Contents

Acknowledgements

About the UK-IRC

De-industrialisation and the Balance of Payments in Advanced Economies

Re-industrialisation – a commentary

Update of prospects for the UK balance of payments

The Legal Framework Governing Business Firms and its Implications for Manufacturing Scale and Performance: The UK Experience in International Perspective

Short-Termism, Impatient Capital and Finance for Manufacturing Innovation in the UK

Knowledge Spillovers and Sources of Knowledge in the Manufacturing Sector: Literature Review and Empirical Evidence for the UK

International Industrial Policy Experiences and the Lessons for the UK

Industrial Policy for the Medium to Long-term
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About the UK~IRC

The UK Innovation Research Centre (UK~IRC) is a joint venture between the Centre for Business Research (CBR) at the University of Cambridge and Imperial College Business School to further research and knowledge exchange on innovation policy practice. The UK~IRC is global in scope and involves a large-scale, multi-year research programme and a Knowledge Hub to engage with and inform policy-makers and practitioners about innovation research. The research programme explores open innovation, service innovation, online communities and innovation policy-making. A further stream of research focuses on the nature of university-industry links and
the role of higher education in innovation systems. Through the Hub, our aim is to maximise the effect of the research on policy and practice, so as to help the UK face its social, environmental and economic challenges. (www.ukirc.ac.uk)

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In October 2013 the Foresight Programme of the UK Government Office for Science published its report on *The Future of Manufacturing: A New Era of Opportunity and Challenge for the UK*. This report was the culmination of a two-year programme of research and deliberation. A key part of this programme was the commissioning of 37 evidence papers. These were intended to provide expert reviews of the evidence relating to key themes and drivers relevant to the future of UK manufacturing out to 2050. In this e-book we have gathered together eight of those contributions. They cover scenario analyses of the future of manufacturing, the legal and economic aspects of financial and labour market behaviour and the role and nature of industrial policy in the future of UK manufacturing. Each paper contains an executive summary and is written as free standing essay. The papers do, however, cross refer to each other and to other evidence papers. As a result taken as a whole they address a set of key related issues in the analysis of future economic trends affecting UK manufacturing and the development of appropriate policy towards that sector.

The first three papers by Coutts and Rowthorn look at the changing position of the UK manufacturing sector both in the domestic economy and in particular in relation to developments in the balance of payments. The analysis in these papers is developed in a comparative international framework. The authors develop a series of potential scenarios for the likely future trend of the share of UK manufacturing in output and employment and for the prospects for the balance of trade in the medium-term. The UK appears as a relatively extreme case of de-industrialization. The share of manufacturing output is, moreover, unlikely to rise in the medium term only in the presence of a relatively unlikely combination of improved manufacturing trade performance, a shift of domestic demand patterns towards UK manufacturing and a slowdown of manufacturing productivity growth relative to services. These papers are followed by an analysis by Deakin of the legal framework governing business firms and its implication for the scale and performance of UK manufacturing. This includes an analysis of corporate governance and the legal framework surrounding labour and capital market decision taking and contracting. The paper concludes that the current legal framework in the UK deters investments in knowledge-based technologies and
firm-specific human capital which generate returns over an extended time horizon. It argues for a shift away from prioritising liquid capital markets and flexible labour markets, in favour of a ‘productive coalition’ approach to corporate governance. The next paper by Hughes focusses specifically on the extent to which short-termism in the UK capital market affects future prospects for investment and innovation in manufacturing compared to other countries. It concludes that the evidence for short-termist attitudes is compelling and is associated with rates of long term investment in tangible capital and intangible capital including R&D which are low by international standards. These papers highlight the need for policy development which favours a long to medium term approach both in the private sector and in the development and execution of government policy including innovation and industrial policy. Aspects of this are addressed in the final three papers in the collection each of which is concerned with industrial policy.

The paper by Bascavusoglu-Moreau and Li focuses on the important issue of the role of knowledge spillovers associated with agglomeration effects and their impact on business performance. This is analysed in relation, in particular, to industrial policy towards the location of manufacturing firms and its connection with future sources of knowledge for innovation. The authors find evidence supporting the importance of spatial agglomeration and the need to incorporate agglomeration effects in industrial and innovation policy design. The collection ends with two papers on industrial policy as a whole. The first by Chang, Andreoni and Kuan looks at international experiences with industrial policy. It draws the lesson that there is, in principle, a potentially positive developmental role for industrial policy in the UK. This will, however, pose challenges in design and execution in the UK institutional context. This is because the UK lacks many of the co-ordinating intermediary labour and business organisations which can encourage long term public private decision taking and policy development and delivery. The final contribution by Crafts and Hughes focusses on the UK. It reviews the market failure and systems failure rationales for industrial policy and assesses the evidence on the past experience of industrial policy in the UK. In the light of this assessment it reviews options for reshaping the design and delivery of industrial policy towards UK manufacturing and adopting a sectoral or technological systems approach to enhancing public-private sector interaction. These options are intended to integrate science, innovation and industrial policy and to encourage a medium- to long-term perspective across government departments as a whole. The options include the possible establishment of a cross departmental Office for Manufacturing to assess and monitor policies aimed at the manufacturing sector.

Alan Hughes
Director, UK-IRC
March 2014
DE-INDUSTRIALISATION AND THE BALANCE OF PAYMENTS IN ADVANCED ECONOMIES

BY KENNETH COUTTS & ROBERT ROWTHORN
De-industrialisation and the Balance of Payments in Advanced Economies

by

Robert Rowthorn & Kenneth Coutts
Faculty of Economics, Cambridge University

December 2013

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Contents

De-industrialisation and the Balance of Payments in Advanced Economies

1. Executive Summary

2. Deindustrialisation

3. Quantification

4. Accounting for deindustrialisation

5. North – South Trade

5.1 The USA and the UK Compared

5.2 Production

6. International Trade

7. Focus on the UK

8. The balance of payments

9. Strong and weak industries in UK Manufacturing

10. The future

References
1. Executive Summary

This paper defines de-industrialisation as a secular decline in the share of manufacturing in national employment. De-industrialisation, in this sense, has been a universal feature of economic growth in advanced economies in recent decades. The paper considers briefly what explains this development and quantifies some of the factors responsible. It then examines the experience of Britain and America, which are two countries that prior to the 2008 financial crisis combined rapid de-industrialisation with a strong overall economic performance. The paper considers both the domestic situation of manufacturing industry in these countries and its foreign trade performance. It concludes by examining in detail the British balance of payments, and documenting how improvements in the non-manufacturing sphere have helped offset a worsening performance in manufacturing trade.

The main findings of the paper are as follows:

The UK: an Extreme Case

All advanced economies have seen a shift in the composition of national employment away from manufacturing and towards services. The decline in manufacturing employment began earlier in the UK and has gone further than in most other advanced economies. Less than one tenth of our employed population is now engaged in manufacturing as compared to one third in the 1960s. Most of the rest are employed in services. Even an industrial powerhouse like Germany has experienced a prolonged decline in manufacturing employment, although its manufacturing sector is still much larger than ours. In 2008, before the full impact of the financial crisis, the employment share of manufacturing was 19% in Germany and under 10% in the UK.

Causes

The factors responsible for the relative decline in manufacturing employment can be classified as follows.
**Internal:** These are factors that would operate even in a closed economy without foreign trade. Of these the most important is the above average rate of growth of labour productivity that is typically observed in the manufacturing sector, which allows the sector to shed labour whilst enjoying, in most cases, a rapid growth in output. Shifting patterns of domestic expenditure may also play a role.

**External:** The size of the manufacturing sector is also influenced by a country’s role in the international division of labour. A country that specialises in the export of manufactured goods, like Germany, will typically have a larger manufacturing sector than a country like the UK that specialises in the export of services. Another factor is “North-South” trade. Much labour-intensive production, such as clothing, has been outsourced from rich countries to poorer countries where wages are low. Rich countries now concentrate on high-value manufactured exports which, pound for pound, contain much less labour than the manufactured goods they import from poorer countries.

The above division into internal and external factors is only a first approximation, and in practice these factors are inter-related.

**Quantification**

An econometric analysis is used to quantify the factors responsible for the decline in the employment share of manufacturing in advanced economies. It finds that on average more than half of this decline is explained by internal factors, such as above average productivity growth in the manufacturing sector and shifting patterns of domestic expenditure. The outsourcing of labour-intensive manufacturing to low-wage countries also played a significant role, accounting for between one sixth and one quarter of the decline in the share of manufacturing.

**The UK**

Between 1973 and 2008, the employment share of UK manufacturing fell by 18.6 percentage points. This decline is considerably larger than predicted by the econometric equations. Further investigation suggests that internal factors account for about two thirds of the decline UK manufacturing employment. The remainder
is explained by the changing composition of our external trade and payments. One such change is the outsourcing of the production of labour intensive manufacturing to low-wage economies. Another is the replacement of net manufactured exports by other sources of foreign exchange, mainly service exports and income from overseas investments. Between 1973 and 2008, net manufactured exports (= exports minus imports) declined from +2% of GDP at the start of the period to -4% at the end. The resulting decline in demand for manufactured goods produced in the UK contributed to the decline in manufacturing employment, but it was not the main factor.

Special Case

The UK is unusual in two respects. It has experienced the largest decline in manufacturing employment of any advanced economy. It has also experienced the biggest post-war deterioration in its manufacturing trade balance. No other advanced economy has gone from surplus to deficit in its manufacturing trade in such a spectacular fashion as the UK has done over the past sixty years. This transformation in our external trade is often taken as a sign of intrinsic weakness in the manufacturing sector. We do not deny that such weaknesses have played a role, but we also argue that this transformation may also be a reflection of positive developments elsewhere in the economy. There are sectors of UK manufacturing which remain competitive in international trade in the sense that they have a positive or improving trade balance. These sectors include chemicals and pharmaceuticals, machinery and equipment, and aerospace. The deficit on motor vehicle production has declined substantially over the past decade. The UK now enjoys large net earnings from the export of services and can, within limits, afford to have a manufacturing trade deficit. However, we argue in a companion paper, that things have gone too far. The present deficit in manufacturing trade is too large and a significant improvement is this area is required.

2. Deindustrialisation

In the course of economic development most countries follow a broadly similar trajectory. As development gets under way, the share of agriculture in national employment falls and there is a rapid increase in the share of manufacturing. This process is known as ‘industrialisation’. At a certain point, however, the
share of manufacturing stabilises and then starts to fall back again. There is a corresponding increase in the share of services in national employment. By analogy with the preceding phase, this falling share of manufacturing is often described as ‘de-industrialisation’. Note that we are talking here about relative shares. If total employment is growing fast enough, then the share of manufacturing may decline even though the absolute number of people working in this sector is actually rising. Note also that employment is not the same thing as production. In many advanced economies, manufacturing productivity is increasing rapidly with the result that this sector is producing more output with fewer workers. De-industrialisation in employment terms does not as a rule imply falling production.

Chart 1 provides information about the manufacturing sector in the G7 countries. There has been a dramatic fall in the share of this sector in national employment in all of the countries shown. This has been matched by a similar decline in the share of manufacturing in GDP or value-added measured at current prices\(^1\). As can be seen from Chart 2, the employment share of manufacturing has also fallen in the newly industrialised countries of East and South East Asia.

![Chart 1. Employment Share of Manufacturing in the G7 Countries: 1962-2008](chart.png)
The causes and significance of de-industrialisation have been debated with fluctuating intensity since the process first began. Some commentators regard declining manufacturing employment as a symptom of economic failure and a harbinger of impending impoverishment. For them the primary objective of public policy should be to halt or reverse this process. Others regard declining manufacturing employment as a normal feature of economic growth in advanced economies. They see it as an inevitable feature of structural change that may create serious problems in the short and medium run, but is potentially beneficial in the longer run. For these commentators, the primary aim of public policy should be to facilitate change and smooth the transition to a new economic structure. In reality, the choice is never quite as stark as this and most commentators take an intermediate position. They recognise the inevitability and potential benefits of structural change, but they also believe that some of the developments in manufacturing may be both undesirable and avoidable. Such developments may reflect the failings of specific industries or firms that would have a viable future if their failings could be overcome.

A variety of reasons have been put forward to explain why the employment share of manufacturing should fall in advanced economies. These include the following:
**Classification.** Certain activities, such as design, catering and transport that were previously performed in-house by manufacturing firms are increasingly performed by specialist service providers. This represents a re-classification rather than a genuine shrinkage in the manufacturing sector. A wider definition of the manufacturing sector would include all of the service inputs that are embodied in the final output of this sector. If this were done, the manufacturing sector would appear larger than it is in official statistics and employment in this broadly defined sector would have declined less than these statistics imply. Thus, part of the decline in manufacturing employment may be a statistical artefact caused by shifting classification.

Many modern manufacturing firms provide services as well as physical products to their customers. These include design and development, installation and implementation, leasing, maintenance and support, systems and solutions, and many other services. Neely et al (2011) estimate that around 30% of manufacturers with over 100 employees offer services globally. The proportion is higher than average in the USA (55% in 2011) and although the proportion is much lower in China (20%) it is increasing rapidly.

As manufacturing firms provide new services to their customers or outsource previously in-house activities to specialist service providers, it becomes increasingly difficult to delineate the boundaries of the manufacturing sector and hence to determine the true scale of employment decline in this sector. However, it seems implausible that such changes account for more than a modest fraction of the huge recorded fall in the share of manufacturing employment in advanced economies over the past thirty years.

**Consumption.** As incomes rise in poorer countries during the course of industrialisation, the proportion of expenditure devoted to food declines, and consumers purchase more manufactured goods. This is known as Engel's Law. The sociologist Daniel Bell (1976) in his theory of post-industrial society predicted that the pattern of consumer demand would eventually shift away from manufactures towards services. The evidence for “Bell’s Law”, as it might be called, is mixed. It is true that the share of monetary income spent on manufactured goods is now falling. However, this is not because the real quantity of manufactured goods consumed in rich countries is stagnating. On the contrary, as everyone knows from personal experience, the amount of electronic and mechanical goods consumed by the average citizen of these countries is mushrooming. The falling share of
monetary income spent on such goods is not due to the saturation of demand for manufactures, as Bell’s Law would imply. What it mainly reflects is a rapid fall in the relative price of manufactures. Rising imports from low wage countries, together with rising productivity at home, mean that manufactured goods in the advanced economies are now so cheap that consumers can buy a lot more of these goods whilst spending a smaller fraction of their income on them.

**International Trade.** International trade affects manufacturing employment in a variety of ways. It may increase productivity in the manufacturing sector by stimulating competition and encouraging domestic firms to produce more efficiently. Competition from imports may also increase productivity by eliminating low value-added activities or inefficient firms. To pay for manufactured imports a country may export other types of manufactured goods or items such as food or services, it may use its income from foreign investments, or it may borrow. These responses have diverse implications for the domestic manufacturing sector.

Of particular interest for the structure of employment in advanced economies (the “North”) is trade with low-wage, developing countries (the “South”). To the extent that the purchase of manufactured goods from low-wage countries is financed by the export of manufactured goods from the advanced economies this will generate new manufacturing jobs in the exporting countries. For example, in return for clothes from Bangladesh the advanced economies may export sophisticated equipment. This exchange will eliminate jobs in the clothing industry of the advanced economies but create new jobs in their equipment-producing industries. However, the number of jobs lost in the low value-added clothing sector will be much greater than the new jobs created in the high value-added equipment industries. As a result, there will be a net loss of jobs in the manufacturing sector as a whole even though the value of manufactured goods exported is equal to the value of manufactured goods imported.

**Investment.** Expenditure on fixed capital has a large manufacturing component in the form of equipment, construction materials and the like. An increase in the rate of investment will therefore increase the share of manufactured goods in total demand, and thereby raise the share of manufacturing in real output and employment.

**Labour Productivity.** By definition, the growth rate of output per worker is equal to the growth rate of output minus the growth rate of employment. Thus, if output in two sectors is increasing at the same rate, the sector with the faster productivity growth
will have the slower employment growth and vice-versa. The employment share of the most dynamic sector will decline. This is simply a matter of arithmetic. Official statistics indicate that, prior to the recent crisis, the real output of manufactured goods in the average advanced economy was growing at about the same rate as the economy as a whole (table 1). Since the non-manufacturing part of a modern economy consists mainly of services, this implies that the real output of services and manufactures were on average growing at about the same rate. One notable exception was the UK where manufacturing output grew much slower than the output of services. We shall return to this point below.

### Table 1. Manufacturing Output and GDP compared

<table>
<thead>
<tr>
<th></th>
<th>Manufacturing (col (1))</th>
<th>Whole Economy (GDP) (col (2))</th>
<th>Difference (col (1)-col (2))</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>3.43</td>
<td>3.07</td>
<td>0.36</td>
</tr>
<tr>
<td>Belgium</td>
<td>1.69</td>
<td>2.16</td>
<td>-0.46</td>
</tr>
<tr>
<td>Canada</td>
<td>2.19</td>
<td>2.78</td>
<td>-0.59</td>
</tr>
<tr>
<td>Denmark</td>
<td>1.21</td>
<td>2.15</td>
<td>-0.93</td>
</tr>
<tr>
<td>Finland</td>
<td>4.78</td>
<td>2.74</td>
<td>2.04</td>
</tr>
<tr>
<td>France</td>
<td>1.37</td>
<td>2.09</td>
<td>-0.72</td>
</tr>
<tr>
<td>Germany</td>
<td>1.40</td>
<td>1.93</td>
<td>-0.53</td>
</tr>
<tr>
<td>Italy</td>
<td>1.39</td>
<td>1.80</td>
<td>-0.41</td>
</tr>
<tr>
<td>Japan</td>
<td>2.67</td>
<td>2.49</td>
<td>0.19</td>
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<tr>
<td>Korea</td>
<td>9.38</td>
<td>7.21</td>
<td>2.17</td>
</tr>
<tr>
<td>Netherlands</td>
<td>2.49</td>
<td>2.51</td>
<td>-0.02</td>
</tr>
<tr>
<td>Norway</td>
<td>0.91</td>
<td>2.90</td>
<td>-1.99</td>
</tr>
<tr>
<td>Spain</td>
<td>2.20</td>
<td>3.05</td>
<td>-0.85</td>
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<tr>
<td>Sweden</td>
<td>4.07</td>
<td>2.39</td>
<td>1.68</td>
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<td>Taiwan</td>
<td>6.40</td>
<td>6.21</td>
<td>0.18</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>1.04</td>
<td>2.74</td>
<td>-1.70</td>
</tr>
</tbody>
</table>

Sources: Manufacturing output from BLS, GDP from IMF

The statistics also indicate that in most countries the growth rate of labour productivity in the manufacturing sector has been faster than in services and in the economy as a whole. To maintain its share of real output, the manufacturing sector has required a decreasing share of total employment.
Conversely, to maintain its share of real output, the service sector has required an ever-increasing share of employment, which it has acquired mainly at the expense of manufacturing\textsuperscript{4}.

This arithmetic suggests that the relative decline of manufacturing employment has been mainly the result of rapid productivity growth in this sector. In their paper on the United States, Triplett and Bosworth (2003) show that productivity growth in the service sector has accelerated markedly in recent times. However, manufacturing industry has experienced a similar acceleration, so the gap between productivity growth in manufacturing and services remains significant\textsuperscript{5}. Chart 3 to 5 show what has happened to manufacturing output, productivity and employment in the G7 countries since 1950. Prior to the climacteric in 1973 manufacturing output grew strongly in all of these countries. In most of them the growth of output has slowed down since then, although over the period 1973-2010 as a whole most of them experienced a substantial increase in production (chart 3). The UK is an exception in this respect and, following the recent crisis, aggregate output in the manufacturing sector is now much the same as it was in 1973.

![Chart 3. Manufacturing output: G7 countries 1950-2010](image)

Source: BLS
In all of the countries shown, labour productivity increased rapidly, if irregularly, throughout the entire sixty year period (chart 4). Prior to the climacteric in 1973,
manufacturing output increased so fast that manufacturing employment rose in absolute terms despite the fact that less labour was required to produce each unit of output. The situation altered when output growth slowed down after 1973. From then onwards, manufacturing employment began to fall as output growth was no longer fast enough to keep up with rising labour productivity, so that more output was being produced using fewer workers (chart 5). In the UK, this turning point was reached in 1966, whereas in Japan it was delayed until 1992. Of all the major advanced economies, the UK has experienced by far the largest proportionate fall in the number of people employed in manufacturing and in the share of this sector in total employment.

3. Quantification

In an article written for the IMF some years ago, Rowthorn and Ramaswamy sought to quantify some of the above effects. Between 1970 and 1994 the employment share of manufacturing in the advanced economies as a whole fell by 8.7 percentage points. They estimated that about four-fifths of this decline was due to internal factors such as productivity growth and changing expenditure patterns, and about one fifth to trade with low wage economies. They also estimated that for every 4.4 manufacturing jobs that were lost thorough competition from imports from low-wage countries, there was on average one new manufacturing job created through the export of more sophisticated manufactured goods to these countries. Rowthorn and Coutts (2004) obtained a somewhat larger figure for the ratio between jobs lost and jobs gained through trade with low wage economies.

The above estimates are now quite old and may have been overtaken by events. We have therefore updated the previous econometric analyses. Our analysis in this paper uses almost the same panel of 23 industrial countries as Rowthorn and Coutts (2004) over the somewhat longer time period 1962-2008. As before, the regression analysis is based on an equation of the following form,

\[
\text{EMPSHARE} = a_0 + a_1 \log_e Y + a_2 (\log_e Y)^2 + \sum_{i>2} a_i Z_i + \text{error}
\]

Where EMPSHARE is the share of manufacturing in civil employment, Y is per capita
income and the Zi are other variables. The latter may include dummy variables for individual countries to correct for international differences in measurement practices and other unexplained ‘fixed’ effects. There is also a dummy for Germany to allow for the impact of reunification in 1990 and subsequent adjustment. In one formulation we include \((\log_e Y)^3\) as an explanatory variable. To capture the influence of international trade on economic structure, there are three variables, MANTRADEBAL, OPEN and LDCIMP. The first of these variables is the overall trade balance in manufactured goods (total exports minus total imports); the variable OPEN is equal to manufactured exports plus imports, and LDCIMP is equal to manufactured imports from developing countries. All trade variables are expressed as a percentage of GDP measured in US dollars at current market prices.

The purpose of MANTRADEBAL is to capture the effect of overall manufacturing trade performance on the structure of employment. Roughly speaking, this variable measures the impact of a change in net manufactured exports which is offset by an equal and opposite change in the net exports of other types of goods and services.\(^{10}\) The variable LDCIMP is designed to capture the additional effects of competition from low-wage countries on manufacturing employment in the advanced economies. These effects include increased efficiency in activities that compete directly with low-wage producers, together with shifts in the composition of manufacturing towards higher value-added, skill-intensive or capital-intensive activities. The variable OPEN is included to see whether greater openness to foreign trade leads to higher relative labour productivity in manufacturing, and hence less employment, in the manufacturing sector.

Finally, there is the variable FIXCAP, which is gross domestic fixed capital formation expressed as a percent of GDP at current market prices. The rationale for using this variable is that capital investment is manufacturing-intensive, so that an increase in the rate of investment should skew demand toward the manufactured goods. Provided the goods in question are produced at home, this will stimulate employment in the domestic manufacturing sector.

<p>| Table 2 | Explaining the Share of Manufacturing in Employment, Regression Equations 1962-2008 (Dependent variable = EMPSHARE) | Equation Number |</p>
<table>
<thead>
<tr>
<th>Explanatory Variables</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
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<td>Loge Y</td>
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<td>122.43***</td>
<td>122.49***</td>
<td>316.09**</td>
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<td></td>
<td>(17.25)</td>
<td>(26.17)</td>
<td>(27.41)</td>
<td>(76.58)</td>
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<td>(Loge Y)2</td>
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<td>-6.61***</td>
<td>-6.57***</td>
<td>-27.14**</td>
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<td>(17.69)</td>
<td>(26.78)</td>
<td>(27.87)</td>
<td>(8.19)</td>
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<td>(Loge Y)3</td>
<td></td>
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<td>0.724*</td>
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<td>0.291***</td>
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<td>(19.42)</td>
<td>(12.33)</td>
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<td>0.347***</td>
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<td>(12.92)</td>
<td>(13.96)</td>
<td>(12.78)</td>
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<td>10,206</td>
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<td>N-S Balanced Trade Ratio</td>
<td>3.71</td>
<td>4.24</td>
<td>3.50</td>
<td>4.59</td>
</tr>
</tbody>
</table>

Notes: *** , ** , * denote significance at the 0.1%, 1%, 5% levels respectively; absolute t-values shown brackets; constant terms are omitted for clarity. All regressions are based on a sample consisting of the following countries: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Korea, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Taiwan, United Kingdom, and United States.

Variables are defined as follows:

- **EMPSHARE** = percentage share of manufacturing in civil employment
- **Y** = GDP per capita at PPP in constant 1995 international dollars
- **MANTRADEBAL** = manufactured exports – manufactured imports
- **OPEN** = manufactured exports + manufactured imports
- **LDCIMP** = manufactured imports from developing countries (UN definition - excludes Korea, Malaysia, Singapore and Taiwan; includes China)
- **FIXCAP** = gross domestic fixed capital formation

**MANTRADEBAL, OPEN, LDCIMP and FIXCAP** are all expressed as percentages of GDP at current market prices. Exports are measured fob and imports are measured cif. In addition to country dummies (fixed effects) there is an adjustment dummy for Germany to allow for the effects of re-unification. The reunification dummy is equal to zero for t ≤ 1990, (t-1990)/6 for
Table 2 reports the econometric results using pooled data from all countries in the sample over the whole time period 1962-2008. There is strong evidence of a hump-shaped relationship between manufacturing employment and per capita income. The employment share of manufacturing rises in the earlier stages of economic development and falls back at high levels of per capita income. The estimated turning point is somewhat less than $10,500 (1995 PPP) per capita which many OECD countries had reached by 1970 and some well before. A number of the more advanced Asian economies have now surpassed this point and the share of manufacturing employment has been falling in these countries for some years.

The coefficient of LDCIMP is negative and significant, supporting the view that imports from low-wage economies impact negatively on manufacturing employment in the industrial countries even when they are accompanied by an equivalent dollar value of manufactured exports in the opposite direction. The coefficient of OPEN is negative and significant, suggesting that more open economies have higher productivity, and therefore less employment, in manufacturing. The regressions also indicate that fixed capital formation exerts a positive influence on manufacturing employment.

As expected, the overall trade balance in manufactures has a significant impact on manufacturing employment. The coefficient of MANTRADEBAL is positive and highly significant in all equations, suggesting that countries with a large trade surplus in manufactures tend to have a larger than average manufacturing sector. The magnitude of this coefficient is consistent with the results obtained in Rowthorn and Ramaswamy (1999) and Rowthorn and Coutts (2004). Depending on the equation, the coefficient of MANTRADEBAL is between 0.2 and 0.3. This is probably too low. Calculations based upon the UK input-output tables for 2008 give a value for this coefficient in the range 0.4 to 0.5. These calculations are reported in appendix 1.

4. Accounting for deindustrialisation

This section uses the regression results shown in table 2 to quantify the influence of various factors that have contributed to de-industrialisation over the period 1973-
2008. Table 3 presents two distinct sets of calculations based on equations (1) and (2) from table 2. Other equations yield similar results.

The headings in table 3 are self-explanatory with the exception of the component labelled “normal growth”. This component covers all of the effects which would normally be associated with rising per capita income in a closed economy, and thus takes into account both the income elasticity of demand for manufactures and the influence of normal productivity and price changes. It is estimated from the coefficients of logY and (logY)^2 in the relevant equation. Note that this component excludes the effect of output and productivity changes due to international trade, in particular the abnormal productivity growth induced by competition from low-wage imports. These are included under the various trade headings.

The main conclusion from our decomposition is that trade with low wage economies (North-South trade) has been a significant factor behind recent de-industrialisation in many of the countries in our sample. However, it has been less important than internal factors such as productivity growth and shifting patterns of domestic demand. In the sample as a whole, such internal factors were two to three times as important as North-South trade in accounting for the relative decline of manufacturing employment since 1973. One puzzling feature of the results is the large unexplained negative residual for the United Kingdom, where the share of manufacturing employment has fallen by much more than the predicted amount. Part of the explanation may be that the impact of trade, in the UK case at least, is underestimated by the regression equations. In these equations the coefficient of MANTRADEBAL is between 0.2 and 0.3. With an arguably more realistic coefficient of around 0.45 (as implied by the UK input-tables), this would explain another 2 percentage points of the decline in the manufacturing employment share. However, it would still leave an unexplained residual of more than 4 percentage points. An examination of the trajectory of the equation residuals suggests that much of this unexplained decline took place during the initial years of the Thatcher government after 1979, reflecting perhaps the big-shake out in manufacturing jobs during this period. This issue deserves further investigation.

<table>
<thead>
<tr>
<th>Table 3 Accounting for De-industrialisation 1962-2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in:</td>
</tr>
<tr>
<td>------------</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th></th>
<th>Percentage share of employment</th>
<th>Normal growth</th>
<th>Investment</th>
<th>German structuring</th>
<th>Total internal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Equation (1)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EU-3</td>
<td>-11.9</td>
<td>-5.6</td>
<td>-0.9</td>
<td>0.6</td>
<td>-5.9</td>
</tr>
<tr>
<td>Japan</td>
<td>-9.2</td>
<td>-6.0</td>
<td>-2.5</td>
<td>0.0</td>
<td>-8.5</td>
</tr>
<tr>
<td>Canada</td>
<td>-11.2</td>
<td>-6.7</td>
<td>0.0</td>
<td>0.0</td>
<td>-6.7</td>
</tr>
<tr>
<td>USA</td>
<td>-12.2</td>
<td>-8.6</td>
<td>-0.3</td>
<td>0.0</td>
<td>-9.0</td>
</tr>
<tr>
<td>UK</td>
<td>-18.6</td>
<td>-6.9</td>
<td>-0.7</td>
<td>0.0</td>
<td>-7.6</td>
</tr>
<tr>
<td><strong>Equation (2)</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EU-3</td>
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<td>-6.2</td>
<td>-1.6</td>
<td>-1.5</td>
<td>-9.3</td>
</tr>
<tr>
<td>Japan</td>
<td>-9.2</td>
<td>-6.7</td>
<td>-4.5</td>
<td>0.0</td>
<td>-11.2</td>
</tr>
<tr>
<td>Canada</td>
<td>-11.2</td>
<td>-7.4</td>
<td>0.0</td>
<td>0.0</td>
<td>-7.3</td>
</tr>
<tr>
<td>USA</td>
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<td>-9.4</td>
<td>-0.6</td>
<td>0.0</td>
<td>-10.0</td>
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<tr>
<td>UK</td>
<td>-18.6</td>
<td>-7.6</td>
<td>-1.3</td>
<td>0.0</td>
<td>-8.9</td>
</tr>
</tbody>
</table>

**Table 3 continued - Accounting for De-industrialisation 1962-2008**

<table>
<thead>
<tr>
<th></th>
<th>Change in:</th>
<th>Change due to:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>North – South trade</td>
<td>Other Trade</td>
</tr>
<tr>
<td><strong>Equation (1)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EU-3</td>
<td>-2.6</td>
<td>0.5</td>
</tr>
<tr>
<td>Japan</td>
<td>-2.7</td>
<td>0.4</td>
</tr>
<tr>
<td>Canada</td>
<td>-4.5</td>
<td>0.7</td>
</tr>
<tr>
<td>USA</td>
<td>-4.3</td>
<td>-0.2</td>
</tr>
<tr>
<td>UK</td>
<td>-3.4</td>
<td>-0.9</td>
</tr>
<tr>
<td><strong>Equation (2)</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Notes: This table decomposes changes in the percentage share of manufacturing employment. Equation numbers refer to the regression results given in table 2. EU-3 is an unweighted average of France, Italy and Germany.

5. North – South Trade

From the estimates shown in Table 2 it is possible to calculate the impact of North-South trade on the structure of employment in advanced economies. The answer depends to some extent on which equation is used. Suppose that manufactured exports to the South increase by 1 percent of GDP. According to equation (2), this will cause the share of manufacturing employment to rise by 0.21 percentage points. Conversely, if manufactured imports from the South increase by 1 percent of GDP, the result will be a 0.91 percentage point fall in the share of manufacturing jobs. Thus, one dollar’s worth of imports from the South destroys approximately 4.2 times as many Northern manufacturing jobs as are created by one dollar’s worth of exports to the South\(^1\). Other equations yield ratios between 3.5 and 4.6 \(^1\)\(^2\). These estimates are similar to the estimate of 4.4 in Rowthorn and Ramaswamy (1999). Such calculations reveal the origin of the “balanced trade effect”, whereby manufactured imports from the South reduce manufacturing employment in the North even when they are matched by an equal value of manufacturing exports from the North\(^1\)\(^3\).

Calculations based on equation (1) of table 2 imply that, amongst the larger countries in our sample, imports from low-wage economies in the South have eliminated manufacturing jobs equivalent to between 3 percent and 5 percent of total employment since the early nineteen sixties. The corresponding estimates for new manufacturing jobs created by exports to the South are in all cases less than 1 percent of total employment. The other equations yield similar results. The structural changes implied by these figures are not huge when spread over a number of
decades, but the impact on particular types of worker or on certain regions has been much greater than the aggregate figures would suggest.

5.1 The USA and the UK Compared

The rest of this paper will focus mainly on the USA and the UK. These countries exhibit some important similarities. They both enjoyed a long period of rapid growth in per capita income prior to the financial crisis (Chart 6) and were often cited as models by those urging economic reform in the Eurozone and Japan. The USA increased its lead over these countries and the UK caught up or overtook many of its rivals. Maddison (2009) estimates that by 2008 GDP per capita in the UK was 7% higher than in France, 14% higher than in Germany and 4% higher than in Japan\textsuperscript{14}.

![Chart 6: GDP per capita in selected countries: 1950-2010
1990 international dollars](image)

In both the UK and the USA, a widely praised economic performance was accompanied by a massive fall in the employment share of manufacturing. Both countries experienced a prolonged decline in their manufacturing trade balance and
in both of them this balance is now in deficit. There are also important differences. The USA still has the world’s strongest manufacturing sector, rivalled only by China in quantity, whereas manufacturing in the UK is in perennial difficulty. Although both countries now have a large deficit in their manufacturing trade, the significance of this deficit is different. The American deficit is financed mainly by borrowing abroad, whereas much of the British deficit is largely covered by income from overseas investments and by the rapidly growing earnings from knowledge-based services. Thus, although the UK has a much weaker manufacturing sector than the USA, its external position taken as a whole is stronger. Let us explore some of these points in more detail.

5.2 Production

Chart 7 compares production in the USA and the UK. The output series in this chart are measured in constant prices at purchasing power parity. This gets rid of differences caused by inflation, fluctuating exchange rates and different price levels in the two countries. The series are our own estimates and they are inevitably rather crude. However, they are accurate enough for their present purpose.
As can be seen from the chart, the per capita output of manufactures was similar forty years ago in Britain and America. Productivity was much higher in America but this was offset by the fact that a much greater fraction of the British population was employed in the manufacturing sector. Since then manufacturing employment has fallen dramatically in the UK and the productivity gap between the two countries has got wider. As a result, the USA now produces roughly 70 percent more manufactured goods per head of population as the UK.

<p>| Table 4 | UK and US Manufacturing Compared 1973-2010 |</p>
<table>
<thead>
<tr>
<th>Output</th>
<th>Output per person employed</th>
<th>Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1973-2007</td>
<td>3.0</td>
<td>3.9</td>
</tr>
<tr>
<td>2007-2010</td>
<td>-2.8</td>
<td>3.4</td>
</tr>
<tr>
<td>1973-2010</td>
<td>2.5</td>
<td>3.8</td>
</tr>
<tr>
<td>UK</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1973-2007</td>
<td>0.4</td>
<td>3.1</td>
</tr>
<tr>
<td>2007-2010</td>
<td>-3.5</td>
<td>0.4</td>
</tr>
<tr>
<td>1973-2010</td>
<td>0.1</td>
<td>2.9</td>
</tr>
</tbody>
</table>


The picture is more favourable to the UK in the service sector. Per capita output of services is lower than in the USA, but the gap has been closing steadily. This strong performance reflects the contribution of new service exports that have helped to raise the overall growth rate of the UK service sector.

The contrast between manufacturing in the two countries can be illustrated by comparing what has happened to output and employment. Between 1973 and 2007, prior to the financial crisis, manufacturing output in the USA rose by 3.0% per annum and employment fell by 0.8% per annum (Table 4). Cumulatively, this implied an increase of 172% in output and a fall of 25% in employment. Over the same period, manufacturing output in the UK rose by 16% and employment fell by a remarkable
58%. Whereas productivity growth in US manufacturing served mainly to increase output, in the UK it served mainly to reduce employment. This is the long-run picture, although since the financial crisis the situation has become more confused, with output falling sharply in both countries and the USA experiencing widespread job losses (Table 4). It remains to be seen whether pre-crisis trends will resume when economic recovery eventually occurs.

6. International Trade

By definition, the manufacturing trade balance is equal to national production of manufactured goods minus national expenditure on such goods. Charts 8 and 9 show what has happened to these items in the UK and the USA. In both of these countries expenditure on manufactures has outstripped national production, with the result that both of them now have a large deficit in their trade balance in manufactures. The production of manufactures has grown much faster in America, but this has been surpassed by an even faster growth of expenditure on manufactures.
Chart 8
Manufacturing expenditure, output and trade balance
UK 1985-2011
constant prices

£2000 bn.

Production  Expenditure  Trade balance

Q1 85 87 89 91 93 95 97 99 01 03 05 07 09 11
-40 -20 0 20 40 60 80 100 120 140 160
Chart 9
Manufacturing expenditure, output and trade balance
USA 1985-2011
constant prices
Further information on manufacturing trade is given in Chart 10 which compares the UK and the USA with other developed economies. The East Asian group – Japan, Korea and Taiwan – has a large, although fluctuating, trade surplus. The Eurozone as a whole has a manufacturing trade surplus which has been relatively stable as a percentage of GDP over the past fifty years. Within the Eurozone fortunes vary. Germany and other northern countries enjoy large and sometimes growing surpluses in their manufacturing trade, whilst France and the Mediterranean countries mostly have deficits on this item.

Provided that some other source of revenue can be found, a manufacturing deficit is not important\textsuperscript{15}. What matters is the overall balance of payments, which in addition to manufactures includes all current expenditures and receipts for such items as food, materials, fuel, services, transfers, and property income. Any loss of net revenue in manufacturing trade can in principle be made good by additional net revenue from these other items. Indeed, this is just what has happened in the British case. New sources of overseas income have been developed and a previously large deficit on such items as energy, food and raw materials (6-10% of GDP in the mid-1970s) has been reduced to a relatively small fraction of GDP (2.6% in 2011). Despite a prolonged and massive deterioration in manufacturing trade, Britain’s overall balance
of payments is, for the time being at least, in moderately good shape. In contrast, the USA has not yet developed new sources of income to offset its worsening trade balance in manufactures. The contrast is reflected in the overall balance of payments of the two countries. In 2011, the UK had a current account deficit equal to 1.9% of GDP whereas the US deficit was more than 5% of GDP.

7. Focus on the UK

The preceding discussion indicates how the UK has prospered and maintained a moderately sound balance of payments despite a weak manufacturing trade performance. This is an unusual combination that is worth exploring in more depth. To round off the paper we shall therefore examine the country's balance of payments in more detail.

The UK emerged from the Second World War in a difficult economic situation. Much of her overseas wealth had been lost in the war and revenue from this source was severely depleted. The price of imported food and raw materials was astronomical, and a huge manufacturing trade surplus was required to pay for vital imports. In 1950, the UK manufacturing trade surplus was 10% of GDP – more than three times its pre-war level, but even this was not sufficient to cover the even larger deficit on other items such as food and materials. The UK was still one of the great industrial nations of the world, but her situation seemed precarious. Moreover, international competition was about to intensify as the war-torn economies of Continental Europe recovered and new competitors appeared in Asia.

In the event, things turned out quite well. The UK economy grew quite fast by its own historical standards, living standards rose, and the country did not go bankrupt. Even so, there was nagging unease as the country experienced periodic currency crises and her manufacturing trade surplus steadily shrank. Following a seminal article by Ajit Singh (1977), there was an intense debate, about why the manufacturing trade surplus had been shrinking and what this trend signified. Some saw it as a pathological development that could only end in disaster. Others, such as Rowthorn and Wells (1987), argued that it reflected long-run structural changes that were altering the shape of the UK economy and its relations with the rest of the world\textsuperscript{16}. In the immediate post-war period, the country had needed a huge manufacturing trade
surplus because there was no other way to pay for her large and expensive imports of food and raw materials. Now the UK was less reliant on these items and their real price had fallen dramatically. Moreover, there were new sources of revenue, such as North Sea Oil, services and income from overseas investments, which could be used to pay for imported food and raw materials. As a result, the previously huge deficit on non-manufacturing trade had disappeared and hence there was no longer the need to finance this deficit by earning a huge surplus on manufacturing trade.

The above description raises an interesting question. To what extent were the changes on the non-manufacturing side of the balance of payments fortunate accidents that compensated for an independently poor manufacturing trade performance? And to what extent did events on the non-manufacturing side of the balance influence manufacturing trade? For example, the exploitation of North Sea oil turned the UK from a major net importer of oil into net exporter and was accompanied by an appreciation of the real exchange rate. This made UK manufacturing firms less competitive, thereby damaging manufactured exports and stimulating imports. In this case, via its effects on the real exchange rate, an improvement in the non-manufacturing side of the balance caused the manufacturing trade balance to deteriorate. Oil is only one example. It is conceivable that other autonomous developments, such as the growth of invisible earnings, have also damaged manufacturing trade through their impact on the real exchange rate. To the extent this is true, the long-run deterioration in manufacturing trade balance may not indicate an intrinsic lack of competiveness, but may be an endogenous consequence to events elsewhere in the balance of payments.

In our view, Rowthorn and Wells were correct to argue that Britain's economy had become overspecialised by 1950, and that a substantial reorientation away from manufacturing towards other activities was inevitable, indeed, desirable. However, as we shall argue in another paper, things may have gone too far. Too much manufacturing capacity may have been shed, and the failure to develop a more dynamic manufacturing sector may eventually turn out to have serious consequences for the balance of payments and the overall prosperity of the country.
8. The balance of payments

The overall payments position of a country is normally measured by the so-called current account. In addition to manufactured goods, this account includes “other visibles”, such as food, fuels and raw materials, together with “invisibles”, such as services, income from overseas investments, migrants’ remittances and inter-governmental transfers. Chart 11 gives a breakdown of the UK current account into three major components: manufactures, other visibles, and invisibles. The general picture is as follows. The trade balance in manufactures has been on a downward trend for a long time and there is now a large deficit on this item. After a period of stability, the balance on “other visibles” has deteriorated in recent times, due to a combination of higher commodity prices and lower domestic oil and gas production. However, for most of the time these negative trends have been largely offset by improvements on the invisible side of the account, so the overall current account deficit has mostly been quite small for most of the time. It is uncertain whether this will continue to be the case in the future.
Table 5 | Components of Services and Property Income in UK Balance of Payments

<table>
<thead>
<tr>
<th>Balances</th>
<th>£ million</th>
<th>1991</th>
<th>2008</th>
<th>2011</th>
<th>% of GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1991</td>
<td>2008</td>
<td>2011</td>
<td></td>
</tr>
<tr>
<td>Knowledge-based services</td>
<td>7425</td>
<td>78149</td>
<td>84510</td>
<td></td>
<td></td>
</tr>
<tr>
<td>of which:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Insurance</td>
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<td>11603</td>
<td>8013</td>
<td>0.1</td>
<td>0.8</td>
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<td>Financial services</td>
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<td>38663</td>
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<td>Computers &amp; Information</td>
<td>301</td>
<td>3941</td>
<td>5174</td>
<td>0.1</td>
<td>0.3</td>
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<tr>
<td>Other Business Services</td>
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<td>18121</td>
<td>25880</td>
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<td>1.3</td>
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<td>-4</td>
<td>4874</td>
<td>6780</td>
<td>0.0</td>
<td>0.3</td>
</tr>
<tr>
<td>Traditional services &amp; Transfers</td>
<td>-4554</td>
<td>-30886</td>
<td>-30346</td>
<td>-0.8</td>
<td>-2.2</td>
</tr>
<tr>
<td>of which:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transport</td>
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<td>2228</td>
<td>3169</td>
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<td>-1357</td>
<td>-0.1</td>
<td>-0.1</td>
</tr>
<tr>
<td>Transfers</td>
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<td>-13765</td>
<td>-22216</td>
<td>-0.2</td>
<td>-1.0</td>
</tr>
<tr>
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<td>32406</td>
<td>17133</td>
<td>-0.6</td>
<td>2.3</td>
</tr>
<tr>
<td>of which:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct Investment</td>
<td>8328</td>
<td>66401</td>
<td>48854</td>
<td>1.4</td>
<td>4.7</td>
</tr>
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<td>-33995</td>
<td>-31721</td>
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<td>-2.4</td>
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<td>-57927</td>
<td>-60646</td>
<td>-0.6</td>
<td>-4.1</td>
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<td>-36155</td>
<td>-39697</td>
<td>-1.1</td>
<td>-2.5</td>
</tr>
<tr>
<td>of which:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy</td>
<td>14</td>
<td>13550</td>
<td>19121</td>
<td>0.0</td>
<td>-1.0</td>
</tr>
<tr>
<td>Food, beverages &amp; tobacco</td>
<td>3955</td>
<td>17379</td>
<td>17971</td>
<td>-0.7</td>
<td>-1.2</td>
</tr>
<tr>
<td>Basic materials &amp; misc.</td>
<td>-2660</td>
<td>-4836</td>
<td>-2911</td>
<td>-0.5</td>
<td>-0.3</td>
</tr>
</tbody>
</table>
The overall improvement in invisibles conceals some widely divergent trends. Table 5 presents detailed information on this topic. On the one hand, net transfer payments to international institutions and others are increasing as a fraction of GDP, mainly due to increased government payments to the EU together with migrants’ remittances. Moreover, after rising strongly for some years, net investment income from overseas has fallen sharply from its 2008 peak and in the first half of 2012 there was actually a deficit on this item. On the other hand, there has been a dramatic growth in receipts from knowledge-based services, such as finance, insurance, consultancy and other business services. Within the space of twenty years, net earnings of this type have risen more than tenfold in monetary terms. In 1991, knowledge-based services, including finance and insurance, generated between them a net income for the UK equal to 1.3% of GDP. By 2011, this had risen to 5.6% of GDP.

9. Strong and weak industries in UK Manufacturing

Chart 12 classifies manufacturing industries into three groups according to their trade performance: weaker, stable, and competitive. Weaker industries are defined as those that have a negative and worsening trade balance; competitive industries have a positive or an improving trade balance, and the rest are classified as stable (in deficit but with no trend deterioration). The list of competitive industries includes coke and refined petroleum products, chemicals & pharmaceuticals, machinery & equipment, motor vehicles and other transport (aerospace and weapons). The list of weaker industries is large and includes such obvious ones as clothing or leather where domestic producers are suffering severe competition from low wage imports. It also includes less obvious ones such as electrical equipment, computer, electronic and optical products.
In most manufacturing industries, imports and exports are increasing simultaneously, both absolutely and in relation to national production. In the strongest sectors, such as chemicals & pharmaceuticals or other transport, exports exceed imports and the balance is stable or improving. In weaker industries, the opposite is true. In some cases, total exports are increasing, but they are being outstripped by mushrooming imports. This is most obvious in computer, electronic and optical products, where exports rose by 80% between 1995 and 2001, but imports grew by 270%. The picture is similar, but less dramatic in wood, paper & printing, vehicle parts and the residual group “other manufacturing”. The fact that exports are increasing in such supposedly weak industries indicates that they still retain some areas of strength. This is confirmed by the fact that, in most of the weaker industries just listed, national production has been increasing. This should make us cautious about writing off such industries simply because their trade balance is negative and getting worse. However, there are a few manufacturing industries, such as textiles, leather & clothing, or basic metals, where both exports and production are falling. This is evidence of long-term decline, although even in these industries there must be areas of actual or potential strength, and they should not be written off prematurely.
Predicting long run movements in the balance of payments is hazardous. This balance is the difference between two very large quantities (exports and imports) and quite small proportionate changes in these items can cause the balance to swing sharply from surplus to deficit or vice-versa. However, it is fair to say that the balance of payments situation is a cause for some concern. Projections that we present in a companion paper suggest that over the next decade there will be a persistent balance of payments deficit equal to roughly 3% of GDP. In itself, this is not a huge figure and could be financed for some years by international borrowing. However, there is a danger that things may get worse. We have identified certain manufacturing industries where there is a continuing deterioration in trade performance. Moreover, the production of North Sea oil and gas is falling; energy and commodity prices may be on an upward trend; net investment income has fallen sharply; and UK transfer payments to others are increasing. To offset these negative developments will require continued improvement in other sectors, such as knowledge-based services or our more competitive manufacturing industries.

The ideal would be to eliminate the current account deficit altogether, but short of this ideal it would still be a valuable achievement to stabilise the balance of payments and prevent a further worsening of our trade performance. This may be difficult to achieve without a strong manufacturing sector. The share of manufacturing in total exports has been falling, but this sector still accounts for almost half of Britain’s total exports of goods and services. Manufactured exports are almost three times larger than total earnings from the export of all knowledge-intensive services combined, excluding finance and insurance. Knowledge-intensive services are a vital and dynamic component of our exports, but they may not be sufficient to compensate for continued failings in the manufacturing sector. For the foreseeable future, manufactures will continue to play an important role in our foreign trade, and the health of our balance of payments will to a significant degree depend on what happens to manufacturing.

To close the projected current account deficit through a stronger manufacturing trade performance would require an increase in net manufactured exports equal to around 3% of GDP. The input-output calculations reported in appendix 1 suggest that this would increase the share of manufacturing in GDP and in employment by around 1.8 and 1.5 percentage points respectively. In job terms this would imply the employment of another half a million manufacturing workers. This is a substantial
increase, but is not remotely sufficient to raise the share of manufacturing to anything like the German level. Moreover, such an increase would be superimposed on a long-run decline in the share of manufacturing in employment and GDP due to rapid productivity growth in this sector.

Notes

1. Gross domestic product = gross value added + taxes on products – subsidies on products

2. See Rowthorn and Wells (1987) for an extensive discussion of this and related issues.

3. This point is explored at length below.

4. This argument was first advanced systematically by Lengellé (1966), Baumol (1967) and Fuchs (1968) and was developed at length in Baumol, Blackman and Wolff (1989). Oulton (2001) presents a more optimistic view of the potential for productivity growth in services.

5. Table 1 of Triplett and Bosworth (2003) indicates that the annual growth rate of labour productivity in 27 service industries (employment weighted) was on average 1.5% over the period 1987-95 and 2.6% over the period 1995-2000. According to BLS statistics for output per worker hour, manufacturing productivity grew by 2.9% and 4.0% per year respectively. Thus, in each period manufacturing productivity growth was around 1.3% a year faster in manufacturing.

6. Chart 4 shows what happened to output per person employed in the manufacturing sector, but the picture is similar for output per worker hour.


9. The only difference is that Belgium is used in this paper in place of Belgium-Luxemburg. Given the small size of Luxemburg the difference is trivial.

10. This statement would be exact if the overall balance of trade (manufactures plus non-manufactures) were always equal to zero. In this case, any changes in the manufacturing trade balance would always be accompanied by an equal and opposite change in the non-manufacturing balance. Ideally, the regression equation should include an additional variable NONMANTRADEBAL to allow for the effect of independent changes in the non-manufacturing trade balance on the structure of employment. Unfortunately, the relevant data on non-manufacturing trade are not readily available. In practice, this may not be a serious problem, since in most of the countries in the sample, for much of the time, the overall current account, and by implication, the overall trade balance (manufactures plus non-manufactures), is close to zero.

11. These numbers are derived as follows. An increase of 1 percentage point in the ratio of manufactured exports from the North to GDP implies a change of +1 unit in the variable MANTRADEBAL. According to equation (2) in table 1, this will cause EMPSHARE to change by \((0.215)(1) = 0.215\) units. Conversely, suppose that the ratio of manufactured imports from the South to GDP increases by 1 percentage point. This will cause the variables MANTRADEBAL and LDCIMP to alter by -1 and +1 units respectively. From equation (2), it follows that EMPSHARE will change by \((0.215)(-1) + (-0.697)(1) = -0.912\). The balanced trade ratio in this case is equal to \(0.912/0.214 = 4.24\).

12. This ratio of 3.5 is derived from equation (3) as follows. An increase of 1 percentage point in the ratio of manufactured exports from the North to GDP implies a change of +1 unit in the variables MANTRADEBAL and OPEN. According to equation (3), this will cause EMPSHARE to change by \((0.291)(1) + (-0.098)(1) = 0.193\) units. Conversely, suppose that the ratio of manufactured imports from the South to GDP increases by 1 percentage point. This will cause the variables MANTRADEBAL, OPEN and LDCIMP to alter by -1, +1 and +1 units respectively. From equation (3), it follows that EMPSHARE will change by \((0.291)(-1) + (-0.098)(1) + (-0.287)(1) = -0.676\). The balanced trade ratio in this case is equal to \(0.676/0.193 = 3.5\).

13. The balanced trade effect was first emphasised by Wood (1994).
14. IMF estimates put Germany neck and neck with the UK and OECD estimates put Germany about 5% ahead, but otherwise they are similar to those of Maddison.

15. For a good discussion of this issue see Singh (1977).


18. We have separated motor vehicles from other activities within its sector and put it into the competitive group because it has substantially reduced its deficit over the past decade. The remaining component consisting of vehicle parts, trailers etc. is put into the stable group.

19. Some of the weaker industries' decline may reflect the success of competition from low wage countries where firms have invested in technology transfer to close the gap in the frontier of technology with advanced economies (see Aghion and Howitt (2009). For other sectors, though, the weakness in trade performance may reflect lack of R&D investment to compete with other advanced countries.


21. These figures are based on Row (4) of table A1.

References


Fuchs, V. R. (1968), The Service Economy, New York, NBER.

Lengellé, M. (1966), The Growing Importance of the Service Sector in Member Countries, Paris, OECD.


Re-industrialisation – a commentary

by

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December 2013
Contents

Re-industrialisation – a commentary

Executive summary

1. Introduction

2. Historical experience

3. Projections

4. Conclusions

References

Technical appendix

Shares in value-added

Relative prices

Modifications

Basic Calculations for 1970-2010

Decomposing Changes in the Manufacturing Share

Projection 2010-2035

Growth Rates of Real Output

A Simple Model of Relative Shares in a Closed Economy

Foreign Trade
Executive summary

The share of manufacturing in UK employment and value-added at current prices ("value-added" for short) has fallen dramatically in recent years. This commentary investigates the feasibility of reversing this decline. The main focus will be on the value-added share, but the conclusions apply to the employment share with equal force.

The paper begins by comparing the historical experience of the UK and a large group of European countries. It first documents how the share of manufacturing in value-added has fallen rapidly in both areas, but the decline has been fastest in the UK, especially after 1995. These changes in the value-added share are then decomposed into three components:

- shifts in the pattern of domestic expenditure,

- shifts in the net trade balance in manufactures,

- shifts in the relative price of manufactures as compared to other goods and services.

This is only a proximate decomposition since in practice these components are behaviourally inter-related. For example, a decline in the relative price of manufactured goods stimulates the demand for manufactures at the expense of other goods and services. Foreign trade influences relative prices both directly through the provision of cheaper goods and indirectly through impact of foreign competition on the productivity of local firms.

Comparing the UK with the rest of Europe over the past forty years, shifting expenditure patterns have had a similar impact on the manufacturing share in the two areas. Relative price movements were also very similar in the two areas. The main difference was the massive deterioration in the UK manufacturing trade balance from a surplus of +4.8% of GDP in 1970 to a deficit of -4.4% in 2010. Over the same period, Europe’s manufacturing trade balance fluctuated considerably but had no
clear trend. This difference in trade performance is the main proximate reason why the share of manufacturing in employment and value-added fell more rapidly in the UK than elsewhere in Europe.

Looking to the future, the paper explores the implications of four scenarios over the next twenty-five years. These scenarios generate very different trajectories for the share of manufacturing in value-added. At one extreme this share declines rapidly in line with past trends. At the other extreme the share is a bit higher in 2035 than it was in 2010. The first three scenarios make identical assumptions about the evolution of domestic expenditure and relative prices, assuming in each case that past trends continue. They differ only in their assumptions about trade performance in manufactures, with successive scenarios assuming stronger trade performance. The final scenario assumes a slower shift in the composition of domestic demand away from manufactures and a slower decline in the relative price of manufactured goods than under the other scenarios, together with the biggest improvement in the trade balance.

It is only under the last scenario that there is an increase in the manufacturing share of value-added over time. To generate this modest “re-industrialisation” requires strong assumptions. Under this scenario, there is a slower decline in the relative price of manufactured goods than in the past. Since relative productivity and relative prices are closely correlated, this implies a slower rate of relative productivity growth in manufacturing than in the past. This scenario also assumes a very large turnaround in the trade balance in manufactures, from a deficit of -4.4% of GDP in 2010 to a surplus of +2.0% in 2035. Given the likely performance of other parts the balance of payments, notably financial services and other knowledge-intensive services, such a surplus in manufacturing trade might be neither economically desirable nor sustainable.

The third scenario appears more feasible, maintaining the historic trends in the domestic demand for manufactures and in their relative price, with a more modest improvement in trade performance, which merely eliminates the present deficit in manufacturing trade. Under this scenario, the value-added share of manufacturing still declines but at a much slower rate than in the past and by implication, the share of employment in manufacturing would also continue to fall. However, manufacturing output in real terms would grow significantly faster than GDP, and with a growing labour force, the absolute number of jobs in manufacturing might increase somewhat.
In this limited sense, a “re-industrialisation”, as compared with the past forty years, would seem feasible.

The main conclusions are as follows. A stronger manufacturing sector would grow faster and generate more net exports. However, the share of manufacturing in employment or value-added would be unlikely to increase. Rapid labour-saving productivity growth in the manufacturing sector would limit the growth of employment in this sector despite rising output. It would also drive down the relative price of manufactured goods, thereby holding down the share of the fast growing manufacturing sector in value-added.

1. Introduction

In the aftermath of the financial crisis it has been widely argued that the UK economy requires rebalancing, away from financial and related services, towards manufacturing industry. Having de-industrialised in recent decades, the UK needs to re-industrialise. The term “re-industrialisation” has various meanings, but it is most frequently taken to mean an increase in the share of manufacturing industry in value-added or employment. This paper accepts that the UK may need a stronger manufacturing sector, but it questions how far such an improvement in performance would be accompanied by an increase in the share of manufacturing in value-added or employment. The historical decline in this share would certainly be slowed down or even halted in the event of a successful rebalancing, but this decline is unlikely to be significantly reversed. The absolute number of people employed in manufacturing sector might increase by a modest amount, but this would be against the background of a stable or falling share of this sector in total employment.

It must be stressed that this is not a paper about policy. It has nothing to say about how to re-industrialise the economy or, more generally, how to strengthen the manufacturing sector. It is exclusively concerned with structural issues, in particular how a stronger manufacturing performance would affect the share of manufacturing in national value-added and, by implication, employment.

The paper contains two main sections, together with a technical appendix which describes in detail how the results discussed in the body of the paper are obtained.
The first section compares the historical experience of the UK with that of a large group of other European countries (“Europe”). The share of manufacturing in value-added has fallen dramatically in both areas since 1970, but the decline has been greater in the UK than in Europe. After reviewing the proximate reasons for this difference, the paper concludes that the main proximate reason is the external trade performance of the UK manufacturing sector.

The next section presents some projections for the period 2010-2035. These projections cover a variety of possibilities and their outcomes range from a rapid decline to a modest increase in the share of manufacturing in value-added and, by implication, employment. Under only one, rather unrealistic, scenario does the manufacturing share actually increase and then by only a modest amount. Under a more realistic scenario, the share of manufacturing slowly declines. By implication there would also be a gradual decline in the employment share of manufacturing. However, because total employment in the economy is expected to grow, this falling share might be accompanied by some increase in the absolute number of people employed in manufacturing. As the paper concludes, this is about as close to “re-industrialisation” as one can reasonably expect.

2. Historical experience

The weight of a sector in the national economy is conventionally measured by its share of total employment or of current price value-added (value-added for short). In an advanced economy like ours these shares are similar and follow similar paths through time. This is what we should expect if profit mark-ups are reasonably stable over time and wages in the various sectors grow at approximately the same rate. We shall focus mainly on the behaviour of the value-added share, although our observations will apply with equal force to the employment share. As can be seen from Figure 1, the UK has experienced a dramatic fall in the share of manufacturing in both value-added and employment.

Figure 2 compares UK experience with what happened in an aggregate of European countries (“Europe”) over the period 1970-2010. The share of manufacturing in value-added was initially similar in the two areas and in both of them this share fell dramatically during ensuing decades. However, the decline was faster in the UK than
Europe, especially after 1995. Cumulatively, the manufacturing share fell by 18.2 percentage points in the UK over the period as compared to 11.7 percentage points in Europe.

The share of manufacturing in current price value-added depends on both prices and quantities. This share may fall because the price of manufactured goods falls in relation to the average price of other goods and services. It may also fall because the output of manufactured goods grows more slowly (or falls more rapidly) than other types of output. The output of manufactured goods is arithmetically equal to domestic expenditure (including additions to inventories) on manufactures plus net exports (exports minus imports), so the behaviour of the manufacturing share depends on what happens to both of these items.

Figure 3 shows what happened to net manufactured exports in the UK and Europe over the period 1970-2010. The net manufactured exports of Europe fluctuated considerably during this period, but as a fraction of GDP they were much the same in 2010 as in 1970. In the UK, in contrast, there was a huge fall in net exports, from +4.8% of GDP in 1970 to –4.4% of GDP in 2010. Such a turn-around in the manufacturing trade balance represents a substantial reduction in the demand for UK manufactures and was an important factor behind the falling share of manufacturing in value-added.
Figure 4 shows what happened to the relative price of manufactured goods (as compared to goods and services in general) over the period 1970-2010. In both the UK and Europe, the cumulative fall over the period was around 33%, which represents an annual rate of decline equal to 0.94%. This downward trend was mainly due to the fact that productivity growth was on average faster in manufacturing than elsewhere in the economy.

Using information on trade and relative prices it is possible to quantify, at least proximately, the contribution of various factors to the observed de-industrialisation. The following analysis decomposes changes in the manufacturing share of current price value-added into three components: (1) a trade balance effect, (2) a relative price effect, and (3) a demand effect which reflects changes in the composition of real domestic expenditure. It must be stressed that this is only a statistical decomposition and does not imply that the three effects are causally independent. For example, the composition of domestic expenditure depends on relative prices. If manufactured goods become relatively cheaper, this will encourage buyers to increase the relative quantity of manufactures they purchase as compared to other goods and services. Thus, the size of the demand effect in our decomposition will be influenced by the behaviour of relative prices. The behaviour of relative prices is in turn affected by a country’s participation in foreign trade. Competition from imports may reduce the relative price of locally produced manufactures by inducing local firms to produce more efficiently. Moreover, the relative price of manufactured goods is highly correlated with relative productivity, so the price effect in our decomposition includes productivity effects of all kinds, including those that originate from international competition.

Coutts and Rowthorn (2013a) present several estimates of how trade impinges on internal economic structure. The most relevant estimate in the present context is derived from UK input-output tables. This estimate implies that, other things being equal, a 1 percentage point fall in the ratio of net manufactured exports to GDP is associated with a reduction of approximately 0.55 percentage points in the share of manufacturing in value-added. We can use this coefficient to modify the observed trajectory of the UK manufacturing share so as to remove the direct structural impact of foreign trade. The result is shown by the dashed line in Figure 5. The equivalent result for Europe is shown in Figure 6. As expected, the trade balance adjustment has a large effect on the UK share but is of minor importance for Europe.
The next step is to modify this hypothetical trajectory to allow for relative price changes. This is done by dividing the hypothetical trajectory by the price index shown in figure 4. The resulting curve plots the “constant price, constant trade balance” share of manufacturing in value-added. This curve indicates how variations in the composition of domestic demand affect the share of manufacturing in the national economy. The downward slope of the curve shows how in real terms the composition of domestic demand is shifting away from manufactures towards other goods and services.

<table>
<thead>
<tr>
<th>Table 1. De-industrialisation Decomposed: UK and Europe 1970-2010</th>
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<tbody>
<tr>
<td></td>
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<td></td>
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<tr>
<td>Share of manufacturing in current price value-added (%)</td>
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<tr>
<td></td>
</tr>
<tr>
<td>1970</td>
</tr>
<tr>
<td>28.9</td>
</tr>
<tr>
<td>27.2</td>
</tr>
<tr>
<td>1.6</td>
</tr>
<tr>
<td>2010</td>
</tr>
<tr>
<td>10.7</td>
</tr>
<tr>
<td>15.5</td>
</tr>
<tr>
<td>-4.8</td>
</tr>
<tr>
<td>Change 1970-2010</td>
</tr>
<tr>
<td>-18.2</td>
</tr>
<tr>
<td>-11.7</td>
</tr>
<tr>
<td>-6.5</td>
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<tr>
<td>of which:</td>
</tr>
<tr>
<td>Domestic demand</td>
</tr>
<tr>
<td>-5.9</td>
</tr>
<tr>
<td>-5.2</td>
</tr>
<tr>
<td>-0.7</td>
</tr>
<tr>
<td>Relative price</td>
</tr>
<tr>
<td>-7.2</td>
</tr>
<tr>
<td>-7.1</td>
</tr>
<tr>
<td>-0.1</td>
</tr>
<tr>
<td>Trade balance</td>
</tr>
<tr>
<td>-5.1</td>
</tr>
<tr>
<td>0.5</td>
</tr>
<tr>
<td>-6.6</td>
</tr>
</tbody>
</table>

Table 1 summarises the cumulative impact of the changes shown in Figures 5 and 6. Since 1970 the UK and Europe have experienced very similar shifts in the composition of domestic demand away from manufactured goods towards other items, mainly services. They have also experienced very similar reductions in the relative price of manufactured goods. Since growth rates of real income per capita and relative prices have been similar in the UK and Europe, this suggests that price and income elasticities of domestic demand for manufactures must be similar in the two areas. This issue is explored briefly in the technical appendix. The main difference between the UK and Europe concerns the impact of foreign trade. The huge deterioration in the UK manufacturing trade balance over the period is the
main proximate reason why de-industrialisation has occurred more rapidly here than in Europe. Even so, our poor trade performance accounts for well under a third of the observed decline in the share of manufacturing in UK current price value-added (and employment). This conclusion does not take into account the indirect impact of foreign trade on relative prices and productivity, which it beyond the scope of this paper to consider.

### Table 2. Proportionate Contributions to Changes in the Share of Manufacturing in UK Current Price Value-Added (% p.a.)

<table>
<thead>
<tr>
<th></th>
<th>Actual 1970-2010</th>
<th>Projected 2010-2035</th>
<th>Projected 2010-2035</th>
<th>Projected 2010-2035</th>
<th>Projected 2010-2035</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic demand</td>
<td>-0.58</td>
<td>-0.58</td>
<td>-0.58</td>
<td>-0.58</td>
<td>-0.40</td>
</tr>
<tr>
<td>Relative price</td>
<td>-0.94</td>
<td>-0.94</td>
<td>-0.94</td>
<td>-0.94</td>
<td>-0.60</td>
</tr>
<tr>
<td>Trade</td>
<td>-0.97</td>
<td>-0.97</td>
<td>0</td>
<td>1.15</td>
<td>1.41</td>
</tr>
<tr>
<td>Total</td>
<td>-2.49</td>
<td>-2.49</td>
<td>-1.52</td>
<td>-0.37</td>
<td>0.41</td>
</tr>
</tbody>
</table>

### Table 3. Growth Rates of Real Output (% p.a.)

<table>
<thead>
<tr>
<th></th>
<th>Whole Economy</th>
<th>Manufacturing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual 1970-2008</td>
<td>2.49</td>
<td>0.98</td>
</tr>
<tr>
<td>Projected 2010-2035</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I SuperServ</td>
<td>2.50</td>
<td>1.05</td>
</tr>
<tr>
<td>II Serv</td>
<td>2.50</td>
<td>2.02</td>
</tr>
<tr>
<td>III Man</td>
<td>2.50</td>
<td>3.17</td>
</tr>
<tr>
<td>IV FastMan</td>
<td>2.50</td>
<td>3.61</td>
</tr>
</tbody>
</table>
3. Projections

In this section we present some projections for the period 2010-2035. These are not predictions of what will actually happen, but what would happen under certain assumptions about the future. Their purpose is to inform the contemporary debate about rebalancing of the UK economy towards manufacturing and to indicate its quantitative dimensions.

The assumptions underlying the various projections are shown in Table A4 of the appendix. These assumptions concern: (1) the rate at which the composition of domestic demand is shifting away from manufactured goods towards other goods and services, (2) the rate at which the relative price of manufactured goods is falling in comparison with other items, and (3) the behaviour of the manufacturing trade balance.

There are four scenarios: I (SuperServ), II (Serv), III (Man) and IV (FastMan). The name of each scenario is chosen to encapsulate some distinguishing feature. The first three scenarios make identical assumptions about the evolution of domestic demand and relative prices. In each case, domestic demand shifts away from manufactured goods towards services at the same annual average rate as in the past (1970-2010), and the relative price of manufactured goods also falls at the same rate as in the past. These scenarios differ only with respect to what they assume about the manufacturing trade balance. The final scenario assumes a slower shift in the composition of domestic demand and a slower decline in the relative price of manufactured goods than occur under the other scenarios. It also assumes a big improvement in the manufacturing trade balance.

Table 2 shows what the various projections imply for the share of manufacturing in value-added and for the balance of payments in 2035. The projected trajectories are illustrated in Figure 7. Table 3 shows what the projections imply for the growth rate of manufacturing output on the assumption that overall GDP increases by 2.5% p.a., which is the average rate observed over the period prior to the 2008 crisis.

The projected outcomes under the four scenarios are as follows:
• **I (SuperServ):** Under this scenario, manufacturing trade performance is very poor and by 2035 the manufacturing trade deficit reaches 7.3% of GDP. To sustain such a large manufacturing deficit would require massive improvements elsewhere in the balance of payments, above all in service exports: hence the name “SuperServ”. Under this scenario manufacturing output grows at 1.05 per cent a year, which is similar to the pre-crisis average. The share of manufacturing in value–added falls rapidly and by 2035 is down to 5.9%. The employment share would presumably fall by a similar amount. The absolute number of manufacturing jobs would also decline considerably.

• **II (Serv):** Under this scenario the manufacturing trade deficit remains unchanged at 4.4% of GDP throughout the trajectory. Since the economy starts off with a current account deficit and negative prospects for trade in energy (Coutts and Rowthorn 2013b), the achievement of external equilibrium under this scenario presumes an improvement elsewhere in the balance of payments, above all in service exports. The required improvement is not as large as under Scenario I, but it is still substantial: hence the name “Serv”. Under this scenario manufacturing output grows at approximately 2 per cent a year, which is well above the pre-crisis average but slower than GDP. The share of manufacturing in value–added continues to falls and by 2035 reaches 7.3%. The employment share would presumably fall by a similar amount. The absolute number of manufacturing jobs would also decline although less sharply than under the previous scenario.

• **III (Man):** Under this scenario, trade performance improves and the manufacturing trade deficit is eliminated by the end of the period. Such an improvement should be sufficient to eliminate the existing current account deficit and put the UK balance of payments on a sound footing. This scenario is named “Man” to stress the improvement in manufacturing trade performance. Under this scenario manufacturing output grows at almost 3.2 per cent a year, which is faster than GDP. However, because of falling relative prices, the share of manufacturing in value–added continues to fall, albeit slowly, and by 2035 is down to 9.7%. The employment share would presumably fall by a similar amount. However, because of growth in population and hence in the national labour force, the absolute number of manufacturing jobs would increase somewhat.

• **IV (FastMan):** Manufacturing trade performance is much stronger under this
scenario and by the end of the period there is a trade surplus equal to 2.0% of GDP. In addition there is slower shift in the composition of domestic demand and a slower decline in the relative price of manufactured goods than either historically or under the other scenarios. Under this scenario, manufacturing output grows at around 3.6 per cent a year, which is much faster than GDP: hence the name “FastMan”. The share of manufacturing in current price value-added gradually rises to reach 11.8% by 2035. The employment share would presumably increase by a similar amount. Because of growth in the national labour force, the absolute number of manufacturing jobs would increase by a substantial amount.

• Of the above scenarios, IV(FastMan) is the only one under which there is an increase in the share of manufacturing in current price value-added. In the other scenarios, this share declines, sometimes by a considerable amount. The assumptions underlying FastMan are collectively rather extreme, although the resulting increase in the manufacturing share is modest. For example, the relative price of manufactures under this scenario falls at 0.6% p.a. which is quite a lot slower than the rate historically observed in most advanced economies. This assumption is also at odds with government policies seeking to encourage innovation in the manufacturing sector through the application of science and technology. To the extent they succeed, such policies will stimulate more rapid growth in productivity and thereby accelerate the decline in the relative price of manufactured goods.
Another questionable feature of FastMan is the assumption that the UK will enjoy a manufacturing trade surplus equal to 2.0% of GDP by 2035. Given the likely evolution of other items in the balance of payments, such as service exports, a manufacturing trade surplus on this scale would be unnecessary and perhaps unsustainable. If service exports continue to increase at a plausible rate in the future and there is some recovery in investment income, the UK will have no need for a large manufacturing trade surplus (see Coutts and Rowthorn 2013). Even if such a surplus could be achieved for a time, it might be difficult to sustain indefinitely. With a strong net export performance in both manufactures and services, sterling would probably appreciate, causing UK producers in general to become less competitive and reducing net exports of all kinds. To this extent, an excessive manufacturing trade surplus would be self-correcting.

4. Conclusions

Under almost any plausible assumptions, the share of manufacturing in current price value-added (and employment) is likely to fall or at best stabilise. The one scenario under which there is an increase in this share rests on implausible assumptions about the behaviour of relative prices and the balance of payments. Even so, the
eventual rise in the manufacturing share in current price value-added is modest.

A more plausible scenario is III (Man). Under this scenario, trade performance improves, the present manufacturing trade deficit is eliminated and the balance of payments is put on a sound footing. Manufacturing output grows faster in real terms than GDP, but because of rapid productivity growth, the relative price of manufactures falls rapidly and there is a gradual decline in the share of this sector in current price value-added. By implication there would also be a gradual decline in the employment share of manufacturing. However, because total employment in the economy is expected to grow, this falling share might be accompanied some increase in the absolute number of people employed in manufacturing. This is about as close to “re-industrialisation” as one can reasonably expect.

Notes

1. The European countries are as follows Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden and Switzerland. The data on GDP are from http://unstats.un.org/unsd/snaama/dnllist.asp. The relevant UN spread sheets are: “GDP and its breakdown at constant 2005 prices in US Dollars” and “GDP and its breakdown at current prices in US Dollars”.

2. Data on manufacturing trade were kindly provided by the UN Statistics Division in Geneva. Our European total for net exports assumes that net exports between countries within the European group cancel out. This will be true if exports and imports are measured on the same statistical basis, since recorded exports from country A to country B will then be equal to recorded imports by country B from country A. In practice, there may be inconsistencies in the recording of exports and imports by different countries. However, such errors are unlikely to be very important in the present context. They are unlikely to alter the finding that net manufactured exports from Europe were much the same as a percentage of GDP in 2010 as in 1970.

3. Each price index shown in figure 4 was derived as follows. A price series for manufacturing was obtained by dividing the UN series for current price value-
added by the UN series for constant price value-added. The same procedure
was done for the economy as a whole. Dividing the former price index by the
latter gave a series for the relative price of manufactures. The resulting series
was rescaled to make the relative price equal to 1 in 1970.

4. See the technical appendix for a detailed description of the methods used for this
quantification.

5. See the appendix for an explanation of this choice.

6. Relative prices and the composition of demand are, of course, intimately related.
Without this sustained decline in relative prices, the composition of demand would
have shifted away from manufactures even faster than actually occurred (see
Rowthorn and Ramaswamy 1999).

7. Of the four scenarios considered in this paper, II (Serv) is closest to the base
projection in Coutts and Rowthorn (2013b) which projects little change in the
manufacturing balance as a percentage of GDP.

8. Ajit Singh (1977) defined a manufacturing sector as “efficient” if it earns a big
enough surplus, at a socially acceptable exchange rate, to cover the deficit other
kinds of trade. In the modern UK context, given the strong performance of service
exports, efficiency does not require a large manufacturing trade surplus. It may
be sufficient for the manufacturing sector to sector to avoid a large deficit.

9. Throughout this appendix shares are given to one decimal place. Because of
rounding errors totals may not add.

References

Payments in Advanced Economies”, paper for the UK Department of Business,
Industry and Skills.
Technical appendix

The tables in this Technical Appendix are best viewed in ‘Scrolling Mode’

This appendix describes the methods which underlie the various diagrams and tables presented in the text.

Let $p_i(t)$ and $v_i(t)$ denote the price and net output of good (or service) $i$ at time $t$. The subscript $m$ will be used to denote manufactures.

**Shares in value-added**

The share of manufacturing in current price value-added is:

$$S_c(t) = \frac{p_m(t)v_m(t)}{\sum_i p_i(t)v_i(t)}$$

The UN database used for this paper also provides series based on 2005 prices. The share of manufacturing in constant price value-added is defined as follows:
Relative prices

An implicit price index for total output is given by

\[ \bar{S}(t) = \frac{p_m(2005)v_m(t)}{\sum_i p_i(2005)v_i(t)} \]

Aggregate real output is given by

\[ P(t) = \frac{\sum_i p_i(t)v_i(t)}{\sum_i p_i(2005)v_i(t)} \]

Note that

\[ P(t)v(t) = \sum_i p_i(t)v_i(t) \]

The following is a price index for manufactures:

\[ P_m(t) = \frac{p_m(t)}{p_m(2005)} \]

An index for the relative price of manufactures (as compared to goods and services in general) is given by:
The above expression can be written as follows:

\[ r_m(t) = \frac{P_m(t)}{P(t)} \]

This index has the property that \( r_m(2005) = 1 \).

Define

\[ R_{t_0}(t) = \frac{r_m(t)}{r_m(t_0)} \]

This is the relative price index for manufactures rescaled so that \( R_{t_0}(t_0) = 1 \).

**Modifications**

Consider a trajectory that begins in year \( t_o \). The constant trade balance trajectory is defined as follows:

\[ S^*_t(t) = S(t) - b \left[ B(t) - B(t_0) \right] \]

where \( B(t) \) is the balance of trade in manufactures as a share of GDP and \( b \) is a constant. Throughout the text it is assumed that \( b = 0.55 \) (see Coutts and Rowthorn 2013a, appendix Table A1). This new trajectory is the original trajectory modified so as to remove the structural impact of foreign trade on the composition of value-added.
The above trajectory can be modified as follows so as to remove the statistical effect of relative price changes:

\[ S_{t_0}^{**}(t) = \frac{S_{t_0}^*(t)}{R_{t_0}(t)} \]

Table A1 uses the above definitions to decompose changes in the share of manufacturing in current price value-added over the period \((t_0, t_1)\). It also shows how these changes affect the growth rate of the current price share.

Note that

\[ S_{t_0}^{**}(t_0) = S_{t_0}^*(t_0) = S(t_0) \]

Thus, by construction all shares are equal at the start of the period. They diverge later under the influence of changes in trade and relative prices. Note also that there is no subscript for \(S(t)\). This is an observed share which does not depend on the base year \(t_0\). The quantities \(S_{t_0}^{**}(t)\) and \(S_{t_0}^*(t_0)\) require subscripts because they are normalised to equal \(S(t)\) in the base year \(t_0\).

### Table A1: Basic Calculations for 1970-2010

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Actual current price share (S(t))</td>
<td>28.9</td>
<td>10.7</td>
<td>Observed</td>
</tr>
<tr>
<td>(2) Manufacturing trade balance (B(t))</td>
<td>4.8</td>
<td>-4.4</td>
<td>Observed</td>
</tr>
</tbody>
</table>
Table A1 shows the basic calculations for the period 1970-2010. The actual current price share at the end of the period is $S(2010) = 10.7$. As a fraction of GDP, the manufacturing trade balance changes by $B(2010) - B(1970) = -9.2$ percentage points over the period. To remove the effect of this change on the share of manufacturing we adjust the observed terminal share by $-0.55 \times (-9.2)$ percentage points. The adjusted share is then $S_{1970}^*(2010) = 10.7 - 0.55 \times (-9.2) = 15.7$.

This is labelled the “current price, constant trade balance share” in the diagrams in the text. We then divide $S_{1970}^*(2010)$ by the relative price index to obtain the “real” share $S_{1970}^{**}(2010) = S_{1970}^*(2010) + R_{1970}(t) = 15.7 + 0.68 = 22.9$. This is labelled the “constant price, constant trade balance share” in the diagrams in the text. Table A1 also shows the growth rates of each type of share and of the relative price index over the period 1970-2010.
Decomposing Changes in the Manufacturing Share

The contributions of domestic demand, relative prices and the trade balance can be calculated using the formulae given in Table A2. The table also shows the formulae used to express these effects in growth rate terms. In addition the table includes a numerical example based on UK experience over the period 1970-2010. The data used for this example are from Table A1. Note that, in behavioural terms, the various effects shown in Table A2 are interdependent. For example, demand and price effects are interdependent, since the demand for manufactures is a function of their relative price (see Rowthorn and Ramaswamy, 1999). See also the note towards the end of this appendix.

<table>
<thead>
<tr>
<th>Derivation of 2035 value</th>
<th>Exponential growth rate 2010 -2035 (% p.a.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial current price share (S(2010))</td>
<td>10.7</td>
</tr>
</tbody>
</table>
### Projection 2010-2035

Table A3 shows how Projection III (Man) is obtained. This is done in reverse order from the historical calculation shown in Table A1. The projection starts from the initial values \( S_{2010}^{**} = S_{2010}^* = S(2010) = 10.7 \). The initial value of the relative price index for manufactures is \( R_{2010} (2010) = 1 \). The share \( S_{2010}^{**}(t) \) and the relative price index \( R_{2010}(t) \) are assumed to grow at constant exponential rates \(-0.58\%\ p.a.\) and \(-0.94\%\ p.a.\) respectively over the period 2010-2035. These are same rates as their equivalents grew on average over the preceding period 1970-2010. The terminal values that result from these assumed growth rates are \( S_{2010}^{**}(2035) = 9.2 \) and \( R_{2010} (2035) = 0.79 \). Multiplying by the former share by the relative price index for manufactures yields \( S_{2010}^*(2035) = 9.2 \times 0.79 = 7.3 \). The required improvement in the trade balance is 4.4 percentage points. Such an improvement implies an estimated increase of \( 0.55 \times 4.4 = 2.4 \) percentage points in the share of manufactures in current trade.
price value-added. Thus, \( S(2035) = 7.3 + 2.4 = 9.7 \). This is the projected share of manufacturing in current price-value at the end of the period in 2035, after demand shifts, relative price changes and the required improvement in the manufacturing trade balance are all taken into account.

Table A4: Contributions to the average growth rate of the current price share

<table>
<thead>
<tr>
<th>Formula for the period ((t_0, t_1))</th>
<th>Actual UK 1970-2010</th>
<th>I (Super Serv) 2010-2035</th>
<th>II (Serv) 2010-2035</th>
<th>III (Man) 2010-2035</th>
<th>IV (Fast Man) 2010-2035</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic demand effect</td>
<td>(\left(\ln S_{t_0}^{**}(t_1) - \ln S(t_0)\right)/\left(t_1 - t_0\right))</td>
<td>-0.58</td>
<td>-0.58</td>
<td>-0.58</td>
<td>-0.58</td>
</tr>
<tr>
<td>Relative price effect</td>
<td>(\left(\ln S_{t_0}^{*}(t_1) - \ln S_{t_0}^{**}(t_1)\right)/\left(t_1 - t_0\right))</td>
<td>-0.94</td>
<td>-0.94</td>
<td>-0.94</td>
<td>-0.94</td>
</tr>
<tr>
<td>Trade effect</td>
<td>(\left(\ln S(t_1) - \ln S_{t_0}^{*}(t_1)\right)/\left(t_1 - t_0\right))</td>
<td>-0.97</td>
<td>-0.97</td>
<td>0.00</td>
<td>1.15</td>
</tr>
<tr>
<td>Total change</td>
<td>(\left(\ln S(t_1) - \ln S(t_0)\right)/\left(t_1 - t_0\right))</td>
<td>-2.49</td>
<td>-2.49</td>
<td>-1.52</td>
<td>-0.37</td>
</tr>
</tbody>
</table>

Table A4 presents the actual growth contributions for the UK over the period 1970-2010. As already pointed out, in this case the domestic demand effect (-0.58) is a residual obtained by subtracting estimated demand (-0.73) and price effects (-0.94) from the known total (-2.49). Projections are obtained using assumed entries for the domestic demand and relative price effects. Assumed entries are shown in italics. For Projection I the entry for the trade effect is the same as for the historical period 1970-2010. For the other projections the trade effect ensures that the manufacturing trade balance achieves some target value in 2035. The final total for each projection is obtained by summation.
Growth Rates of Real Output

The average growth rate of real manufacturing output over the period \((t_0, t_1)\) is as follows:

\[
g_{v_m} = g_v + \left( \frac{\ln S(t_1) + \ln R_{t_0}(t_1) - \ln S(t_0) - \ln R_{t_0}(t_1)}{t_1 - t_0} \right)
\]

where \(g_v\) is the growth rate of GDP. The expression in parentheses is the growth rate of the share of manufacturing in “real” value-added.

A Simple Model of Relative Shares in a Closed Economy

Consider a closed economy in which the price and income elasticities are constant. In such an economy there is no need to make an adjustment for foreign trade. Using the previous notation and the symbol \(g\) to denote growth rates the demand function for manufactures is as follows.

\[
v_m = A \left( \frac{P_m}{P} \right)^{-\alpha} v^\beta
\]

Since there is no adjustment for foreign trade:

\[
S^{**} = \bar{S} \frac{v_m}{v} = A \left( \frac{P_m}{P} \right)^{-\alpha} v^{\beta-1}
\]

\[
S^* = S \frac{P_m \nu_m}{PV} = A \left( \frac{P_m}{P} \right)^{1-\alpha} v^{\beta-1}
\]

The above formulae indicate how, for a given value of \(v\), a change in relative prices, as indicated by \(P_m / P\) will influence the shares \(S^*\) and \(S^{**}\). Differentiating logarithmically yields the exponential growth rates:

\[
g_{S^{**}} = g_{\bar{S}} = -\alpha \left( g_{P_m} - g_P \right) - (1 - \beta) g_v
\]

\[
g_S = g_{S^*} = (1 - \alpha) \left( g_{P_m} - g_P \right) - (1 - \beta) g_v
\]
Suppose that $0 < a , 0 < b < 1, g_r > 0$ and $g_{p_m} \leq g_p < 0$. In this case 

$$-\alpha(g_{p_m} - g_p) > 0 \text{ and } (1 - \beta)g_r > 0.$$ 

If $(1 - \beta)g_r > -\alpha(g_{p_m} - g_p)$ the share of manufactures in real output $S^*$ will decline through the course of time. This is what happens in all of the cases considered in this paper.

**Foreign Trade**

Coutts and Rowthorn (2013a) present an econometric analysis of the factors which determine the employment share of manufacturing. Their analysis finds that imports from developing economies have a larger impact on the manufacturing share than do imports from advanced economies. An earlier paper by Rowthorn and Ramaswamy (1999) explored this issue in greater depth. The authors found that competition from low-wage economies leads to higher productivity in the importing economy by either driving out certain types of local production or encouraging local firms to produce more efficiently or move up market. They also found that such productivity effects are highly correlated with changes in relative prices within the importing country and that lower prices are the main channel through which imports from low-wage economies influence the composition of real expenditure. Their estimates imply that the labour saving effect of higher productivity outweighs the demand-enhancing effect of lower prices, so the net impact of the two effects on manufacturing employment is negative. This negative impact is measured by the coefficient for LDCIMP in their regression equations for the employment share of manufacturing in Rowthorn and Ramaswamy (1999, Table 4) and in Coutts and Rowthorn (2013a, Table 2). However, these equations do not include explicit terms for either prices or productivity. In contrast, our statistical decomposition contains a specific component for relative price changes. This component includes the impact of foreign trade of all kinds on relative prices, including indirect effects that arise from the impact of trade on productivity. Moreover, the influence of relative prices on the composition of real expenditure is included in our demand effect. Hence, the effects associated with LDCIMP in the regression analyses in the above articles are already captured by the relative price and expenditure effects in our decomposition. There is therefore no need to include an explicit developing country trade effect in the decomposition.

This leaves the straightforward compositional effect of foreign trade on the internal structure of the economy. Suppose that net exports of manufactured goods increase
by 1 per cent of GDP and at the same time net exports of other items, such as services, fall by an equal amount. Other things being equal, this will cause the output of the manufacturing sector to rise and the output of other sectors to fall. The effect of this switch will be an increase in the share of manufacturing in value-added or employment. Its effect on the employment share is estimated by the coefficient of MANTRADEBAL in the regressions of Coutts and Rowthorn (2013a, Table 2). They estimate that a 1 percentage point rise in the ratio of net manufactured exports to GDP will lead to a rise of 0.207 to 0.312 percentage points in the employment share of manufacturing. As the authors point out, these estimates are implausibly low. Calculations based upon the UK input-output tables for 2008 give a value for this coefficient in the range 0.42 to 0.52 for the employment share and 0.52 to 0.59 for the value-added share (Coutts and Rowthorn 2013a, Appendix Table A1). These are probably a better guide to the compositional impact of foreign trade than the regression coefficients. In our decomposition we therefore assume a value of 0.55 for the coefficient of MANTRADEBAL (‘B’ in our notation) in accordance with the input-output table. For practical reasons we assume the same coefficient for all years and for both Europe and the UK. We make no additional allowance for imports from developing countries, for reasons stated above. It should be borne in mind that the relative price effect in our decomposition includes relative price effects resulting from trade of all kinds.
UPDATE OF PROSPECTS FOR THE UK BALANCE OF PAYMENTS

BY KENNETH COUTTS & ROBERT ROWTHORN
Update of prospects for the UK balance of payments

by

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University of Cambridge

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Contents

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Executive Summary

1. Prospects for the UK balance of payments

2. Previous projections

3. Looking to the Future

3.1 Base Projection: Assumptions

3.2 Base Projection: Results

3.3 Base Projection: Sensitivity Analysis

3.4 Alternative Scenarios

4. Discussion

References

Appendix: Sources and Methods
Executive Summary

This paper is a companion piece to the paper on de-industrialisation of the UK Economy. It updates the authors’ previous projections of the balance of payments and its components. The paper discusses the enormous structural changes in trade and income flows over the past sixty years. In 1950, Britain was a leading industrial power with a trade surplus in manufactured goods equal to 10% of GDP. There is now a trade deficit in manufactures of 4% of GDP. Over the same period, trade in services has moved into substantial surplus exceeding 4% of GDP. No other industrialised country has experienced such a large shift in the structure of its trade.

The paper reviews the authors’ earlier projections of the current account balance for the period 1997-2007. The projection of a steady deterioration in the manufacturing trade deficit proved accurate, but the non-manufacturing balance performed better than projected, so that the current account deficit as a whole was only about 2.5% of GDP by the end of the period. Major changes in the non-manufacturing balance included financial services (“The City”) where we projected a rising trend but could not foresee the bubble in net earnings prior to the financial crisis of 2008. Similarly, we failed to anticipate the scale of the increase in net investment income. An error in the other direction was that the energy balance worsened more than anticipated. While we anticipated a decline in North Sea production from the turn of the century, we did not anticipate the rise in energy prices. Our review of the projections illustrates the great uncertainty in trying to make ten-year projections of the current account and its components.

The paper uses a small model of the balance of payments to project the main components of the current account consisting of visible trade, invisibles (services), current transfers and net investment income. Visible trade is separated into: manufactures food, energy and other materials. The main invisible items are: transport, travel, government services, knowledge-intensive services, and financial and insurance services. The projections are conditional on plausible assumptions about the growth of world trade, the growth of domestic spending, oil and gas production, the real exchange rate and real interest rates.

Under this base scenario, the current account is projected to remain in deficit over the decade and to be about 3% of GDP by 2022. This is only a little larger than the
average current account deficit of the UK over the past two decades. The paper discusses the detailed results. There is a growing deficit in oil and gas and in net investment income. Trade in services as a whole shows a substantial improvement. Trade in manufactures remains in deficit but shows a small improvement relative to GDP.

The paper illustrates the sensitivity of the projections to unforeseen shocks or variations in assumptions that would result in a worsening of the current account by 1% of GDP. Another way to illustrate the uncertainties is to make assumptions that generate a more optimistic and a more pessimistic projection than assumed in the base scenario. Assuming that domestic spending increases more slowly and that net investment income is stronger than under the base projection, the current account deficit declines and is less than 1% of GDP by 2022. By contrast, if world trade increases each year by 5% compared with 6% under the base projection and the output of oil and gas declines by 7% a year compared with 5%, the current account deficit widens to over 5% of GDP and is on a worsening trend.

The paper concludes by discussing the range of uncertainties involved in projecting the balance of payments. It argues that if the current account deteriorates as in the pessimistic scenario to a persistent range of 4-5% of GDP, the sustainability of deficits of this size becomes problematic. In practice, there would either be market forces such as depreciation of the currency, or rises in interest rates that would ameliorate the problem, or policy action, such as restrictive fiscal and monetary policy to reduce the growth of domestic demand. The paper concludes by arguing that there is a case for industrial and other policies to boost UK trade performance in manufactures, knowledge-intensive services and to maintain the prominence of the UK’s trade in financial services.

1. Prospects for the UK balance of payments

Over the past sixty years, the UK economy has undergone huge structural changes. In 1950 this country was a great industrial power with more than a third of its labour force employed in the manufacturing sector and a further million in coal mining. There
was a trade surplus in manufactured goods equal to 10% of GDP and the country was a net exporter of energy. Since then, employment in the manufacturing sector has shrunk dramatically and coal mining has almost disappeared. There is now a trade deficit in manufactured goods equal to 4% of GDP and, after an interlude following the discovery of North Sea oil, the UK is now a net importer of energy. The gap left by the decline of our traditional industries has been filled by a whole range of service activities, which now account for the bulk of employment and, collectively, earn a valuable trade surplus. Until recently, the country enjoyed significant net earnings in the form of interest, profits and dividends from international investment.

The costs and benefits of these changes, and what could or should have been done about them, were at one time hotly debated. However, such concerns were eventually buried under the euphoria of a prolonged economic boom and a bubble in house and share prices. They have now resurfaced following the credit crisis and ensuing recession. There is a widespread feeling that something has gone wrong, that the economy has become dangerously unbalanced, and we have put too much faith in finance at the expense of manufacturing and other activities. There are also new concerns about food and energy security in the face of rising world demand and limited supplies.

2. Previous projections

Some years ago a small group of us in Cambridge, under the aegis of the Centre for Business Research, set out to investigate the role of manufacturing in the UK economy. The manufacturing sector had been shedding jobs for some decades and the pace of decline had been faster than in other countries. The official index of production indicated that the aggregate output of UK manufacturing had been stagnating for nearly twenty years, whereas many other countries had experienced considerable growth in production. Was this situation sustainable over the longer term? In particular, was it compatible with the sound balance of payments required for national solvency? Would manufacturing exports be sufficient in the future to pay for the imports we require? If not, what alternative sources of income would be available to bridge the gap?

Figure 2.1: Balance of Payments Current Account (% GDP) old base
We began our investigations at a time when the UK balance of payments had been improving for some years. The current account balance as a whole was close to zero (Figure 2.1). There was a small deficit on manufacturing trade and a small surplus on the totality of other current items. Our objective was to investigate whether this satisfactory state of affairs would continue, and to see if there were underlying trends that might disrupt this equilibrium and give rise to serious payments difficulties in the future. Our starting point was the “base projection”. This projection represented our best estimate of what would happen over a ten year horizon in the absence of policy changes or shocks. This is a much longer horizon than is usually attempted in macroeconomic forecasting. Under the base projection there was a steady deterioration in the overall current account culminating in a deficit equal to 4.5% of GDP in 2007. In the event, the current account did deteriorate but by less than projected.

In evaluating our projection, it is useful to consider manufactures and non-manufactured items separately. We projected that the trade balance in manufactures would get steadily worse, culminating in a deficit of around 4% of GDP in 2007. This turned out to be an accurate forecast, and our projection of the manufacturing balance tracked closely what actually happened. We also projected a worsening situation on the non-manufacturing side of the account. This turned out to be wrong, which explains why the current account as a whole performed somewhat better than
In recent years, the behaviour of the non-manufacturing side of the current account has been dominated by the following items, all of which have been subject to large changes that we did not foresee:

• Finance (“The City”): Net overseas earnings of the financial sector have been on an upward trend for a considerable time. Starting in 2005 there was also a spectacular bubble in which these earnings rose by 60% within the space of two years. Our projections got the upward trend, but not the bubble.

• Investment income: Net investment income has fluctuated widely over the years. During our projection period, net income was boosted by a wave of cross-border mergers and acquisitions through which UK firms trebled their highly profitable stock of overseas assets. Towards the end of the period, net income was also inflated by the huge and unexpected losses sustained by certain foreign banks operating in London. Our projections underestimated the growth of net income because we failed to anticipate either of these developments.

• Energy, food and basic materials: For some time before and after our projections began in 1997, the UK had a modest deficit on trade in these items. Net earnings from trade in energy (oil, gas, coal and electricity) were outweighed by expenditure on imported food, minerals and the like, but the gap was quite small as a percentage of GDP. However, from the turn of the century onwards the situation become much worse under the impact of falling North Sea oil production and rising import prices. Our projections took into account the fall in oil production but not the large price increases.

The above errors illustrate some of the pitfalls involved in long-term forecasting and highlight the inherent uncertainty surrounding major items in the balance of payments. Without the unforeseen growth in overseas investment income and the bubble in City earnings, there would have been a much larger deficit in the current account at the end of the projection period in 2007. Conversely, without the unexpected rise in import prices for energy, food and materials, the current account would have been close to balance in 2007. With hindsight, these developments can be explained, but they were not widely foreseen at the time.
3. Looking to the Future

The fate of our original projections is now water under the bridge. What about the future? What are the prospects for the UK balance of payments? To what extent will national solvency in the future depend on the strength of the manufacturing sector? What is likely to be the performance of this sector in the absence of major new policy initiatives? If manufacturing performs badly, will other sectors be able to fill the gap and generate the income required to pay for our imports? These are the questions that the CBR group in Cambridge explored in our original projections. We revisited this topic in 2009 and in the current paper we present a further set of projections for the period 2012-2022. These projections come with a health warning. As we have seen above, some of the main items in the balance of payments are subject to great uncertainty and any longer term projection, such as ours, is therefore subject to a large margin of error.

A projection is a conditional forecast. It does not say what will actually happen. It forecasts what would happen under certain assumptions about government policy and the behaviour of a number of economic variables, such as the price of oil or the growth of world trade. Different assumptions yield different forecasts. We start from the “base projection”, which assumes no change in government policy and embodies a set of assumptions about broad economic trends that seem reasonable in the light of existing evidence. We then examine how varying some of the main assumptions would affect the projected outcomes. Such an exercise helps to identify potential sources of error and quantifies their relative importance. It also indicates the potential importance of various policy interventions to strengthen the balance of payments. A full description of the projections is given in an appendix and here we describe only their main features.

Table 3.1: Main Items in the UK Current Account Balance of Payments 2011 (£ millions)

<table>
<thead>
<tr>
<th>Credits</th>
<th>Debits</th>
<th>Balance</th>
<th>%GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surplus Items</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Financial services &amp; insurance</td>
<td>61,043</td>
<td>14,367</td>
<td>46,676</td>
</tr>
</tbody>
</table>
Table 3.1 lists the main items in the current account. Most of the headings are self-explanatory. A separate category of "other knowledge-intensive" services is identified. This heading covers a huge variety of services such as communications, construction, computer & information services, royalties and license fees, consultancy, legal services, audio-visual services etc. It excludes financial services and insurance. These items are of increasing importance in the balance of payments.

Table 3.2: The Base Projection 2009-2020 - Main Assumptions (annual percentage growth rates)
3.1 Base Projection: Assumptions

- The main assumptions underlying the base projection are shown in Table 3.2. Further details are given in the appendix. In addition we assume that there is no change in government policy. The following are some points to note:

- Domestic Spending and GDP. Real domestic expenditure is exogenous. We assume that the economy starts to recover in 2013 and the growth rate of real domestic expenditure accelerates to 3% p.a. by 2015. Given the trade performance of the economy, this implies that GDP growth accelerates to 3.1% p.a. by the end of the period. This is somewhat faster than the historic trend and implies that some of the loss following the financial crisis is recouped (Figure 3.1). It must be stressed that the behaviour of domestic spending under the base projection is an illustrative assumption and not a forecast of what will actually happen. It may turn out that the economy grows significantly slower than is implied by this assumption.

Figure 3.1: Historical GDP and Base Projection 1948-2022
Exchange Rate. The exchange rate plays a role in the projections for trade in manufactures and also for certain other items such as trade in services and the valuation of overseas assets. We assume that the devaluation that took place in 2007-2008 is maintained throughout the projection period.

World Trade. UK exports are closely linked to the behaviour of world trade. We assume that world trade growth accelerates to reach 6% p.a. from 2016 onwards. The historical average growth rate up to 2007 was 6.9%p.a. and the October 2012 IMF World Economic Outlook projects 6.3% p.a. up to 20177.

Financial services. UK exports of financial services mushroomed in the early part of this century but then fell sharply during the ensuing crisis. They have now recovered in absolute terms, although the UK share of world exports of this type remains lower than it was at the peak. However, the UK is still a leading exporter and in 2011 accounted for 19.1 percent of world exports of financial services8. There are many threats to the City of London and the future is uncertain. Over the longer term the UK share of world financial exports is likely to fall as new competitors appear. However, world demand for financial services is growing rapidly and despite a falling share, UK net exports of this type should continue to increase in absolute terms. Our base projection assumes that net exports of
financial services (including insurance) grow slightly faster than GDP over the projection period.

- Other knowledge-intensive services. This heading covers a wide diversity of activities. Apart from a temporary decline in their dollar value in 2008-09, UK exports in this category have been increasing, albeit more slowly than world exports. There is no obvious reason to believe that this state of affairs will alter. The most likely prospect is that the UK share of world exports of other knowledge-intensive services will continue falling, but in absolute terms UK exports in this category should continue to increase quite strongly. Under our base projection net exports of other knowledge-intensive services grow faster than GDP over the projection period. This projection is derived from an equation estimated from past experience.

- Travel and Transport. Over the past decade UK trade performance in this area has improved. The ratio of tourist inflows to outflows has been rising, the UK-owned shipping fleet has expanded, and revenue from foreign airlines using UK airports has risen. In our base projection net exports from travel and tourism are projected separately using equations estimated from past experience.

- Government Services. This is a small item which is projected separately using an equation estimated from past experience.

- Current Transfers. The deficit on current transfers has been increasing rapidly mainly due to increasing payments to EU institutions. The future will depend on what happens to such payments and also on what happens to government aid to developing countries. This item is projected using an equation estimated from past experience.

- Energy, food and basic materials. There is considerable uncertainty about the future prices of these items. Over the longer term, world population growth plus rising incomes may lead a large and permanent increase in the world prices of energy, food and materials. However, this is by no means certain. We assume that the real price of oil & gas rises by 1% p.a. We make a similar assumption for basic material prices. The behaviour of food prices is estimated. Our base projection for net exports of oil and gas is based on official projections for UK
production and demand. Production falls at 5% p.a. after 2016 and demand is flat. Net exports of food and basic materials are projected separately using equations estimated from past experience.

- Investment income. This is a highly volatile item and its future trajectory is very uncertain. UK net income from international investment was inflated in 2007-2008 by the huge losses of foreign banks operating in London. Net investment income has fallen sharply since then. Indeed, in the first half 2012 there was actually a deficit on this item. We assume there is some recovery in the second half of the year and that for 2012 as a whole net investment income is zero. Our base projection assumes, in line with past experience, that the rate of return on UK overseas assets is slightly higher than on UK liabilities.

- Manufactures. Exports and imports are projected using equations estimated from past experience. The import equation allows for the fact that higher manufactured exports lead to higher imports of intermediate and capital goods. These projections take no account of the possible trade implications of government carbon emissions policy. If this policy leads to much higher energy prices than our competitors face, this will damage domestic production of energy-intensive manufactures and have a negative impact on the balance of trade.

### 3.2 Base Projection: Results

The main results for the base projection are as follows:

- Balance of Payments Current Account: the current account is in deficit throughout the projection period. In monetary terms, this deficit increases in the course of time, but relative to the economy as a whole it declines from 4% of GDP in 2012 to 3% by 2022 (Figure 3.2).

- Manufactures: the deficit on manufacturing trade increases in monetary terms from an estimated £67 billion in 2012 to £85 billion in 2022 (Figure 3.3). However, relative to the economy as a whole it declines from 4.4% of GDP in 2012 to 3.3% in 2022 (Figure 3.4).
• Other goods: There is a growing deficit in oil and gas due to falling North Sea production. The deficit in food and basic materials gets somewhat larger in money terms, but gradually declines as a share of GDP.

• Services: Taken as a whole, services enjoy a large and growing surplus. The recent improvement in “traditional” services (transport, travel and government) continues and, taken as a whole, this group is in approximate balance by 2022. Net earnings from other knowledge intensive-services increase as a share of GDP. By assumption, net earnings from finance (including insurance) increase a little as a fraction of GDP.

• Current transfers: The deficit on this item continues to widen as a fraction of GDP.

• Investment income: Net income from investment continues its downward trajectory and by 2012, the deficit on this item is around 1 percent of GDP.

**Figure 3.2: Current Account Balance (% of GDP)**
Figure 3.3: Balance of Trade in Manufactures (£ billion)
Figure 3.4: Balance of Trade in Goods (% GDP)

Figure 3.5: Balance of Trade in Services (% GDP)
Figure 3.6: Net Investment Income (% GDP)
3.3 Base Projection: Sensitivity Analysis

The base projection can be summarized as follows. There is a growing deficit in oil & gas trade and in net income from international investment. There is also a substantial improvement in service trade. The trade deficit in manufactured goods increases in money terms, but gets smaller as a fraction of GDP. The current account deficit as a whole also increases in money term, but gets smaller relative to the economy as a whole. At the end of the projection period in 2022, the current account deficit is around 3% of GDP.

When projecting the future balance of payments, what matters is not just the growth rate of any particular item, but also its initial size. The two largest items by a long way are manufactured goods and income from overseas investment (Table 3.1). Despite all the changes that have occurred, manufactured exports are still almost three times as large as the total earnings from the export of financial services of the entire City of London and well over three times export earnings from the whole gamut of other knowledge-intensive services. The balance of trade in manufactures
is the difference between two very large magnitudes. A given proportionate error in projecting either exports or imports may result in a much larger proportionate error in the trade balance in manufactures. An instant ten percent rise in manufactured exports combined with a similar fall in manufactured imports would generate a £51 billion improvement in the balance of payments, which is more than UK net earnings from financial services and insurance. An instant ten percent reduction in the amount of investment income we receive combined with a ten percent increase in what we pay out, would lead to a net loss of £36 billion. These are huge figures. They are similar in magnitude to what our imports of oil and gas would cost if North Sea oil and gas dried up overnight.

Table 3.3 provides further information on this issue. It shows how sensitive our overall balance of payments projection is to unforeseen shocks or variations in the assumptions underlying the base projection. It lists a number of changes that would individually cause the current account balance in 2020 to deteriorate by 1% of GDP. These are as follows:

- **World Trade.** The base projection assumes that world trade grows by 6% p.a. If it were to grow instead by 5.3% p.a., this would produce the required deterioration in the balance of payments.

**Table 3.3: Individual changes that *worsen* the current account by 1% of GDP by 2020**

<table>
<thead>
<tr>
<th>Change</th>
<th>Base Projection</th>
<th>Alternative Assumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slower growth of world trade</td>
<td>6.0% p.a.</td>
<td>5.3% p.a.</td>
</tr>
<tr>
<td>Currency revaluation (increase in relative unit labour costs)</td>
<td>0% p.a.</td>
<td>20% p.a.</td>
</tr>
<tr>
<td>Faster growth of domestic spending</td>
<td>3.0% p.a.</td>
<td>3.36% p.a.</td>
</tr>
<tr>
<td>Real price increase of oil &amp; gas</td>
<td>1% p.a.</td>
<td>9.0% p.a.</td>
</tr>
<tr>
<td>Faster decline in oil &amp; gas production</td>
<td>-5% p.a.</td>
<td>-20% p.a.</td>
</tr>
<tr>
<td>---------------------------------------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>Lower long term rate of return on UK investments</td>
<td>0.5%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Slower growth in real exports of financial services</td>
<td>3.8% p.a.</td>
<td>0.5% p.a.</td>
</tr>
<tr>
<td>Slower growth in real exports of other knowledge-intensive services</td>
<td>5.8% p.a.</td>
<td>1.5% p.a.</td>
</tr>
<tr>
<td>Slower growth in real exports of manufactures</td>
<td>5.2% p.a.</td>
<td>4.2% p.a.</td>
</tr>
</tbody>
</table>

Note: Calculated by modifying the relevant assumption in the base projection. Each modification leads to a 1% of GDP deterioration in the balance of payments on current account by 2022. Real quantities are derived by deflating nominal quantities by the GDP deflator.

- **Revaluation.** The base projection assumes that the real exchange rate remains constant throughout the projection period. A permanent revaluation of 20% would eventually cause the balance of payments to deteriorate by 1% of GDP. This revaluation would reverse the large currency devaluations that occurred during 2007-08.

- **Domestic Demand.** The base projection assumes that domestic spending grows at 3.0% p.a. If spending were to grow at 3.36% p.a. instead, this would eventually increase the balance of payments deficit by 1% of GDP.

- **Real Oil & Gas Prices.** The base projection assumes that the real price of oil & gas increases at 1% p.a. over the period. To produce the required deterioration in the balance of payments would require the real price of oil & gas to rise by an average of 9.0% p.a. over the entire projection period. This is conceivable, but unlikely.

- **UK Oil & Gas Production.** The base projection assumes that UK oil & gas production will fall by 5% p.a. To generate the required worsening in the balance of payments would require oil & gas production to fall by 20% a year.
• Return on Overseas Assets. A reduction of 0.3 percentage points in the return on UK investments abroad would reduce net income in 2022 by 1% of GDP. This calculation assumes there is no change in the return that foreigners obtain on their investments in the UK. Such a negative shock cannot be ruled out, although neither can a shock in the opposite direction. The future behaviour of net investment income is highly uncertain.

• Financial Services (including insurance). A reduction of 28% in net export earnings from this sector by 2022 (as compared to the base projection) would be equivalent to 1% of GDP. To achieve this outcome would require real net earnings of this type to grow at 0.5% p.a. over the next decade as compared to 3.8%.

• Other knowledge-intensive services. A 34% fall in net earnings from other knowledge-intensive services by 2022 (as compared to the base projection) would be equivalent to 1% of GDP. To achieve this result would require real net earnings to grow at 1.5% a year as compared to 5.8% p.a.

• Manufactured exports. A reduction of 9% in manufactured exports (as compared to the base projection) would cause deterioration in the balance of payments equal to 1% of GDP by 2022. This calculation takes into account the fact that manufactured exports have high import content.

• If all or most of the above changes to the base projection were to occur simultaneously, then by 2022 the UK would have a very large current account deficit. Conversely, if similar changes were to occur simultaneously in the opposite direction, there would be a current account surplus. The above calculations illustrate the sensitivity of our projections to two particular items: investment income and manufacturing trade. As Table 3.1 indicates, these are very large items and relatively small proportionate errors in projecting their behaviour will have a substantial impact on the balance of payments. This is not the case for most of the other items in the balance of payments, which are mostly much smaller in magnitude.
3.4 Alternative Scenarios

Table 3.4 compares the base projection with some alternative scenarios. There is an optimistic scenario which modifies the assumptions of the base projection as follows:

• Domestic demand. This item increases more slowly than under the base projection. As a result, the long-run growth rate of GDP is 2.9% p.a. instead of 3.1%.

• Net Investment Income. UK income from overseas investment bounces back in 2013 and net income remains in surplus throughout the projection period.

Under this scenario, the current account deficit shrinks from 4.1% of GDP in 2012 to 0.7% in 2022. The above assumptions and the projected trajectory for the deficit are similar to forecasts made by the Office for Budget Responsibility in December 201213.

Table 3.4 also shows what happens if some of the assumptions of the base projection are modified in a more pessimistic direction. These modifications are as follows:

• World Demand. The annual growth rate of world trade is 5% instead of the 6% assumed under the base projection.

• Oil & Gas. The output of oil & gas falls at annual rate of 7% instead of 5%.

• Knowledge-intensive Services. Real net exports of financial and insurance services grow at the same rate as under the base projection. Real net exports of other knowledge-intensive services grow at an annual rate of 4.5% instead of 5.8%. The latter is still an impressive performance. Under the more pessimistic scenario there is a current account deficit equal to 5.2% of GDP. This is much larger than under the base projection.14
Table 3.4: Projections Compared

<table>
<thead>
<tr>
<th></th>
<th>Estimated 2012</th>
<th>Base Projection 2022</th>
<th>Optimistic Scenario 2022</th>
<th>Pessimistic Scenario 2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real domestic expenditure (% p.a. long-run growth rate)</td>
<td></td>
<td>3.0</td>
<td>2.7</td>
<td>3.0</td>
</tr>
<tr>
<td>GDP (% p.a. long-run growth rate)</td>
<td></td>
<td>3.1</td>
<td>2.9</td>
<td>2.8</td>
</tr>
<tr>
<td>Current account (% GDP)</td>
<td>-4.1</td>
<td>-3.0</td>
<td>-0.7</td>
<td>-5.2</td>
</tr>
<tr>
<td>Balance of trade in manufactures (% GDP)</td>
<td></td>
<td>-4.4</td>
<td>-3.3</td>
<td>-2.7</td>
</tr>
<tr>
<td>Balance of trade in other goods (% GDP)</td>
<td></td>
<td>-2.9</td>
<td>-3.2</td>
<td>-3.0</td>
</tr>
<tr>
<td>Balance of trade in services (% GDP)</td>
<td></td>
<td>+4.6</td>
<td>+6.1</td>
<td>+6.3</td>
</tr>
<tr>
<td>Investment income (% GDP)</td>
<td>0.0</td>
<td>-1.1</td>
<td>+0.2</td>
<td>-1.3</td>
</tr>
</tbody>
</table>

4. Discussion

The base projection presents an informed picture of what may happen over the next decade if present trends continue and a strong economic recovery is sustained. Under this projection there is a current account deficit equal to 3% of GDP by 2022. However, this projection is subject to a number of uncertainties. On the upside, earnings from overseas investments might recover or the City of London might perform better than our somewhat cautious assumptions imply. There are also a number of downside risks. Under the pessimistic scenario the current account deficit reaches 5.2% of GDP by 2022. A deficit of this magnitude would be a cause for serious alarm.

Most economists agree that countries cannot run large current account deficits forever, because of the resulting growth of foreign debt; sooner or later some form
of adjustment will be required. The question is how large is large and how painful
will the eventual adjustment be? C. Fred Bergsten (2002) has argued that “research
at both the Federal Reserve Board and the Institute for International Economics
reveals that industrial countries, including the United States, enter a danger zone of
current account unsustainability when their deficits reach 4–5 percent of GDP... At
these levels, corrective forces tend to arise either spontaneously from market forces
or by policy action.” More recent research by Clarida et al (2007) reaches the same
conclusion. In their econometric analysis of industrial countries, Freund and Warnock
(2007) find that deficit adjustment typically involves a decrease in GDP growth and
may involve currency depreciation. They also find that larger deficits take longer to
adjust and are associated with significantly slower output growth (relative to trend)
during the current account recovery than smaller deficits.

The relentless deterioration in the balance of payments that occurs under the
pessimistic scenario would not be sustainable and sooner or later something would
have to give. As the deficit built up, pressure on the exchange rate would mount,
leading eventually to a large currency devaluation and domestic inflation; the
government and central bank might also intervene by restraining demand so as to
combat inflation and limit the growth of imports. This combination would bring down
the deficit but only at the cost of lost output and unemployment.

Some of the factors that influence the balance of payments are beyond our control,
but there are at least three areas where government policy can make an important
difference. These are: the City of London, manufacturing and other knowledge-
intensive services. As far as the City is concerned, future reform of the financial
sector should be designed so as to preserve the export potential of this sector and
attempts by the Eurozone bloc to undermine the City should be resisted. In the case
of manufacturing and knowledge-intensive services, there is scope for what might be
loosely called an “industrial policy”. This is now coming back into fashion, although
what it would mean in practice is at present rather vague and subject to debate.

Given the orders of magnitude involved, any policy for strengthening the balance of
payments must assign a significant role to manufacturing. UK trade in manufactures
,exports plus imports) is several times larger than exports of the City of London
and other knowledge-intensive services put together. Safeguarding the City and
increasing other knowledge-intensive exports are both important objectives, but it is
unlikely that success in these areas would be sufficient to compensate for serious
failings in the manufacturing sector.

The opposition between manufacturing and services is to some extent a false one. In a modern economy like ours, the dividing line between manufacturing and services is becoming increasingly blurred. Many manufacturing firms rely heavily on knowledge-intensive services provided by outside suppliers, whereas some manufacturing firms are also major service providers in their own right. It would be difficult to conceive of a viable industrial policy for manufacturing that did not also involve knowledge-intensive services. With a stronger manufacturing sector, there would be a larger internal market for manufacturing-related services, and access to this market would enable UK service providers to benefit from economies of scale and develop skills which can be exploited in export markets.

There is a precautionary motive for policies to strengthen the balance of payments. Our projections are surrounded by a great deal of uncertainty and, although things could turn out better than we envisage under the base projection, there is a fair chance they could turn out significantly worse. Simply on grounds of prudence there is a case for industrial and other policies designed boost UK trade performance.

Notes

1. This paper is an updated and revised version of Coutts and Rowthorn (2009). We should like to thank two anonymous referees for their comments.


3. The members of the group were Alan Hughes, Ken Coutts, Andy Cosh and Robert Rowthorn. Publications of the group include: Cosh, Hughes and Rowthorn (1993, 1994) and Cosh, Coutts and Hughes (1996).

4. For most of the period since 1971 the balance of trade in manufactures has steadily deteriorated. The two major exceptions, 1990-95 and 2007-2008 were both episodes where major recessions occurred combined with real devaluation
of the exchange rate.

5. UK net investment income is income credits minus income debits. If foreign banks operating in London lose money, this counts as a negative debit and has the effect of increasing UK net income. Net investment income from direct investment is also difficult to interpret, because measurement conventions regarding the finance of direct investment affect what gets counted as income from direct investment. See Coutts, Glyn and Rowthorn (2007).

6. Coutts and Rowthorn (2009). The econometric work for the 2009 projections and for the projections presented here was done by Kenneth Coutts.


8. WTO database.

9. WTO database.


11. DECC (2012)

12. The UK has a surplus on high paying direct investment and a deficit on other types of investment. The country gains by borrowing cheap and lending dear. For information on rates of return on different kinds of asset and liability see UK Balance of Payments Pink Book 2012. ONS figures 1.8 and 1.9.

13. OBR (2012). The OBR forecasts that GDP growth will accelerate to 2.8% p.a. by 2017 and the current account balance in 2017 will be -1.4% of GDP (Table 3.5). Under out optimistic scenario GDP growth in 2017 is 2.9% and the current account balance in 2017 is -1.8% of GDP.
14. The deficit under the pessimistic scenario is also larger than in a previous projection made by the authors (Coutts and Rowthorn, 2009), which projected a current account balance equal to -4.7% of GDP in 2020. The main reason for the difference is the behaviour of investment income. Since the previous projection was made UK net income from international investment has fallen sharply and this deterioration is taken into account in the pessimistic scenario presented here.

15. All econometric analysis and model solutions are done in Eviews 7.2, Quantitative Micro Software © 1994-2011.

References


OBR (2012), Economic and Fiscal Outlook, December 2012, Office for Budget Responsibility.


Appendix: Sources and Methods

Our model is a convenient information system for making alternative conditional projections of the balance of payments, its main components and some macroeconomic aggregates of the UK Economy.
### Table A1: The Balance of Payments and its main components

<table>
<thead>
<tr>
<th>Current Account (Flows)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Visible Trade</strong></td>
</tr>
<tr>
<td>Food, beverages and tobacco</td>
</tr>
<tr>
<td>Oil and gas</td>
</tr>
<tr>
<td>Basic materials and other energy</td>
</tr>
<tr>
<td>Manufactures</td>
</tr>
<tr>
<td><strong>2. Invisible Trade</strong></td>
</tr>
<tr>
<td>(services)</td>
</tr>
<tr>
<td>Transport</td>
</tr>
<tr>
<td>Travel</td>
</tr>
<tr>
<td>Government services</td>
</tr>
<tr>
<td>Knowledge-intensive services1</td>
</tr>
<tr>
<td>Finance and insurance services2</td>
</tr>
<tr>
<td><strong>3. Income</strong></td>
</tr>
<tr>
<td>Investment income (credits and debits)</td>
</tr>
<tr>
<td>Net current transfers and remittances</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CAPITAL AND FINANCIAL ACCOUNT (FLOWS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transactions in real and financial assets and liabilities3</td>
</tr>
<tr>
<td>Net capital transfers</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>INTERNATIONAL INVESTMENT POSITION (STOCKS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balance sheets: assets and liabilities</td>
</tr>
</tbody>
</table>

1 Communications, construction computer and information technology, royalties and licence fees, other business, personal cultural and recreational, communications.
2 Finance and insurance (“The City”).
3 Direct investment, portfolio investment and other financial securities.
Table A2. Model structure and properties

<table>
<thead>
<tr>
<th>Endogenous variables</th>
<th>81</th>
</tr>
</thead>
<tbody>
<tr>
<td>of which:</td>
<td></td>
</tr>
<tr>
<td>identities</td>
<td>64</td>
</tr>
<tr>
<td>inexact equations</td>
<td>17</td>
</tr>
<tr>
<td>(statistically estimated)</td>
<td></td>
</tr>
<tr>
<td>Exogenous variables</td>
<td>27</td>
</tr>
<tr>
<td>TOTAL</td>
<td>108</td>
</tr>
</tbody>
</table>

The model has 108 variables of historical time series up to latest estimates for 2012. There are 81 endogenous variables, i.e. variables whose value is determined by the model, given values of 27 exogenous variables, whose values are assumed and not explained by the model. A projection is a solution of the 81 endogenous variables for each year of the projection period, conditional on assumptions about the exogenous variables (a time-path for each exogenous variable over the projection period).

Most of the structure of the model consists of accounting identities relating to the various components of the balance of payments. The inexact equations summarize behavioural relationships over the historic period from 1970-2011 and include a residual between the actual historical value of the endogenous variable and the value calculated from the equation. The coefficients of the equations are estimated by econometric methods from a sample of historic data and used in the projections from 2013 onwards. For the projection period we must make assumptions about the future value of the residual. A common assumption is to project the last observed residual in 2012 so that there is a smooth transition from the 2012 value of the variable to its projected value for 2013 and beyond (so-called “add factors” in the equations). Of the 17 inexact equations, there are 10 equations for which we can establish reasonably stable long-run relationships; they include trade volumes, trade prices and the domestic expenditure deflator. There are 7 equations for which we use add factors in the projections.
Exogenous variables

The principal exogenous variables in the conditional projections divide into six groups. They are: the volume of domestic expenditure; the index of wages and salaries per unit of output; the nominal exchange rate and relative unit labour costs in common currency (a measure of the “real” exchange rate); the price and volume of oil; the world demand for manufactured goods; the real returns on external assets and liabilities. Our “base projection” assumptions are summarised in Table 3.2. The sensitivity analysis summarised in Table 3.3 is obtained by calculating alternative solutions of the model to vary the variables listed in the table by the amounts required to achieve a 1% of GDP improvement in the current account. For this exercise, the current account is “the target” and the exogenous variable is “the instrument”.

Principal Behavioural Relationships

Export and import volumes of manufactures depend upon income and relative cost elasticities. Export volumes are related to an index of the volume of world demand for manufactures, weighted by the UK share in each market, which is derived from OECD series. Import volumes depend both upon the volume domestic expenditure and the volume of exports, so that faster export growth draws in more imports of manufactures. Exports and imports both depend on an index of relative unit labour costs expressed in common currency, published in IMF Financial Statistics. Changes in the real exchange rate (as measured by the IMF normalised relative unit labour cost index) gradually affect trade volumes, so that the full effect of devaluation on the volume of exports or imports takes up to four years to complete. Our recent estimates of the elasticities suggests that the relative cost response of export and import volumes is low. Trade prices depend upon the domestic price index and relative unit labour costs. Our measure of inflation is based on the domestic expenditure deflator, which depends on unit wage and salary costs and import prices. The equation has the long-run property that when unit wage costs and import prices are growing at the same rate, domestic inflation is also growing at this rate.

Investment income is projected on assumptions about real rates of return on assets and liabilities and on capital gains or losses on the stocks of assets and liabilities. The current account balance then determines changes in the net stock of external assets. This provides a feedback between the current account balance and the
trajectory of net external assets by means of the income earned on these assets.

**Statistical Sources**

The primary sources are Office for National Statistics (ONS) data published on the ONS website. Balance of payments data comes from the Pink Book, supplemented by the latest monthly trade data. National accounts data is from the blue Book, supplemented by the latest quarterly national accounts. Other UK data sources include production and labour market series from the ONS and foreign exchange data from the Bank of England.

The principal international sources are the International Monetary Fund (IMF) and the Organisation of Economic Cooperation and Development (OECD).

**Statistical References**


Organisation of Economic Cooperation and Development, Economic Outlook, September 2012.  

THE LEGAL FRAMEWORK
GOVERNING BUSINESS FIRMS
AND ITS IMPLICATIONS FOR
MANUFACTURING SCALE AND
PERFORMANCE:
The UK experience in international
perspective

BY PROFESSOR SIMON DEAKIN
The Legal Framework Governing Business Firms and its Implications for Manufacturing Scale and Performance: The UK Experience in International Perspective

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December 2013

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Contents

The Legal Framework Governing Business Firms and its Implications for Manufacturing Scale and Performance: The UK Experience in International Perspective

Executive Summary

2. Research questions

3. Sources, methods and scope of this review

4. Corporate finance, governance, shareholding, and management objectives

5. The scale, outcome and effects of takeover activity

6. The contractual and corporate governance environment for medium-sized enterprises ('Mittelstand' type firms)

7. The legal framework for early-stage finance and start-ups

8. Insolvency law and corporate rescue procedures

9. Employment protection legislation

10. Assessment and policy analysis

References
Executive Summary

In the course of the past decade, there has been a considerable increase in the scale and sophistication of empirical studies examining the economic effects of laws governing the formation, financing and organisation of business firms. Much of this evidence is cross-national in its focus, enabling the experience of the UK to be placed in a comparative perspective.

**Corporate finance, governance, shareholding, and management objectives**

In general, managers of UK listed companies see their role in terms of the maximisation of shareholder value over both the short and long term, and non-executive directors see their role in terms of monitoring the performance of executives with a view to ensuring that shareholder interests are protected. How far the law induces managers and boards to take a short-term view over a long-term one is hard to assess; in principle, company law allows boards considerable discretion to defer returns to shareholders in order to allow necessary investments in R&D and organisational capabilities to be made, but in practice they appear to be coming under increasing pressure to meet short-term demands for high dividends and share buy-backs. This pressure is due in part to the growing pro-shareholder orientation of corporate governance codes, culminating in the UK Corporate Governance Code, and to the operation of the market for corporate control, which is underpinned by the Takeover Code.

**The scale and outcome of takeover activity**

The UK Takeover Code’s ban on defensive tactics that are widely used in other industrialised countries, such as ‘poison pills’, makes UK listed companies more open to takeover than those of, for example, the USA or Japan. In Germany, the two-tier board structure, with employee directors on the supervisory board, has an influence on the scale of takeover activity and on outcomes, while in France and the Nordic countries multiple or weighted voting continues to be a factor in dampening down takeover activity, notwithstanding recent EU rules discouraging such voting structures. An active market for corporate control should in principle
reduce agency costs and so improve managerial performance, while also ensuring the efficient movement of resources across the economy, allowing capital to be reallocated from declining industries to growing ones. However, a growing body of empirical evidence identifies negative impacts of the market for corporate control on firm-level innovation, arising from reduced expenditures on R&D and short-termism in management strategy, stemming from the need to maintain high returns to shareholders over both the short and long run.

**The relative importance of the listed company sector and of ‘Mittelstand'-type businesses**

The UK has a large listed sector by international standards but does not have a substantial segment of enduring, middle-sized, family-run manufacturing firms such as the German ‘Mittelstand’. This is linked to the relatively high incidence of merger and acquisition activity in the UK which, in turn, is in part a consequence of legal support for investor rights and the market for corporate control. Further factors which make it difficult for Mittelstand-type firms to prosper in the UK include features of the institutional environment for inter-firm contracting: these include the ease with which standardised terms of business can be customised to the advantage of larger firms, and the greater reliance of British SMEs on litigation to ensure prompt payment, which both tend to reduce trust in inter-firm contracting.

**The scale and nature of finance for early stage and start up businesses**

Factors which should, in principle, support a sizable venture capital sector in the UK include relatively open access to a stock market listing (this is regarded as important in providing VC firms with exit from their investments), the underlying flexibility of contract and commercial law (allowing for the customisation of debt and capital structures), and a favourable tax regime, which allows debt financing to be set off against corporate tax liabilities. At the same time, there is dispute among researchers and scholars over how far these features of the UK legal and institutional set-up are falling short of providing encouragement for start-ups; some parts of the literature suggest that their main effect has been to support private equity style investments in already established firms.
Insolvency law and creditor rights

Comparative legal studies show that there has been a general strengthening of creditor rights around the world over the past decade and a half. This trend may favour bank-led financing, but at the cost of deterring financial risk-taking by firms, and reducing the potentially positive role of leverage in supporting firm-led innovation. The UK is towards the stricter end of the spectrum, internationally, on creditor protection.

Personal bankruptcy law and attitudes to business failure

There is evidence from cross-national studies that strict personal bankruptcy laws operate as a deterrent to self-employment, and that there is a negative impact on venture capital funding for start-ups of laws prescribing lengthy periods for discharges from bankruptcy. The UK is towards the more liberal end of the spectrum on laws governing personal bankruptcy.

Employment protection

Theoretical and empirical studies alike point to the ambiguity of employment protection rules from an economic viewpoint: they may deter hiring and slow down the pace of adjustment to technological and macroeconomic shocks, on the one hand, while, on the other, encouraging firm-level investments in skills and capabilities and generating a cooperative workplace environment. Recent research comparing labour law systems using a standardised set of measurements for the effects of such laws suggests that the UK’s employment protection regime is not as ‘light touch’ as supposed, and is closer to Germany, for example, than to the USA. At the same time, studies find only weak evidence linking employment protection rules to higher unemployment or lower employment growth, and, conversely, a positive impact of such rules on productivity and innovation, so it is not clear that deregulation of UK employment law would bring net economic benefits.

Looking ahead
The literature identifies two models of legal support for manufacturing which imply different directions for policy: on the one hand, the Silicon Valley model of VC-funded growth which depends on liquid capital markets and flexible labour markets, and the northern European and Japanese model which is based on long-term innovation, stable ownership, and institutionalised worker-management cooperation. The UK has some of the legal features of the Silicon Valley model, but important parts are missing: for example, the Californian rule under which post-employment restraints (‘restrictive covenants’) are void on the grounds of their anti-competitive effects has no equivalent in the UK. Conversely, although the UK has certain elements of the northern European or east Asian model of institutionalised corporate governance, it is unlikely to be able to replicate the ‘productive coalition’ approach of these countries as long as the legal framework prioritises shareholder rights and the market for corporate control, and provides limited encouragement for job security.

The Silicon Valley and ‘productive coalition’ models are ideal types which can distract from the fact that most countries, the UK included, are hybrid systems with some of the characteristics of each model. Rather than designing laws and policies exclusively with one model or the other in mind, it may be preferable to consider specific laws and policies on their own merits, while bearing in mind that a given legal rule or policy does not operate in isolation from others and that there may be some ‘network effects’ in operation due to the way that particular rules interact.

Bearing these points in mind, the empirical evidence presented in this review suggests that there is a case for looking again at the way that the legal framework of corporate governance affects innovation and manufacturing more widely. The weight of the empirical evidence is that the current legal framework in the UK is a deterrent to certain types of innovative activity, namely those involving complementary investments in knowledge-based technologies and firm-specific human capital which generate returns over an extended time horizon. Over the past thirty years there have been very few cases of British firms attaining pre-eminence in global competition in high-technology manufacturing industries requiring complementary investments of this kind. A shift in the UK legal framework away from the current emphasis on prioritising liquid capital markets and flexible labour markets, in favour of a ‘productive coalition’ approach to corporate governance, could help build a larger and more sustainable manufacturing sector going forward.
1. Introduction

This paper is a review of international comparative research analysing the effects of the UK legal and institutional framework on the scale and performance of the manufacturing sector, with particular reference to financing, innovation and productivity performance. The review covers legal and institutional arrangements affecting the financing, governance and management of business firms, including:

- corporate finance, governance, shareholding, and management objectives
- the scale and outcome of takeover activity
- the relative importance of quoted and unquoted sectors and of ‘Mittelstand’ businesses
- the scale and nature of finance for early stage and start up businesses
- attitudes to insolvency and business failure
- employment protection

The review also assesses current debates about possible future directions for the evolution of the current UK legal and institutional structure and their implications, both positive and negative, for the future of manufacturing in the UK in the next 20 years.

The structure of the paper is as follows. Section 2 below provides an overview of the possible effects of legal institutions on growth, and sets out the core research hypotheses which the empirical literature has explored. Section 3 then makes some preliminary points on the sources used in the literature on the economic effects of legal institutions, and on the balance between quantitative and qualitative research methods. It also considers the relevance of this literature, some of which is manufacturing-specific in its coverage but much of which is not, to the scope of the review. Section 4 surveys findings on the economic effects of laws and corporate governance codes concerning corporate form, board structure and composition, and
shareholder rights, with specific reference to their impact on innovation and their relationship, complementary or otherwise, to product market competition. Given the importance of these questions for policy and the depth and extent of the available empirical evidence, this set of issues receives the most extended treatment in the survey. Sections 5-9 then provide a briefer overview, in each case, of the most relevant findings from a number of linked issues concerning the economic effects of laws and codes affecting the governance and management of firms: takeover regulation (section 5), inter-firm contracting (section 6), the legal framework for early-stage financing (section 7), the law on insolvency and business rescue (section 8), and employment protection legislation (section 9). Section 10 consists of an assessment of the findings from the point of view of the development of policy.

2. Research questions

The legal framework governing the ownership, financing and organisation of business firms can be expected to affect the competitiveness of the UK’s manufacturing base in a number of ways.

Corporate governance, or the body of laws, regulations and practices affecting the way in which companies are governed and controlled, will affect the nature and scale of external financing of firms and the effectiveness of the capital market as a resource-allocation mechanism. Through these channels, corporate governance regulations can be expected to have effects on the innovation path of firms and on the quality of management. Other aspects of the legal framework governing companies include insolvency law, which affects credit flows to firms and the governance of firm-level risk, and employment law, which affects hiring and labour use strategies and the quality of employment relations.

Table 1 summarises hypothesised relationships between legal rules and prevailing modes of firm-level innovation. It follows the ‘varieties of capitalism’ approach in identifying likely ‘clusters’ of complementary institutions operating in different national contexts (Hall and Soskice, 2001; Hall and Gingerich, 2009).

According to the varieties of capitalism approach, ‘liberal market’ systems such as the UK and USA, liquid capital markets and flexible labour markets are underpinned
by legal protection of shareholder rights coupled with relatively weak employment protection legislation. By contrast, in 'coordinated market' systems such as those of France, Germany and Japan, capital markets tend to be less liquid and share ownership more concentrated at the level of the firm, while workers, conversely, have more substantial legal guarantees of employment protection and voice within the governance of the firm. In principle, these different patterns of ownership, governance and legal regulation could give rise to divergent forms of innovation, with liberal market systems favouring ‘radical’ innovation through the development of new products and processes, and coordinated market ones tending towards the ‘incremental’ adaptation of existing technologies (see Table 1, below).

Creditor rights are more difficult to fit into this typology. There is some evidence of an association between medium or weak creditor protection, on the one hand, and risk-taking by innovative firms, associated with greater use of leverage (Acharya and Subramanian, 2009). In so far as this model is a good description of any single national regime, it is a better match for the US than for Britain, where insolvency law has traditionally favoured the interests of secured creditors over those of incumbent managers and unsecured creditors. Although the Enterprise Act 2002 moved UK practice closer to a model in which the coordinating role of secured creditors during insolvencies was reduced, the British system remains, in comparative terms, a creditor-friendly one.

Table 1. Complementarities between corporate governance and modes of innovation (source: Deakin and Mina, 2012)

<table>
<thead>
<tr>
<th>Liberal market systems</th>
<th>Shareholder protection</th>
<th>Creditor protection</th>
<th>Worker protection</th>
<th>Mode of innovation</th>
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<td></td>
<td>High (legal support for hostile takeover bids, share buy-backs, shareholder activism)</td>
<td>Medium or weak (debtor in possession laws, laws favouring corporate rescue over liquidation)</td>
<td>Weak (minimal legal support for employment protection, no codetermination)</td>
<td>Strong venture capital market</td>
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<td>‘Schumpeterian’ creative destruction regime</td>
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<td>Efficient labour market matching</td>
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3. Sources, methods and scope of this review

In the course of the past decade there has been a considerable increase in the scale and sophistication of empirical studies examining the effects of legal rules and institutions on firm performance, financial development and, more generally, on economic growth. Much of this evidence is cross-national in its focus, enabling the experience of the UK to be placed in a comparative perspective. Methodological advances have made it possible to model and estimate the impact of legal rules on the economy in more rigorous ways than before.

3.1 Sources

The principal change has been the development of data on legal and institutional variables which can be used in quantitative analysis. So-called ‘leximetric’ coding techniques involve the construction of indices providing measures of the content of legal rules and of the general effectiveness of legal institutions in a given country. The earliest of these, the OECD’s index of employment protection legislation (EPL), dates from the late 1980s and has been considerably extended and refined since then (Grubb and Wells, 1993; OECD, 1994, 2004, 2008). Starting in the mid-1990s, indices for shareholder rights, creditor rights and labour regulation were developed.
by US-based researchers, with the support of the World Bank (La Porta, Lopez-de-Silanes, Shleifer and Vishny, 1998; La Porta, Lopez-de-Silanes and Shleifer, 2008; Botero, Djankov, La Porta, Lopez-de-Silanes and Shleifer, 2004; Djankov, McLiesh and Shleifer, 2007; Djankov, Hart, McLiesh and Shleifer, 2008). The coding methods developed in these studies were incorporated into the World Bank's *Doing Business* reports (World Bank, various years), which have appeared annually since the mid-2000s and provide data on a wide range of legal and institutional variables. The World Bank is also responsible for developing a set of indicators on governance which, among other things, measure respect for legality (or the 'rule of law') on a cross-national basis (Kauffmann, Kray and Mastruzzi, 2009).

In parts of the empirical literature, the 'legal origin' of a given country's legal system, that is to say its origin in one of the main 'families' of legal systems (English common law; French and German civil law), is taken as a proxy for the quality of legal institutions. The basis for this view is the claim that systems with an English-law origin (the UK and Commonwealth countries, and the USA) have inherited institutions which are more effective in protecting contract and property rights than those prevalent in civil law regimes (most of mainland Europe, east Asia, and Latin America) (La Porta et al., 2008). This claim is controversial; it seems unlikely that a single variable can stand in for the wide variety of legal-institutional arrangements found in both developed and developing systems (Ahlering and Deakin, 2007). In analysing the UK's comparative position with regard to other industrialised countries, it would therefore be going too far to assume that the UK's common law legal origin necessarily provides it with an inherent source of competitive advantage. However, the legal origin of a country may well have a number of consequences for the relationship between law and economic growth, including facilitating (or obstructing) the transplantation of legal rules: there is evidence that transplants occur more frequently, and work better, within legal families, so that, for example, transfers from the common law world to the civil law world, and vice versa, may face institutional obstacles (Armour et al., 2009c).

Providing a quantitative measure of the content and effect of legal rules is not a straightforward process, and the results obtained from leximetric coding should be treated with caution. Indices generally report 'ordinal' values, capturing the relative strengths of legal rules and legal effectiveness across different countries and over time in the same country. They should not be regarded as providing an absolute or 'cardinal' measure of the contents or effects of laws. Subjective or judgmental elements enter into the process of index construction, in the choice of indicators, the
A major limitation, nevertheless, of both OECD and World Bank data, is the lack, in both cases, of extended and continuous time series data. The OECD’s EPL index provides data on laws from the late 1980s but on a discontinuous basis, while the Doing Business datasets go back only to the early 2000s. The datasets on corporate, insolvency and labour law developed at the Cambridge Centre for Business Research (CBR) provide continuous time series for a small sample of mostly developed countries (including the UK) going back to the early 1970s, and time series for a larger sample of 25 developed and developing countries covering the period 1995-2005 (see http://www.cbr.cam.ac.uk/research/projects/project2-20output.htm; Armour, Deakin, Lele and Siems 2009; Armour, Deakin, Sarkar, Siems and Singh, 2009; Armour, Deakin, Mollica and Siems, 2009). Longitudinal data of this kind make it possible to use time-series econometric techniques which distinguish between short-run and long-run effects of legal change.

3.2 Methods

The greater availability of data creates opportunities for statistical testing of the impact of the law on the economy, but it also poses new challenges. A pervasive problem is the so-called ‘endogeneity’ issue: even if correlations can be established between an ‘independent’ or causal legal variable, and a ‘dependent’ or outcome economic variable, the direction of causation between the two may not always be clear (with the result that the causal variable may be ‘endogenous’ to or caused by the outcome variable). For example: is the UK’s broadly pro-shareholder takeover law a driving force behind takeover activity, or, on the contrary, a reflection of a
financial system within which institutional shareholders are powerfully placed to influence the content of the relevant rules? A simple correlation between regulatory and economic variables does not provide an answer to this question, because correlation is not equivalent to causation. A number of techniques have been developed by econometricians and statisticians to address the endogeneity problem, including the use in regressions of variables which are (or can be assumed to be) uncorrelated with one or other of the principal variables of interest (‘instruments’), and lagged or historical values of variables (as used in ‘Granger causality’ techniques), to identify the direction of causality. Another approach is to use ‘difference in differences’ techniques when estimating the impact of a legal change. This is often done in the context of ‘quasi-experimental’ or comparative studies which compare the experience of a jurisdiction which have undergone a legal change with that of a comparable jurisdiction which has not (Card and Krueger, 1995).

A further problem is the possibility of spurious correlations, which is a particular problem in regression analyses of longitudinal data (‘auto’ or ‘serial’ correlation). Statistical techniques developed to deal with this include ‘differencing’ of values (used to overcome autocorrelation in time series) and ‘cointegration’ (the identification of a common stochastic trend linking two otherwise unstable or ‘non-stationary’ time series). A particular set of regression models used in time series and panel data analysis, known as vector autoregression (VAR) and vector error-correction (VEC) models, have been advanced as capable of distinguishing between short-run and long-run effects of exogenous ‘shocks’ to the economy in a context where multiple causal influences are in play, including non-linear (dynamic, two-way) causation (Hoover, Johansen and Juselius, 2008). Because of these properties, VAR and VEC models are becoming widely used in estimating the economic impact of legal and regulatory changes (see below). Notwithstanding these methodological advances, caution must be exercised when seeking to draw policy conclusions from these and other econometric studies, given that time-series and panel data econometric analysis is a developing area, with a changing ‘state of the art’.

The limitations of econometric testing in this area can be addressed through consideration of evidence from case studies and other qualitative analyses. A ‘multiple methods’ approach, combining qualitative and quantitative analysis, should, in principle, be used to analyse legal-institutional phenomena (Nielsen, 2010). Case studies, based on interviews and direct participant or non-participant observation, can be useful in identifying the direction of causality, thereby complementing quantitative research (Poteete, Janssen and Ostrom, 2010). Thus in the review that follows,
while the principal focus is on empirical quantitative studies, reference is also made to qualitative research, where it expands on or clarifies the results of statistical analyses.

3.3 Scope of the review

Most of the econometric studies reviewed in this survey are based on samples of private-sector firms drawn from a wide cross-section of industries, but some focus specifically on manufacturing or on mixed samples of manufacturing and utility companies. The sectoral scope of particular studies is detailed in the sections which follow. The literature on innovation and corporate governance is largely concerned with manufacturing firms. Thus it is possible to draw conclusions on the impact of legal and institutional factors upon the manufacturing sector specifically.

4. Corporate finance, governance, shareholding, and management objectives

4.1 Shareholder rights, ownership structure and the separation of ownership and control

The standard legal form of the business enterprise, the company limited by share capital or (as it is sometimes known) the ‘joint-stock company’, contains features which, while generally conducive to efficient corporate governance, may also detract from it. The legal institutions of separate legal personality (giving the company as a legal person the capacity to hold property and enter into contracts) and limited liability (protecting shareholders from claims by the company’s creditors) between them provide the foundation for a division of labour between managers and investors, which allows for specialisation of the management function and reduces the costs of capital (Armour, Hansmann and Kraakman, 2009). At the same time, the separation of the ‘ownership’ of the firm (vesting, at least residually, in the shareholders) from
its ‘control’ (vesting initially in the board of directors and then, through delegation, in managers and other employees of the firm) creates a divergence of interests between owners and managers which could impact negatively on the value of the firm. In the corporate governance literature this is referred to as the problem of ‘agency costs’, shareholders in this context being regarded as the ‘principals’ and managers as their ‘agents’ (It should be borne in mind that the terms ‘principal’ and ‘agent’ are not being used here in their legal sense; in law, directors are agents of the company, not of the shareholders.)

The implications for corporate governance of the separation of ownership and control differ according to how, more precisely, ownership is structured. In the UK, USA and other ‘liberal market economies’, the tendency has been for share ownership to be dispersed among a large number of retail or portfolio shareholders, investing for returns. By contrast, in the ‘coordinated market’ systems of mainland Europe and Japan, the predominant form of corporate ownership consists of blocks held by banks, families or companies holding shares in order to maintain a business relationship with the investee company.

There is empirical evidence suggesting that ownership structures are correlated with different approaches to governance of the firm (Berglöf and Van Thadden, 1999; Barça and Becht, 2001; Armour, Cheffins and Skeel, 2002). In dispersed ownership systems, governance tends to be externally orientated, that is to say, it is based on external benchmarks of performance, such as return on equity and other shareholder-value based metrics, and monitoring is undertaken by actors external to the organisational structure of the firm, such as independent directors and portfolio shareholders investing for returns. In this arrangement, shareholders tend to operate at ‘arms-length’ from managers, rarely intervening directly in operational matters, and relying on share options and similar performance-related executive remuneration schemes to align managers’ interests with their own. Such shareholders seek to minimise the risk of underperformance by diversifying their holdings across a wide range of listed firms, and using the liquid capital market to exit their holdings if performance in a given firm declines.

By contrast, in blockholder systems, governance is internally orientated. Benchmarks for managerial performance tend to refer to organisational objectives such as sales growth, production and employment, and to profitability defined as return on assets rather than return on equity. Monitoring is undertaken by actors
internal to the firm, such as blockholders, long-term customers and suppliers who are often also shareholders, and employees, as in the case of Japanese ‘peer-based’ monitoring of CEOs by other members of the senior management team (Buchanan and Deakin, 2008), or German-style codetermination, in which employee representatives have seats on the supervisory board (Pistor, 1999). In these systems, dominant or majority shareholders tend to take, of necessity, a long-term view of their holdings, given the limited opportunities they have for exit from the firm, and do not generally act as pure portfolio shareholders seeking to maximise investment returns, at least over the short run. Instead, they tend to see a large share stake as a strategic investment which serves a number of purposes: in the case of customers and suppliers, maintaining business links; in the case of ‘main’ or ‘house’ banks, generating network-type externalities across a group of linked firms, or in the case of family ownership, supplying a mix of employment and investment opportunities. It further follows that in the case of blockholder systems, the problem of agency costs arises more at the level of relations between dominant shareholders and minority investors, than between shareholders as a whole, on the one hand, and managers, on the other (Shleifer and Vishny, 1996).

The above descriptions are ideal types which abstract from the detail of national systems; within national regimes, diverse approaches to governance and monitoring can also be found (Aoki and Jackson, 2008; Aguilera and Jackson, 2010; Aoki, 2010). Nevertheless, they provide models which may be useful when characterising the nature of corporate governance in the UK by comparison to practices in other developed countries. There is a history of dispersed ownership of large listed companies in the UK which goes back to nineteenth century stock exchange rules requiring a ‘free float’ (or large allotment of shares for sale on the open market) on the occasion of a stock market listing or ‘IPO’ (Hannah, 2008; Burhop, Chambers and Cheffins, 2011). Concerns about the separation of ownership and control were already being voiced in the UK in the 1920s (Keynes, 1926, anticipating the analysis by Berle and Means (1932) for the US). The trend was reinforced in the UK after 1945 by a further decline in family shareholdings arising from mergers and acquisitions (Franks, Mayer, Volpin and Wagner, 2012) and by a rise in institutional shareholdings, as pension funds increased their equity investments (Cheffins, 2008). The result was a structure of ownership of UK publicly listed companies that was much more dispersed than was the case in continental Europe at this time (Franks et al., 2012), and somewhat more dispersed even that of the US (Holderness, 2009).

How far this evolving pattern of ownership, and the corresponding emphasis on
‘external’ forms of monitoring, was driven by legal change is difficult to judge. Company law was not especially protective of the rights of external shareholders during this period, and it is likely that the rise of institutional investors led to changes in the law and stock exchange listing rules to reflect the need for shareholder protection, rather than the other way round (Franks et al., 2012). Fiscal law, which subsidised occupational pension funds in various ways including giving preferential tax treatment to payments received as dividends, appears to have played a more direct role than company law in shaping ownership patterns in UK listed companies during this period (Cheffins, 2008).

By the early 1990s, there was a perception that existing legal mechanisms in the UK were not effective in ensuring effective monitoring of managers by shareholders. Rather than legislate for new protections, government took the step of encouraging self-regulation through corporate governance codes beginning with the Cadbury Code of 1993. Among the reforms initiated in this way was legal and regulatory encouragement for independent boards and for separation of the CEO/Chair functions, both of which, it was believed, would enhance the accountability of managers to shareholders. This was not an isolated development; other countries were taking similar steps to strengthen shareholder rights, although to some degree the UK was in the vanguard in this process, and the model set out in the Cadbury Code was to prove influential worldwide in the years following its adoption. Figure 1 records in graphical form the strengthening of shareholder rights in the UK by comparison to those in other large economies over the past four decades, and Figures 2 and 3 display data on global trends since the mid-1990s. These show that developed and common law countries have, on average, stronger shareholder protection than developing or emerging and civil law ones, respectively, but that the latter are catching up.

Figure 1. Shareholder protection in five countries, 1970-2005 (maximum score: 60). Source: CBR Shareholder Protection Index (SPI-60).

Figure 2. Shareholder protection in developed, developing and transition countries, 1995-2005. Source: CBR Shareholder Protection Index (SPI-10).
4.2 Empirical evidence on the impact of shareholder protection laws and corporate governance standards

The key empirical question arising from the trend towards greater shareholder protection is whether the strengthening of shareholders’ legal rights has had tangible effects on firm performance and, more generally, on economic growth. In principle, it should have led to improved managerial effectiveness and, via that route, to greater organisational efficiency and higher growth. These effects should be measurable in a number of ways: by reference to the value placed by shareholders on firms (share price movements around the ‘event window’ of corporate announcement, and longer term share values relative to assets, or ‘Tobin’s q’); the efficiency with which firms use their capital (return on equity); their profitability (return on assets); and their productivity performance.
Early research in this field was shaped by Gompers, Ishii and Metrick’s study (2002) of the effects on firm values of the adoption by US listed companies of measures restricting shareholder decision-making over changes of control, including takeovers and mergers, and entrenching boards against shareholder influence. Their so-called G-index of corporate governance provisions focused on poison pills, supermajority requirements, staggered board rules, golden parachutes and similar measures adopted by US listed firms, mostly in the period during the 1980s when the effects of hostile takeover bids were highly contested. They found a consistently negative correlation between firm value (measured by Tobin’s q) and a high score on the G-index (indicating weak shareholder rights). Subsequent studies have refined this analysis, and have suggested that the results derived from the G-index are mostly driven by the adoption by firms of poison pills and similar devices for restricting the role of shareholder decision making in change of control transactions (Bebchuk, Cohen and Ferrell, 2009; Cremers and Ferrell, 2010, 2012). The G-index and later variants based on it mostly focus on company by-laws and other internal corporate arrangements rather than legal regulation of corporate governance, although some account is taken of state-level laws on takeover bids. Because of its focus on poison pills and other features of corporate practice which are mostly specific to the American experience, this series of studies, although highly influential for both research and policy in the USA, has limited relevance for the experience of most other countries, including the UK, which have placed greater focus on board structure and in particular the issue of director independence as a route to more effective corporate governance.

Another very influential paper in the development of the field was the study by La Porta et al. (1998) of the impact of cross-national differences in shareholder rights on financial development and growth. Their ‘anti-director rights index’ measured shareholder rights by coding for laws affecting shareholders’ voting, voice and dividend rights. Higher scores on this index, indicating a higher degree of shareholder protection, were found to be correlated with more dispersed share ownership, and also with common law legal origin. This original index was limited in scope (it did not code for director independence or takeover regulation) and time-invariant; later studies (reviewed below) have added further variables and incorporated a time-varying element to the process of legal index construction.

The first studies of the likely effects of legal encouragement for independent boards and related aspects of corporate governance were carried out in the context of US listed firms in the 1990s, when director independence was not a legal requirement,
making it possible to compare the situation of companies with different board arrangements. In the most comprehensive such study, Bhagat and Black (2002) found that there was no clear correlation between independent boards and corporate performance. While underperforming companies increased the proportion of non-independents on their boards, apparently in an attempt to improve performance, this strategy was largely unsuccessful.

Bhagat and Black's causal variable, board structure, was constructed from data on the proportion of ‘inside’, ‘affiliated’ (that is, non-executive but linked to the company) and ‘independent’ directors, in a sample of around 1,000 large US public companies across a range of industries (including manufacturing sectors). Their outcome variables were Tobin’s q, return on assets, sales over assets, and adjusted stock price returns. They controlled for firm-specific characteristics including pre-existing board structure, firm size, industry, and the presence of larger, ‘blockholder’ shareholders (>5%). They found that there was a negative correlation between director independence and one or more of the performance variables in the period prior to the adoption of majority independent boards, suggesting that weaker firms were more likely to increase the proportion of independent directors on their boards. They also found that firms adopting independent boards did not subsequently outperform the market, and, for one of the variables (Tobin’s q), did worse than comparable firms. They then looked at the impact on growth, using the percentage growth in assets, sales and operating income over a period of years as the outcomes variables. Again, they found no positive impact of director independence on performance.

Bhagat and Black concluded from their study that the performance advantages of independent boards were most likely being overstated: insider directors were ‘conflicted’ (that is, inclined to support management) but well informed, whereas independent directors, while likely to be more attuned to shareholder concerns, were also less knowledgeable on underlying business of the firm. On this basis, they argued for corporate governance standards based on a model of a ‘mixed’ board of insiders and outsiders, rather than the majority-independent boards that were then being widely advocated in both the US and the UK.

Notwithstanding these findings, which were replicated by a number of other studies at the time and since (see Adams et al., 2010, for a recent survey), US corporate governance standards in the early 2000s moved in the direction of mandatory
independent boards: the Sarbanes-Oxley Act of 2003 required a majority of independent directors on audit and remuneration committees, and listing rules on the NYSE and NASDAQ exchanges were tightened up to require main boards of quoted companies to have majority independent membership. Studies of the impact of the SOX provisions including those on board structure have generally found negative effects of its introduction, in particular for already well-governed firms, indicating high costs of compliance associated with this form of legislative intervention, and few if any performance-related benefits (Litvak, 2007).

In the UK, company law largely leaves companies free to structure boards as they wish. The issues of board composition and structure are governed by the flexible regulatory approach of corporate governance codes applying to listed companies (currently, the UK Corporate Governance Code). Under the principle of ‘comply or explain’, listed companies have the option of either complying with the relevant corporate governance standard (such as rules on board structure), or of explaining why they do not comply. The thinking behind this approach is that companies are heterogeneous and should be allowed to match their corporate governance arrangements to their own needs. Thus the test of whether a given firm has adopted effective governance procedures is, in the final analysis, for the market to make; weak (or ill-matched) governance structures will be reflected in lower share prices.

The flexibility inherent in the UK approach makes it possible to test for the consequences for firm performance of companies’ decisions on board structure and other corporate governance arrangements. The empirical literature for the UK broadly follows that for the US, in failing to find a clear correlation between the adoption of independent boards and separate CEO/Chair roles, on the one hand, and firm performance on the other. One of the few studies to examine in detail the effects on performance of companies’ different approaches to disclosure (or ‘explanation’ as an alternative to ‘compliance’) is by Arcot and Bruno (2007). Using a sample of a sample of 245 non-financial listed UK firms, they studied the impact of corporate governance compliance and reporting on firms’ return on assets, over a five year period (1999-2004). They found some evidence of a positive correlation between compliance and performance and some evidence, but also evidence that firms which did not comply with the standards set out in the Cadbury Code but offered effective explanations for non-compliance performed best of all. The worst performers were those which did not comply with corporate governance standards prior to the implementation of the Code, but did so after it was introduced.
The implication of the Arcot-Bruno study is that corporate governance standards may perform a useful function in enabling already well-run firms to signal this fact, in particular through their use of the ‘explanation’ option. However, this potentially positive effect of corporate governance codes must be qualified by another of Arcot and Bruno’s findings, namely that shareholders did not value this subset of firms as highly as they should have done given their higher profitability; rather, there was a bias, in the valuations placed on companies by the stock market, in favour of firms which formally complied with the provisions of the Cadbury Code. This result implies a degree of shareholder myopia which puts into question the assumption, implicit in the ‘comply or explain’ approach, that the market can efficiently gauge the quality of explanatory disclosures.

There is evidence to suggest that the impact of the laws and corporate governance codes strengthening shareholder rights differs according to the national context that is being considered. A number of studies have found that changes to legislation and/or to listing rules, encouraging greater independence of boards and related corporate governance changes, have been reflected in improved firm performance in developing countries, as measured by Tobin’s q (Black, Jang and Kim, 2006, for Korea) and abnormal share price returns around the ‘event window’ of the announcement of legal changes (Black and Khanna, 2007, for India).

There are few studies comparing the experience of developed and developing countries. Deakin, Sarkar and Singh (2012) report findings from a study of the impact of legal reforms in a panel of 25 developed and developing countries over the period 1995-2005. Their causal variable consisted of the measure of legal adoption of pro-shareholder reforms in the 10-indicator version of the CBR Shareholder Protection Index (SPI-10). This set of indicators is focused on issues of board structure, shareholder voice and voting rights, and protection of minority shareholder interests in the context of takeover bids. The outcome variables in this study consisted of country-level measures of financial development, drawn from the IMF’s Financial Structure Dataset. They used a vector error correction analysis and the GMM (generalised method of moments) technique to estimate the long-run impact of legal changes, and Granger causality techniques to test for the direction of causation. They found a positive impact of legal change on stock market values (stock market capitalisation over GDP) for developing countries, as well as evidence, in the developing world, of reverse causation, suggesting that investor demand was, in part, driving legal change. For developed countries, they found a positive impact of reforms on stock market capitalisation for common law countries only; there was no
effect in civil law systems. This finding suggests that standards of the kind contained in corporate governance codes have had most impact in common law systems, such as the USA and UK, which have dispersed share ownership, but a limited impact in civil law systems, which tend to have concentrated or blockholder ownership. In addition, the results from this study for developed common law countries indicated a possible ‘bubble’ effect, with legal change associated with an increase in equity values but not in the underlying volume of shares traded (this was not the case with the developing country sample).

These comparative studies imply that corporate governance reforms encouraging or mandating protections for shareholders are most likely to have positive impacts in systems where equity markets are still in the process of emerging and where firm-level governance is weak. In developed country contexts, on the other hand, they can have negative implications, imposing regulatory costs on already well-governed firms, and contributing to overvaluation of shares during stock market bubbles. This effect is most marked in common law systems such as the UK and USA (Deakin et al., 2012). In civil law countries, where ownership still tends to be concentrated in large blocks, reforms premised on the assumption of the US- or UK-style separation of ownership and control run the risk of failing to bed down in practice.

4.3 Legal support for shareholder activism

An alternative mechanism for ensuring managerial accountability to shareholder interests is direct engagement by shareholders with the managements of their investee companies on matters ranging from dividend policy and financial structure to corporate strategy. In the US, a number of the larger pension funds pursued activist strategies during the 1990s, approaching companies directly with a view to eliciting their agreement on changes to corporate governance structures. Econometric studies generally have not found a positive correlation between this type of activism and firm performance (Gillan and Starks, 2007). Through a combination of the high costs of engagement, uncertain returns, and free-riding by other shareholders, it had largely petered out by the mid-2000s (Kahan and Rock, 2007).

A more enduring form of shareholder engagement has been so-called ‘hedge fund activism’. This takes the form of sustained, public and often confrontational engagement by specialised investment vehicles with the capacity to take large
holdings (on average 5-20%) in mostly cash-rich, medium-sized firms, and put pressure on their managements to release value to shareholders through higher dividends and share repurchases (Armour and Cheffins, 2012; Buchanan, Chai and Deakin, 2012). Hedge funds have generally been more successful in pursuing this strategy than pension funds were, in part because they are not constrained by the same requirements of prudential regulation and so have greater flexibility in targeting their investments according to a high-risk, high-return strategy.

The incidence of hedge fund activism is linked to differences in the legal framework for corporate governance. Katelouzou (2012), using the CBR Shareholder Protection Index as a measure of legal protection for shareholders, finds that a higher value on the index is correlated with a greater incidence of hedge fund activism across countries. This kind of activism is particularly pronounced in the USA, where, it has been estimated, around half of listed companies have an activist investor holding a stake of 5% or more, and is also present in the UK, although to a lesser extent (Buchanan, Chai and Deakin, 2012). Buchanan et al. (2012) report that hedge fund activism in the UK is mostly focused on smaller listed companies on the AIM exchange, although there are instances of activists targeting larger, listed companies, as in the intervention by Nelson Peltz’s fund in Cadbury Schweppes in 2007 which triggered the sale of the company’s drinks business and opened the way to its subsequent hostile takeover, in 2010, by its US rival, Kraft (see House of Commons BIS Committee, 2010).

Empirical studies report generally positive impacts of hedge fund interventions on share price returns but are more equivocal on their implications for long-run firm performance. Brav, Jiang, Partnoy and Thomas (2008), analysing a dataset containing over 1,000 interventions by activist hedge funds in US companies over the period between 2001 and 2006, found evidence of positive abnormal returns to shareholders in the ‘announcement window’ around the disclosure that a fund had taken a 5% or more stake in a target company. Greenwood and Schor (2009), basing their analysis on a somewhat different sample of activist interventions covering the period 1993-2006, found that events which led to a takeover within the following 18 months produced very substantial gains for target shareholders. Becht, Franks and Grant (2010), analysing a sample of 362 interventions in 15 European countries, also reported positive abnormal returns to activism. On the other hand, Klein and Zur (2009), analyzing a sample of hostile hedge fund interventions, reported declining profitability and earnings in the year following the event, and no recovery thereafter. Brav et al. (2008) found, on average, a negative impact on both profitability and
return on assets in target firms immediately following interventions by reference to the performance of firms in control groups, but a recovery in both to pre-event levels by the end of the first year, and a small improvement by the end of the second year. Some studies report negative impacts on other stakeholders. Klein and Zur (2011) found that target companies' bonds suffered a loss of value following interventions.

There is also evidence that hedge fund interventions have been less successful in countries with concentrated share ownership and a limited role for independent directors on boards. In Japan, notwithstanding a legal environment which was ostensibly favourable to hedge fund interventions, activism of this kind failed to make much headway in the light of resistance from boards unwilling to prioritise the maximisation of shareholder value over long-term strategic goals. In addition, hedge funds active in Japan were unable to gain the support of other shareholders for their campaigns, a reflection of the limited role played by portfolio investors even now in the Japanese market, and the continuing role of business-related investments by large shareholders (Buchanan et al. 2012). Buchanan et al. (2012) report the results of an econometric analysis of hedge fund activism in Japanese firms which shows minimal impact of hedge fund interventions on capital structures; a negative stock market reaction, indicated by declines in Tobin’s q; and, either no impact on managerial performance (for confrontational interventions) or deteriorating performance (non-confrontational interventions) three years after the initial share purchase.

Activism need not necessarily take a public and/or confrontational form. An alternative to confrontational hedge fund activism is the model of the ‘focus fund’, pioneered by the Hermes UK Focus Fund. Focus funds engage with investee companies over management strategy and offer a combination of investment support and management-consultancy type advice. Becht, Franks, Mayer and Rossi (2010) report positive returns from 41 focus-type investments made by the Hermes fund between 1998 and 2004. In September 2012 the fund was sold in a trade sale, reportedly after a number of years of disappointing returns.

Another form of shareholder activism is direct engagement on corporate social responsibility (CSR) issues such as climate change, supply chain management and labour standards. Dimson, Oguzhan and Li (2012) study the impact of 2,152 such engagements in a sample of 613 publicly listed US firms in the period 1999-2009, derived from data provided by a large institutional investor with a commitment
to socially responsible investment. They find that firms which are the subject of successful targeting (in the sense of an engagement which leads to change in firm practice) have cumulative abnormal returns of around 4% in the following year, and also have above average operating performance (measured by return on assets). They suggest that these positive effects on operating performance are the result of CSR engagements attracting more loyal and socially conscious employees, customers and shareholders, and signalling a commitment to governance improvements of a kind likely to increase firm value.

The belief that institutional investors should be more active in engaging with management underlies the Stewardship Code, issued by the Financial Reporting Council in 2010, and intended to lay down guidance to pension funds and other institutional shareholders on the steps they should take to ensure effective monitoring. The prospects for the Code are uncertain in the light of the mixed evidence (see above) on returns from activism, and the declining proportion of UK equities held by the domestic institutional investors to which the Code is principally addressed (less than a third in 2012, down from three fifths in 1993: Cheffins, 2010).

4.4 Corporate objectives, short-termism, fiduciary duties, and the investment chain

Company law does not prescribe in a precise way the criteria which should guide strategic decision-making by boards. Company directors have a duty to act in the ‘best interests of the company’ or, as this is now put under the Companies Act 2006, section 172, to ‘promote the success of the company for the benefit of its members as a whole’, the ‘members’ here being the shareholders. To this end, the board must ‘have regard to’ a number of matters including ‘the likely consequences of any decision in the long term’, as well as the interests of the company’s employees, the need to foster the company’s relationships with customers and suppliers, and the impact of the company’s operations on the community and the environment. It is not clear whether the enactment of section 172 has had an impact on either the procedure or the substance of decision-making at board level. Prior to its coming into force, it was already the case that company law granted boards considerable discretion to balance short-term and long-term considerations when taking strategic decisions, and, specifically, to have regard to the interests of non-financial stakeholders where to do so would, in the directors’ view, promote the success
of the company. On the other hand, it was also clear that company law imposed few constraints on boards which took a short-term view of corporate objectives; nor did the law do much to offset growing pressure from shareholders for high and continuous returns.

In a series of papers based on around 40 in-depth interviews with UK-based investors and managers carried out in the early 2000s, Barker, Hendry, Sanderson and Roberts reported on attitudes towards shareholder value maximisation as the goal of the company. They found some evidence of pressure from asset management firms and other institutional investors on their investee companies to enhance returns, but also a high degree of internalisation of the shareholder value ‘norm; among corporate managers themselves: managers were ‘almost more dedicated to the pursuit of shareholder value than the fund managers they were meeting’ (Roberts et al., 2006: 288). Shareholder-value type arguments were used by senior corporate managers to bolster their internal authority and as a justification for potentially contentious decisions on restructuring and remuneration. They also reported that while corporate executives generally drew a distinction between managing for long-term shareholder value and satisfying short-term demands of the market, in practice the line between these two notions of shareholder value was blurred (Hendry et al., 2006a, 2006b).

One of the consequences of the move towards independent boards in both the UK and the USA has been greater scrutiny of the hiring of senior executives, including CEOs, by board members, and the increased use of incentive payments and bonuses for CEOs based on share price performance and other performance criteria. The delegation of nomination and remuneration decisions to board subcommittees with a majority of independent members is mandatory for US listed companies under the Sarbanes-Oxley Act and recommended practice under the UK Corporate Governance Code. Although in principle these changes should bring about a closer alignment of managerial and shareholder interests, and hence increase firm value, there is evidence that firm value may be negatively affected by short-termism associated with the financial incentivisation of CEOs. Antia, Pantzalis and Chul (2010) find that longer time horizons for CEOs of US listed companies, which they calculate in terms of current tenure plus age, are associated with higher firm value as measured by Tobin’s q, while Brochet, Loumioti and Serafeim (2012), who measure the short-term orientation of CEOs on the basis of transcripts of conference calls with investors, find that US firms with a short-term strategy attract short-term investors and have higher stock price volatility.
The nature of relationships in the investment chain between pension fund trustees (who have a fiduciary duty to maximise returns for the scheme members) and asset managers, and the resulting implications for the strategies pursued by investee companies, is the subject of a small but growing empirical literature. Del Guercio and Tkac (2002) find, in the context of a US study, that pension funds are more likely than mutual funds to replace fund managers after poor performance over the short term (up to one year), and Heisler, Hittell, Neumann and Stewart (2007) similarly find that US pension fund trustees’ fiduciary duties and duty to monitor managers together make them prone to use short-term performance measures and to replace managers who fail to meet them.

4.5 Corporate governance, shareholder rights and innovation

There is a developing literature on the relationship between corporate governance and innovation, which specifically relates to the impact of shareholder pressure for high returns on the growth and performance of manufacturing firms.

From the viewpoint of agency theory, corporate governance arrangements which designate residual control and income rights to shareholders have ‘survival value’ because by doing so they reduce the costs associated with contractual monitoring and risk-adjustment. The reduction of agency costs contributes to the firm’s competitive survival because it enables it to deliver products at lower prices, all things being equal (Fama and Jensen, 1983). In principle, this argument can be extended to cover the case of innovation: shareholder-focused firms should be more likely to survive and prosper in environments which offer the possibility of supra-competitive returns from innovation, on the one hand, and the threat of obsolescence, decline and exit under the pressure of Schumpeterian ‘creative destruction’, on the other.

The agency-theoretical view of the governance-innovation link has been challenged by the theory of the innovative firm developed by Lazonick (2001, 2007, 2010) and O’Sullivan (2000; 2003). In their approach, the firm consists of a set of organisational relations which determine the way in which investment decisions are made, what types of investments are made, who makes these decisions and who claims the returns from these investments. The fundamental trade-offs in the
investment decision are, firstly, between the short and the long term, and, secondly, between internal and external mechanisms of financing. The main trade-off in the redistribution of profits is between the claims of shareholders and those of ‘residual’ stakeholders, above all the employees of the firms who engage in collective learning and by doing so develop the innovative potential of the business. The central conflict of interest for the firm rises from the need to commit to innovation, a source of sustainable growth and continued employment, over a longer period of time than the one that would be sufficient to generate equal amounts of speculative returns for shareholders. The potential consequences of this conflict include the (mis-)use of the stock market to maximise shareholders’ returns to the detriment of other stakeholders (in particular employees but also strategic customers and suppliers) as well as investment in innovation. It can also lead, as Lazonick has argued in the case of the US, to inequitable and unstable resource allocation in a number of large corporations governed according to the shareholder value maximisation principle (Jensen, 1986) which has had negative effects, Lazonick argues, on workers, firm competitiveness, and macroeconomic growth (Lazonick, 2010).

A related critique of the agency-theoretical view has been made by Tylecote and his collaborators. After reviewing the role of finance and corporate governance in a national innovation systems framework (Tylecote 2007), they find that country-specific factors significantly influence the rate and direction of technical change as well as the development path of firms. This suggests that the agency model describes those systems, those such as the US and UK, which rely heavily on external finance, supplied through the capital market, to support innovation, but has limited relevance in other contexts.

In the case of the USA and the UK, there is evidence of potentially negative effects of shareholder-orientated corporate governance rules on investment decisions. Graham et al. (2005) report that US listed companies are becoming less willing to invest in R&D when they come under pressure to prioritise shareholder returns through share buy-backs and higher dividends. Asker, Farre-Mensa and Ljungvist (2012) find that US listed firms invest less than comparable private firms and are less responsive to changes in investment opportunities, particularly in industries characterised by high sensitivity of stock prices to current earnings. Comparative studies also provide evidence of trade-offs between shareholder protection and stock market values, on the one hand, and innovation, on the other. Belloc (2012) reports the findings of a 48-country study which analyses the relationship between shareholder protection, as measured by the World Bank and CBR indices, and
innovation, as measured by investments in R&D and patenting activity. Employing a panel data methodology, he finds that that a high level of legal shareholder protection is correlated with a higher level of stock market capitalisation, but a lower level of innovation activity.

Lazonick and Prencipe’s (2005) case study of Rolls Royce points to tensions between corporate governance practices in the UK and the development of technological capabilities by manufacturing firms. The paper describes how Rolls Royce consolidated and then improved its position in the global market for aircraft engine production in the course of the 1990s through a strategy of building internal capabilities that was led by a largely engineering-focused team of managers. In this period, the development of the company’s three-shaft turbofan engine enabled it to overtake its US rival Pratt and Witney to become the second-ranked commercial aviation engine producer after GE. In the early 1990s the company cut dividend payments, and its share price subsequently under-performed the FTSE 100 index. Despite this, the company was able to raise capital through a rights issue in 1993, and it took on debt to fund a number of acquisitions. By the end of the decade it had largely paid off its debt through the revenues generated by increasing sales; its share of the global turbofan market increased from 8% in 1987 to 30% in 2002. Throughout this process, the company’s management was effectively protected from negative investor opinion by the ‘golden share’ retained by the UK government. The senior management team had virtually no ownership stake in the company, and the board members between them held less than 0.5% of the issued share capital. The authors of this study make the point that the success of Rolls Royce needs to be seen against the background of ‘the relative lack of success, more generally, of British companies in high-technology manufacturing industries over the past half century or so’ (Lazonick and Prencipe, 2005: 502).

4.6 Corporate governance, product market competition and innovation

There is a growing literature examining the interaction between corporate governance standards and product market competition, which has implications for the relationship between governance and innovation. One of the main drivers behind productivity improvements in British industry since the early 1980s has been the stimulus to competition provided by policies of deregulation and privatisation, the removal
of barriers to international trade, and changes to domestic and European Union competition law (Crafts, 2009). Buccirossi et al. (2009) report a positive correlation between competition policy and total factor productivity growth in 12 OECD countries over the period 1995-2005. These findings are consistent with the view that product market competition selects out inefficient firms and generally serves to maximise the aggregate value of firms across a given sector or national economy. This view, however, begs the question of the role of corporate governance mechanisms: are they needed in a context where product markets are already competitive?

The empirical literature diverges on this point. Giroud and Muller (2010) analyse the impact of firm-level governance practices on a number of performance measures (share price performance, Tobin’s q, return on equity, return on assets, net profits) for a sample of over 3,000 US listed companies across a range of industries (including but not confined to manufacturing sectors). They then control for the competitive structure of industries, as measured by the Hirschman-Herfindahl index of concentration. They find that governance has only a small effect on firm performance in competitive industries and a more sizable positive impact on performance in non-competitive ones. They conclude that product market competition and corporate governance operate as substitutes: governance has little role to play in enhancing firm performance if product markets are already competitive.

Knyazeva and Kynazeva (2012) reach an opposite result, although differences in their focus, which is on legal rules rather than firm-level practices, and in the scope of their study, which does not include the USA or Canada, may partly explain the divergence. Rather than focusing on differences in firm-level governance practices in a single jurisdiction as Giroud and Muller (2010) did, they look at differences in country-level laws on shareholder protection, using, for this purpose, the time-invariant index developed by La Porta et al. (1998). They use a very large sample of mostly manufacturing firms (regulated industries and financial firms are excluded) in 45 developed and developing countries, excluding US or Canadian incorporated firms. They find that shareholder rights have a positive impact on firm performance (both financial performance and profitability) in industries which are more competitive (using the HHI as the measure of competitive structure). They explain this result on the basis that shareholders are likely to monitor managers more effectively in competitive industries where it is easier to identify and remedy managerial underperformance.
Chai, Deakin, Sarkar and Singh (2013) introduce innovation into the picture by using as a measure of product market competition the abnormal persistence of firm-level profits. If markets were perfectly competitive, abnormally high profits should be competed away over time. Persistence of profits can therefore be interpreted as indicating incomplete or imperfect competition in product markets. However, abnormal persistence can also be interpreted as evidence for the presence of innovative firms which are successful over time in capturing rents from product or process innovation. Using a very large sample of manufacturing firms in 18 developed and developing countries, Chai et al., (2013) estimate the impact of laws governing shareholder rights on the persistence of firm-level profits. They use the CBR Shareholder Protection Index for the period 1995-2005 (SPI-10) as the measure of legal shareholder protection; as this varies over time it provides an alternative (and potentially more revealing) measure to the time-invariant index of La Porta et al. (1998). They find that higher shareholder protection reduces the persistence of profits in common law countries and increases it in civil law countries. This is consistent with the view that increases in legally mandated or encouraged shareholder protection during the 1990s and 2000s had a negative impact on firm-level innovation (proxied here by the abnormal persistence of profits) in common law systems. In civil law systems, which had a lower level of shareholder protection to begin with, the effect was positive, implying that there is a curvilinear (inverted U) relationship between shareholder rights and firm-level profitability based on innovation.

5. The scale, outcome and effects of takeover activity

Hostile takeover bids (defined as bids for a controlling shareholding made without the initial agreement of the board of the target company) are more common in the UK than in other developed countries, allowing for the relative size of the UK’s listed company sector, and such bids are more likely to lead to a change of control than elsewhere. Jackson and Miyajima (2008) record 18 hostile bids in France between 1991 and 2005 and 6 each in Germany and Japan. In the same period there were 176 in the UK and 332 in the US (the US listed company sector is more than twice the size of the British one). The success rates for hostile bids (defined as a sale of control to the bidder) was 42% in the UK and 22% in the US. During the same period, they report that 12 bids succeeded in France, 5 in Germany, and one in Japan.
The regulatory framework governing takeover bids for listed companies in the UK is derived from the Takeover Code and certain rules of company law. The Takeover Code currently has a statutory underpinning, following the implementation in 2006 of the Thirteenth Company Law Directive, but it remains essentially a self-regulatory code, developed and administered by the City Panel on Takeovers and Mergers. The contents of the Code broadly reflect the interests of institutional shareholder groups which, historically, were in a position more effectively to lobby for protection for minority shareholder rights than their US counterparts (Armour and Skeel, 2007). Rules protecting shareholder interests under the UK Takeover Code include the principle of equal treatment, which is to the effect that all shareholders of the offeree company of the same class must be accorded equivalent treatment; the mandatory bid rule, under which a shareholder which has acquired 30% of the company’s voting rights must extend to all shareholders an offer to purchase their holdings for at least the highest price it has paid for similar shares in the previous 12 months; an obligation upon directors to give shareholders financial advice on the merits of the bid; and rules prohibiting various defensive actions such as issuing new shares or disposing of assets during the bid period. In addition, general company law places limits on the powers of boards to issue stock to friendly third parties and stock exchange rules on pre-emption require any new shares to be issued to existing shareholders first. Company allows non-voting shares to be issued but in practice this has been discouraged by institutional shareholder bodies such as the Institutional Shareholders Committee.

The general effect of these legal provisions, listing rules and code provisions is that target boards of UK listed companies generally have less leeway to oppose bids than boards of similar firms in other industrialised countries (for an overview of the relevant legal and regulatory differences, see Deakin and Singh, 2009). Since the mid-1980s the US courts have generally upheld ‘poison pills’ which can be triggered by a target board if it considers that an offer undervalues the company. A common type of poison pill is a ‘rights plan’ under which the board has the power to issue stock to a friendly third party or more generally to shareholders other than the bidder. To this end, a US board can take into account what it may consider to be the negative impact of a bid on employees, suppliers and other non-financial stakeholders and hence on the wider company as a going concern. A target board may have to ‘redeem’ (or abandon) a poison pill if it receives multiple bids and an ‘auction’ for the company begins. However, in the absence of an auction, boards with poison pills already in place are generally able to deflect hostile bids, as long as they avoid conflicts of interest and otherwise act in good faith. This is contrary to the
UK position, where a single hostile bid can often result in a takeover. As Deakin and Singh (2009) explain, had Cadbury been a US-listed company with a poison pill in place, it would have been in a position to resist Kraft’s uncontested bid on the ground that it was not conducive to long-term value.

In other industrial countries, hostile takeovers are rare because of other elements in the regulatory framework (see Deakin and Singh, 2009). In France and in the Nordic systems, multiple voting rights can be used to entrench dominant shareholders, notwithstanding attempts to limit the use of weighted voting in the Thirteenth Company Law Directive. Germany has moved away from weighted voting following the passage of the Thirteenth Directive, but the continuing presence of worker directors on the supervisory board makes it more difficult for bidders to win board approval. A number of EU member states, including France and Germany, have taken advantage of provisions in the Directive which allow companies to put anti-takeover defences in place with the approval of the supervisory board or shareholder meeting. The adoption of the mandatory bid rule in some continental European countries has had the paradoxical effect of making it more difficult for takeover bids to be launched against incumbent blockholders, who are now in a position to demand an increased premium in return for control (Berglöf and Burckart, 2003; Ventoruzzo, 2008).

Japan has recently moved in the direction of allowing companies greater leeway to adopt poison pills and other takeover defences. Following the Bull-Dog Sauce litigation of 2006, in which a hedge fund that launched a hostile bid against a mid-cap food manufacturer as part of an activist campaign was described by the court as an ‘abusive acquirer’ on the grounds that it had no long-term plan for the management of the company, substantial number of listed companies moved to adopt US-style poison pills whose legality had previously been in doubt, a move further encouraged by legislative changes around the same time. Japanese courts have developed a test of ‘corporate value’ as the benchmark for evaluating bids, as an alternative to shareholder value, a development also reflected in guidelines on takeover bids issued by the industry ministry, METI, in the mid-2000s (for assessments of how far this represents a qualification of shareholder rights, see Armour, Jacobs and Milhaupt, 2011; Buchanan et al., 2012a).

Qualitative empirical research suggests that directors of UK-listed companies tend to see their role during a bid as ensuring that the financial interests of the current
shareholders are fully protected. If this means advising shareholders to accept an offer which values the company at a premium to the pre-bid share prices rather than taking steps to resist a bid that they regard as value-destroying over the medium to long term, they will tend to take the former route. Deakin, Hobbs, Nash and Slinger (2002) report findings from case studies of 15 hostile takeovers of public utilities and manufacturing firms in the UK takeover wave of the mid-1990s. For this study, interviews were conducted with executive directors and other senior managers, non-executive directors, institutional investors and legal advisers. They found that boards generally focused on short-term shareholder returns when evaluating bids, in part because of legal advice that this was required by the Takeover Code. A provision in the version of the Code in force at that time, which stipulated that boards should consider the impact of bids on employees, was regarded by the directors and advisers interviewed by Deakin et al. as unimportant in practice. Non-executive directors were reported as making the case for maximising shareholder value in preference to rejecting bids that would lead to the break-up of companies.

Since this research was conducted, the Takeover Code has been amended, in the light of the Directive, to include a provision requiring the bidder to set out a corporate strategy for the target and to detail possible job losses and changes to terms and conditions of employment. The target board must also give its view on the implications of the bid for employment. It is unclear whether these changes have affected the likelihood of bids succeeding, but it seems unlikely that they would have this effect. They do not appear to have materially affected the outcome of the Kraft-Cadbury bid. Representations made by the bidder during a bid, concerning its corporate strategy, do not normally give rise to legal obligations, as Kraft’s closure of Cadbury’s Somerdale plant, which it had indicated would continue to operate, made clear. The Takeover Panel criticised Kraft for making a statement in respect of its intentions with regard to the Somerdale plant for which, it found, there was no objective or reasonable basis (see House of Commons BIS Committee, 2011), but this did not affect the validity of Kraft’s bid or give rise to any legal liabilities on its part. As part of the so-called ‘Cadbury law’ consisting of amendments to the Code made in September 2011, the Code now provides that a party to a bid that makes a statement in relation to a course of action that it intends to take after the end of the offer period is to be regarded as bound by that statement for a period of 12 months from the date on which the offer period ends, unless there has been a material change of circumstances.

Econometric studies suggest that, on average, hostile takeovers do not lead to
improved financial performance in target firms, although the variance is large, with gains in a significant proportion of cases (Martynova, Oosting and Renneboog, 2006; Cosh and Hughes, 2008). Thus the performance benefits of hostile bids for firms that are actually taken over are unclear at best. The wider and perhaps more pertinent issue is the impact of the UK’s takeover regime on listed companies in general. The absence of takeover defences of the kind which are commonplace in other developed economies means that managers of UK-listed companies are more exposed to the disciplinary effects of the ‘market for corporate control’ than their counterparts elsewhere. From an agency-theoretical perspective, this should lead to reduced agency costs and more efficient management (Fama and Jensen, 1983). The counter argument is that the pressure to maximise short-run shareholder value which stems, indirectly, from the operation of the UK’s takeover regime, deters firms from investing in strategic capabilities, the returns on which can only be realised over a longer-term time horizon than that implied by the interests of at least a segment of shareholders in speculative returns (Lazonick and O’Sullivan, 2000). From this point of view, the continuation in force of the bid-friendly Takeover Code is a fetter on the innovative potential of UK-listed companies.

US research based on 1990s data suggests that shareholders during this period placed a higher value on the stock of companies which did not have anti-takeover defences (Gompers, Ishii and Metrick, 2002; Cremers and Ferrell, 2011, 2012). This can be read as evidence that poison pills reduce firm value, by allowing managers to entrench themselves against shareholder pressure (Bebchuk, Cohen and Ferrell, 2009). An alternative interpretation is that shareholders overvalue the speculative opportunities which arise from hostile bids, while finding it harder to assess potential returns on R&D and investments in organisational capabilities (Deakin and Slinger, 1997; Lazonick and O’Sullivan, 2000). There is also evidence that the premium enjoyed by US firms with more shareholder-orientated corporate governance arrangements of this kind has diminished over time (Bebchuk, Cohen and Wang, 2011). This is compatible with the view that the choices firms make on corporate governance structures, including takeover defences, are endogenous to their particular strategies and circumstances, and so likely to be efficient, and evaluated as such by the market. Relatedly, there is evidence that anti-takeover defences are widely adopted by high-technology firms following an IPO. Google and Facebook are among companies with weighted voting provisions which have allowed the founders to retain effective control post-flotation. Provisions of this kind are not prohibited by UK law, but are very rarely observed among listed companies, largely because of institutional shareholder pressure for the retention of the practice of one-share, one-
6. The contractual and corporate governance environment for medium-sized enterprises (‘Mittelstand’ type firms)

The relatively large size of the German ‘Mittelstand’ sector in proportion to the rest of the national economy, together with the stable and enduring nature of many Mittelstand firms, stands out in comparisons with other industrialised economies but in particular with the UK. The longevity of German Mittelstand firms appears to be linked to family ownership and to the absence of opportunities for owners to exit through a trade sale or IPO, both of which are common in the UK for successful, first-generation medium sized enterprises. The differences in the trajectories of UK and German firms appear to be related, in the first instance, to ownership structures and modes of financing, but also to the legal-regulatory framework affecting mergers and acquisitions. Franks et al. (2012), in a cross-country study, report that family firms tend to evolve into widely-held firms only in countries with strong investor protection and liquid capital markets, and even then not in sectors with a low incidence of mergers and acquisitions and fewer investment opportunities. In countries with weak investor protection laws and less liquid capital markets, family ownership persists, regardless of sectoral effects.

In addition, there is evidence that the institutional environment for inter-firm contracting in Germany is more favourable, in a number of respects, to the emergence of a sustainable medium-sized enterprise sector, than it is in the UK. The economic impact of these different national legal frameworks for contracting was the subject of the ‘vertical contracts’ study which was carried out by the Cambridge Centre for Business Research as part of the ESRC’s contracts and competition programme in the mid-1990s. This project set out to examining how functionally similar transactions (contracts between ‘original equipment manufacturers’ and suppliers of component parts) were organised across the three national legal systems of Germany, Britain and Italy. Around 60 in-depth interviews were carried out with firms in the three countries concerned and further interviews were undertaken with
trade associations and other relevant parties. A semi-structured questionnaire was used to obtain a mix of quantitative and qualitative data. The sample firms were drawn in each case from two established manufacturing sectors, namely mining machinery and kitchen equipment.

The research found considerable diversity in the form of contracts, their duration, and their substance. Contracts in Germany tended to be longer term, spanning more than one exchange, and to make greater use of formal mechanisms of risk allocation, such as hardship clauses, than in the other two countries. The study also found divergence in the willingness of parties to use legal action to enforce their contractual rights. Although the British firms most strongly stressed the virtues of contract informality, they were also the most likely to have to take legal action in response to non-performance. Resort to law to pursue a debt or resolve a contractual dispute was least likely in the apparently most highly juridified system, Germany.

Three levels of contractual regulation are relevant in the German context: the body of commercial contract law, which in Germany is infused by the values of ‘good faith’ in commercial dealing derived from paragraph 242 of the civil code; the standard form agreements for commercial dealing which are laid down at industry level in Germany; and inter-party agreements at micro-level. Standard forms follow closely the guidance of the law on what amounts to performance in good faith; individual contracts, in turn, rarely depart from the template set at industry level.

There is a considerable contrast here with English commercial law governing inter-firm contracting. Parties to contracts are very much ‘free to make their own agreements’ in the absence of an overarching principle of good faith and relatively weak industry-level standard terms. During the period of the study in the early 1990s, standard form contracts were disintegrating in the industries being studied, as a result of the privatisation of coal, gas and electricity; monopsony buyers, in the form of the old nationalised state corporations, had performed a similar role to trade associations in Germany in ensuring that standardised contract terms were followed. With their departure from the scene, long-established terms dealing with the balance of risk between main contractors and sub-contractors were swept aside in favour of agreements which shifted the risk almost entirely on to the latter.

In Italy, as in Germany, trade associations play an important role in setting and enforcing standards for commercial agreements. However, legal notions of good
faith have limited relevance in commercial contracting in this context, by virtue of the perceived rigidity of the court system. Principles of fair dealing are reflected instead in trading standards which operate in particular regions or industries and which are linked to the roles played by local government and by trade associations.

Among the empirical findings of this ESRC-funded research on contracts was considerable evidence of differences in the way commercial parties regarded the legal system (Arrighetti, Bachmann and Deakin, 1997; Burchell and Wilkinson, 1997). In Germany, respondents commented that their contracts were shaped by the general law as well as by the ‘general conditions of business’ applying in their industry. Both the Civil Code and the general conditions were seen to apply ‘as a matter of course’. In Italy, firms were unable to estimate the costs and outcomes of legal action and did not rely extensively on contractual form to shape their relationship, apparently reflecting a court system perceived as slow, expensive and uncertain in terms of outcome. In Britain, there was a sectoral divide. Most mining machinery contracts were detailed and sophisticated, reflecting the legacy of nationalisation in the coal industry; in the other sector studied, the manufacturing of kitchen furniture, it was common to find firms reporting that informal understandings were preferable to legally binding and/or written agreements.

The research also threw light on attitudes to trust. A large proportion of British respondents reported that they would try to deal with a breakdown of trust through personal and informal contacts, while German managers emphasised pre-contract screening and the use of formal contract terms to provide protection against failure to keep to agreements. The German approach to contacting was ‘indicative of a system in which firms are careful about entering into business relationships but, when they do, they expect them to be long-term, and to deal with difficulties within the relationships by contractual means’ (Burchell and Wilkinson, 1997: 226).

7. The legal framework for early-stage
finance and start-ups

The legal regime governing early-stage finance and start-ups is a composite of the standard-form contracts which have evolved over time to meet the needs of firms and investors, and elements of the legislative framework drawn from each of the areas considered in this review, (company law, insolvency law and employment law), as well as tax law.

It has been argued that shareholder pressure operates as a device for releasing capital from under-performing firms and ensuring its reallocation to more profitable and, in principle, innovative ones elsewhere in the economy, including start-ups. Specifically, it is suggested that the availability of venture capital for start-ups is linked to the ability of shareholders to extract value from companies in mature sectors through takeover bids and direct engagement with companies to increase dividends and engage in share buy-backs (‘shareholder activism’). Once the capital is released in this way, the capital market functions to redirect it to growing firms in developing sectors of the economy (Summers, 2001). More generally, it is argued that a liquid stock market is important for providing venture capital firms with an exit strategy, via an IPO, which will enable them to cash out their investments (Gilson and Black, 1997).

In the same vein, a flexible labour market can be understood as complementing the corporate governance mechanisms which underpin early-stage finance. The ability of established firms to downsize at minimal cost is part of the process by which hostile takeovers and shareholder activism work to free up capital for wider circulation in the economy. While downsizing in response to shareholder pressure can be analysed as a breach of implicit contracts between the firm and its core workforce (Shleifer and Summers, 1988), agency-theoretical approaches see advantages in labour law regimes which give employers the freedom to restructure the enterprise where to do so will enhance shareholder value (Jensen, 1993). This implies a regime of minimal employment protection regulation and limited provision for collective employee voice in the event of redundancies.

For start-ups, a low degree of employment protection could be seen as providing an important source of flexibility in hiring and firing (although for evidence linking employment protection to higher innovation rates, see section 9 below). Conversely,
freedom for employees to move between firms, free of the constraints imposed by non-competition clauses of ‘restrictive covenants’, has been identified in empirical studies of Silicon Valley as an important dimension of the ‘high velocity’ labour markets which characterise high-technology clusters (Saxenian, 1994; Hyde, 1998).

The protection of creditors’ rights can also exert direct and significant influences on the capacity of the firm to finance its R&D activities. Strong creditor protection, in particular as it relates to the rights of secured creditors such as banks, reduces the lender’s risk, thereby, at least in theory, favouring access to credit by firms that seek external finance. Improved access to credit will provide more and better inputs to be deployed in the R&D process with potentially positive effects on the innovation performance of the firm. Thus strong protection of secured creditors’ rights should favour innovation by firms dependent on bank-led finance.

A counter-argument is that stronger creditor protection rights will imply stricter control over borrowing and exert a conservative influence over the technological and market risk associated with the innovation investment of the debt-holder. Since innovation can be sensitive to threshold effects and because its outcomes are systematically and heavily skewed, weaker creditors’ rights should be conducive to innovation via a high-risk, high-rewards strategy.

Acharya and Subramanian (2009) offer empirical evidence for this argument. Using the limited time-series index prepared by Djankov et al. (2007), they find that stronger creditor rights in corporate bankruptcy laws dampen innovation as measured by patents lodged and citations to patents. In countries which experienced a change to their insolvency laws, additional protections for creditors led to a decrease in patenting rates in innovative industries, linked to the unwillingness of firms to take on debt. Acharya, Yakov and Litov (2011) report complementary findings to the effect that strong creditor rights reduce financial risk taking by firms.

Armour and Cumming (2005) also find empirical support for this proposition, using an index which measures changes in the severity of personal bankruptcy legislation over time. Reductions in the severity of personal bankruptcy law in several European countries in the 1990s were strongly correlated with a rise in self-employment in that period. Armour and Cumming also report a stronger effect of bankruptcy law on entrepreneurial activity, defined in terms of the size of the self-employed sector, than either real GDP growth or stock market returns. Relatedly, Armour and Cumming
(2006) find evidence that strict enforcement of personal bankruptcy laws, as measured by, among other things, the period of discharge from bankruptcy, is related to lower levels of venture capital fundraising. The UK is towards the more liberal end of the spectrum on laws governing discharge from personal bankruptcy (Armour, 2004).

Although there is a growing body of evidence on cross-national variations in the extent of venture capital funding and in the nature of start-up activity, this is not, as yet, clearly linked into the literature on the legal framework of corporate governance. A focus on the US case, which remains by far the largest national market for VC funding, would suggest that a combination of strong shareholder protection, flexible labour laws and weak creditor rights works well in encouraging start-ups. Within Europe, the UK has a regulatory regime which most closely resembles that of the US in each of these respects, but it does not have the highest incidence of VC activity relative to the size of the national economy; the Nordic economies, in particular Finland and Sweden, have a higher volume of VC investment in proportion to GDP (Lahr and Mina, 2011: 7), despite having weaker shareholder rights regimes and stronger employment protection legislation than the UK. The UK more clearly leads the rest of Europe in private equity (PE) funding as a whole (that is, VC funding plus PE-type buy-outs of mature companies: Lahr and Mina, 2011: 9). It has been argued that the UK’s sizable private equity sector, which accounts for around a fifth of all private sector employment, is driven as much by the preferential tax treatment of debt in comparison to equity, in particular the availability of corporate tax relief on interest payments, as it is by the framework of corporate governance and employment law (Thornton, 2007).

8. Insolvency law and corporate rescue procedures

The CBR creditor protection index (CPI) codes for three areas of corporate insolvency law: the law governing creditors’ rights while the company is a going concern; the rights of secured creditors; and the law governing priority of claims and related matters in the event of bankruptcy (Armour et al., 2009a). A reduced form of this index with ten core variables can be used to analyse legal change in the larger sample of 25 countries (the CPI-10: Deakin et al., 2012).
Figures 4-5 show an increase in creditor protection over time in countries independently of their level of development and legal origin. Common law systems and developed systems have the highest scores, but the gap between the common law and civil law has almost disappeared by the end of the period. Within the civil law group, French origin systems (a group which includes the southern European and Latin American systems) had lower scores than both the English-origin and German-origin ones, but they also saw some of the greatest increases in protection, suggesting convergence on the more protective approaches of the other two

Although there has been a general trend towards the strengthening of creditor rights, countries have also been experimenting with corporate rescue mechanisms which allow incumbent managers to retain control of the underlying business in an insolvency, where this is in the interests of a range of internal stakeholders (employees, customers and suppliers) and third parties who would be negatively
affected by the failure of the firm. The US Chapter 11 model of ‘debtor-in-possession’ bankruptcy procedures provides the leading example of this approach, although, in practice, it is becoming more common for creditors in the US to assert control through strict conditions attached to the financing of firms undergoing such reorganizations (Skeel, 2004; Ayotte and Morrison, 2009). In the UK, the passage of the Enterprise Act 2002 altered the balance of power between secured and unsecured creditors in favour of the latter by replacing (mostly bank-led) receiverships with a streamlined administration procedure, but did not go as far as Chapter 11’s debtor-in-possession regime in qualifying creditor rights (Armour, Hsu and Walters, 2012).

In the UK, insolvencies increasingly take the form of ‘pre-packaged’ administrations under which the business is sold to a separate entity following negotiations between an insolvency practitioner and a potential purchaser while the incumbent management team is still in place. Empirical research on pre-packs by Frisby (2007), based on a mixture of interviews and statistical analysis of insolvency data, suggests that they tend to preserve employment and do not have a higher failure rate than other types of business sale, but that they also have a negative effect on unsecured creditors’ returns. Polo (2011) finds that pre-packs tend to be used in industries where reputation, intangibles and employees are important aspects of firm value, and that by avoiding the break-up of viable businesses they increase overall returns from the insolvency process, without leading to expropriation of unsecured creditors.

9. Employment protection legislation

Theory predicts mixed effects of employment protection legislation (‘EPL’) on employment and productivity. On the one hand, stricter EPL should cause unemployment as the costs of hiring are increased in an upturn. In addition, EPL may slow down the movement of workers from less productive firms and sectors of the economy to more productive and growing ones (Saint Paul, 1997). On the other hand, stricter EPL may reduce unemployment by making firms more reluctant to dismiss in a downturn. EPL can also induce productivity gains by ensuring the more efficient matching of firms and workers (Levine, 1991). Firms subject to stricter EPL come under incentives to train workers for more productive employment, thereby compensating for restrictions on their ability to hire and fire at will (Koeniger, 2005).
Because EPL is generally stricter in Europe than in the USA, the divergence between the European and American experiences of job growth since the 1970s has been the focus of a number of studies. In the 1960s, the USA had higher unemployment than western Europe, but in the 1980s this relationship was reversed, with the USA enjoying faster employment growth in comparison to the sluggish European record on job creation. In France and Germany there was a significant increase in the intensity of job security legislation in the 1970s, while in the US context there was, relatively speaking, little change. The UK has had unfair dismissal laws which were modelled on continental European practice since the early 1970s and it continues to be more closely aligned with mainland Europe than with the US on this issue, as Figure 6 below, which is based on the CBR labour regulation index (LRI), indicates.

In the late 1980s and early 1990s, the divergence in the legal environment between the US and Europe was used in a number of analyses, culminating in the OECD’s Jobs Study (OECD, 1994) to argue for the negative effects of EPL. However, these early studies used data on the strength of EPL which can now be seen to be somewhat rudimentary. In 2004 the OECD, using its more developed EPL indicator, which incorporated a time-series element, reported only weak evidence of a link between EPL strictness and flows into and out of unemployment (OECD, 2004). This found no link, overall, between EPL and cross-national variations in unemployment levels. The same study found some evidence of a reduction in unemployment associated with greater flexibility in the use of temporary and fixed-term employment, but more recent studies suggest that relaxation of dismissal rules in the case of these forms of employment is more often associated with a rise in dismissals which is not compensated for by increased hirings (Güell and Rodríguez Mora, 2010).

Complementarities between EPL and institutional variables such as product market regulation and corporate governance structures are being examined by a growing number of studies. In this vein, Amable, Demou and Gatti (2007) find that, in OECD countries, product market deregulation produces higher GDP growth only if a high
level of EPL is preserved. They suggest that product market regulation, rather than high EPL, was a cause of Europe’s sluggish employment growth after 1980. Gatti (2009) reports that high levels of EPL are complementary to concentrated corporate ownership in coordinated market systems, with this conjunction leading to high rates of GDP growth. Low levels of EPL strictness are combined with dispersed ownership and liquid capital markets in liberal market systems.

Similar complementarities can be found in Deakin and Sarkar’s analysis of the CBR labour regulation index (LRI) (Deakin and Sarkar, 2008). They undertake a time-series analysis of changes in labour law over time and trends in employment and productivity growth in France, Germany, the USA and UK. For the UK they found no long-run effects of these legal reforms on either employment or labour productivity. In Germany, on the other hand, a positive impact of stricter dismissal law on productivity growth was identified. In France there was a positive relationship between working time reductions and employment growth.

These findings suggest that EPL (and related forms of labour law legislation such as working time controls) may have had beneficial economic impacts in coordinated market (and civil-law origin) systems. In such systems, the potentially negative effects of EPL, in terms of disincentives for hiring and a reduction in the intensity of flows into and out of employment, are countered by the positive institutional influences of active labour market policy and state support for training (Hall and Soskice, 2001). In the same way, a stable corporate governance environment may operate alongside strict dismissal laws and legally mandated codetermination, to produce circumstances conducive to a high level of complementary investments by employers and workers in firm-specific human capital. This in turn tends to foster the long-run growth of capital intensive, high-productivity orientated firms.

Deakin and Sarkar’s analysis for the US suggest that the strengthening of dismissal laws there in the late 1980s (in the form of the WARN laws which required employers to give notice of dismissal and make severance payments when downsizing their workforces) was associated with productivity gains, but at the expense of employment growth. This result implies that for a liberal market regime, such as the US, dismissal legislation can bring about efficiency gains through better utilization and motivation of labour in parts of the economy, but at the expense of slowing down overall employment adjustments, which are then reflected in higher unemployment.
Other studies have looked at the effect of the partial erosion of the rule of employment at will which took place in a number of US states from the 1970s. Autor, Donahue and Schwab (2004) report some evidence that the most far-reaching of the modifications to employment at will, the ‘implied contract’ exception, led to an increasing in unemployment in the states affected, without any countervailing improvements in productivity (Autor et al., 2004). To reach this result, Autor et al. constructed a sophisticated index which timed changes in the law to the point at which pro-worker decisions were first reported in the press and would thereby have come to the attention of employers. An alternative approach to coding, based on rulings which marked a shift in doctrine at the level of the appellate courts as opposed to all decisions marking a shift to a pro-worker approach, found no evidence of a disemployment effect (Walsh and Schwarz, 1996). In further analysis, Autor, Kerr and Kugler (2007) found evidence that pro-worker rulings were associated with a rise in both employment and labour productivity in manufacturing sectors, but with a decline in total factor productivity in these industries.

A body of work is beginning to look specifically at the relationship between EPL and innovation. There are two possible routes by which they might be related. One possibility is that EPL, by raising dismissal costs, provides incentives for firms to move to, or remain on, a ‘high road’ to competitive success, based on continuous product and process innovation, as the condition of being able to maintain a credible commitment to job security. This also implies a greater commitment by firms to training and upgrading of the labour force. A second possible route depends on the effect of EPL in reducing the downside costs to employees of risk-taking of the kind associated with high-innovation practices. If employees are confident that their knowledge and know-how will not be appropriated ex post by the employer, through dismissal, they are more likely to contribute their skills and knowledge to the development of innovative products and processes.

There is some evidence to support both these sets of claims. With respect to the first, Koeniger (2005) finds that a high level of EPL at country-level is associated with more innovation-related firm-level training. With respect to the second, Acharya, Baghai-Wadji and Subramanian (2012a) use the CBR labour regulation index to examine the effects of changes in EPL over time on patenting activity and citations to patents. Using a difference-in-differences approach, they find a positive correlation which can be interpreted as a causal relationship, with greater employment protection laws stimulating higher innovation based on employee input to new products and processes. In a separate study Acharya, Baghai-Wadji and Subramanian (2012b)
examine the effects of the erosion of the employment at will rule in US states from the 1970s onwards. Again, stricter controls over dismissal are found to be correlated with higher innovation, with the direction of causation running from the former to the latter. This study finds that the states with the greatest concentration of high-tech firms, namely California and Massachusetts, are among those with the most significant exceptions to the employment at will rule (the ‘implied good faith exception’), and that following the tightening of wrongful discharge laws in these states there was an increase not only in patenting activity but in the number of entrepreneurial start ups and in the numbers employed in innovative firms. The study also reports positive effects on patenting activity in California following the adoption of the federal WARN law on notice and severance pay (on WARN, see above). The authors ascribe these effects to the reduced risk of ‘hold-up’ of innovative employees by firms following the adoption of stricter employment protection laws.

These findings on the positive link between innovation and employment protection are being replicated in other studies. A cross-national study by Belloc (2012) reports evidence that a combination of low EPL and high shareholder protection is correlated with reduced innovation, measured in terms of patenting and patent citation rates. Griffith and McCartney (2010) report a correlation between high EPL and investments by multinational firms engaging in incremental innovation (involving the adaptation of existing technologies), although they also find that low EPL attracts cross-border investments by firms pursuing radical innovation (developing new technologies). Zhou, Decker and Kleinknecht (2011) find, in an econometric study of Dutch firms in a range of sectors including manufacturing, that firms adopting ‘Rhineland’ style job security practices had stronger innovation performance (measured in terms of sales of new or improved products) than those with ‘Anglo-Saxon’ hire-and-fire type practices. Temporary contracts were positively correlated with ‘imitative’ (follower) strategies on the part of innovating firms, but negatively correlated with strategies of market-leading firms. They interpret their findings as support for a theoretical model within which innovating firms offer ‘functional flexibility’, combining job security with a high degree of firm-specific training and intra-organisational mobility on the part of workers, rather than ‘numerical flexibility’ which relies on temporary contracts and redundancies to meet fluctuations in labour demand. On this basis they caution against policies of labour market deregulation, arguing that they will reduce pressures on weaker firms to upgrade their performance.
10. Assessment and policy analysis

This paper has reviewed the growing body of studies examining the economic effects of laws governing the formation, financing and organisation of business firms. Key findings from empirical papers are summarised in Table 2.

Table 2. Summary of key findings on the impact of the legal framework for corporate governance on firm performance and innovation

<table>
<thead>
<tr>
<th>Study</th>
<th>Methodology</th>
<th>Result</th>
<th>Magnitudes</th>
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<tbody>
<tr>
<td>Bhagat and Black (2001)</td>
<td>OLS and 3SLS</td>
<td>Board independence is negatively correlated with firm performance (US firms, 1990s)</td>
<td>Adjusted R² 0.376 (retrospective effect) and 0.429 (prospective effect)</td>
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<tr>
<td>Black and Khanna (2007)</td>
<td>Event study</td>
<td>Pro-shareholder corporate governance reforms trigger share price increases (India, 2000s)</td>
<td>Increases of 4%, 7% and 10% over 2, 5 and 10 day event windows</td>
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<tr>
<td>Black, Jang and Kim (2006)</td>
<td>OLS regression</td>
<td>The adoption by firms of improved corporate governance standards leads to higher firm values (Korea, 2000s).</td>
<td>Firms with 50% outside directors had 0.13 higher Tobin's q (roughly 40% higher share price)</td>
</tr>
<tr>
<td>Arcot and Bruno (2007)</td>
<td>Pooled regression</td>
<td>Compliance with corporate governance code provisions is positively correlated with firm performance, although the best performers are firms which do not comply with the code but offer full explanations for non-compliance (UK, Cadbury Code, late 1990s to mid-2000s)</td>
<td>Companies not complying but offering full explanations had ROA 3.4% higher than average</td>
</tr>
<tr>
<td>Study</td>
<td>Methodology</td>
<td>Result</td>
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<td>Deakin, Sarkar and Singh (2012)</td>
<td>Time series analysis (VEC and GMM methods)</td>
<td>Legal protection for shareholder rights induces stock market development in common law and developing countries (25-country study, 1995-2005), but not in civil law countries</td>
<td>$R^2$ 0.659 (common law countries), 0.259 (developing countries), 0.227 (negative sign for turnover ratio)</td>
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<tr>
<td>Knyazeva and Knyazeva (2012)</td>
<td>OLS regression</td>
<td>Laws protecting shareholder rights are correlated with superior performance by firms in more competitive industries (cross country study, 1989-2007)</td>
<td>The addition of one point in the La Porta et al. shareholder rights index (1-5 scale) increases average return on assets by around 13% and average return on equity by around 10% for firms in competitive industries, and is equivalent to half the effect of a one standard deviation change in other performance determinants (firm size, assets, investment opportunities)</td>
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<td>Bello (2012)</td>
<td>Panel data analysis</td>
<td>Stronger shareholder protection laws increase stock market capitalisation but reduce innovation as measured by patenting activity (cross-national study, 1993-2006)</td>
<td>$R^2$ between 0.374 and 0.877 (different models)</td>
</tr>
<tr>
<td>Chai, Deakin, Sarkar and Singh (2013)</td>
<td>Panel data analysis</td>
<td>Stronger shareholder protection laws reduce innovation as measured by the abnormal persistence of profits in common law countries but increase it in civil law countries (1995-2005)</td>
<td>$R^2$ 0.323.</td>
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<tr>
<td>Armour and Cumming (2006)</td>
<td>Panel data analysis</td>
<td>Temperate personal bankruptcy laws stimulate venture capital financing (cross-national study, 2000s)</td>
<td>A reduction in time to discharge in bankruptcy by one year increases VC fundraising in proportion to GDP by approximately 0.03%</td>
</tr>
<tr>
<td>Acharya and Subramanian (2009)</td>
<td>Panel data analysis (difference in differences method)</td>
<td>Laws strengthening creditor rights dampen innovation by reducing financial leverage and risk-taking by firms (cross-national study, 1978-2002)</td>
<td>Countries that underwent a creditor rights increase (decrease) generated 9.7% less (10.7% more) patents, 13.3% less (15.4% more) citations to these patents, and 8.4% less (9.2% more) patenting firms; in countries that underwent an increase (a decrease) in creditor rights, more innovative industries generated 10.3% less (11.5% more) patents, 56.4% less (29.3% more) citations to these patents, and 9.5% less (10.5% more) patenting firms than less comparable, less innovative industries</td>
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<tr>
<td>Deakin and Sarkar (2008)</td>
<td>Time series analysis (ARDL method)</td>
<td>Laws strengthening working time and dismissal protections have positive impacts on employment and productivity in civil law countries (France, Germany); in the US, strengthening of dismissal protection led to increased productivity but reduced employment growth</td>
<td>Adjusted R² 0.69 (working time and employment growth, France), 0.17 (working time and productivity, Germany), 0.18 (dismissal regulation and productivity, Germany), 0.51 (dismissal regulation and employment growth, US), 0.17 (dismissal regulation and productivity, US)</td>
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Acharya, Baghai-Wadji and Subramanian (2012a)  
Panel data analysis (difference in differences method)  
Increases in dismissal protection lead to increased innovation as measured by patenting rates, citations to patents, and start ups (cross-national study, France, Germany, USA, UK, 1970-2006)  
The tightening of procedural standards in UK dismissal law in the late 1980s, equivalent to an increase of 0.0378 in the dismissal law index, corresponded to an increase in the annual number of patents, citations, and standard deviation of citations by 1.3%, 1.6%, and 2.2% respectively; after passage of the US WARN Act in 1988, affected firms filed about one additional patent every two years and received two additional citations per year on average.

Acharya, Baghai-Wadji and Subramanian (2012b)  
Panel data analysis (difference in differences method)  
Adoption of dismissal protection in US states (exceptions to employment at will) leads to increased innovation as measured by patenting rates, citations to patents, and start ups (1970s-2000s)  
The adoption of the good-faith exception to employment at will led to an increase in the annual number of patents and citations by 12.2% and 18.8% respectively, compared to firms located in states not adopting this rule, and to an increase in start-ups of 12.4% by comparison to other states.

More generally, the literature identifies two models of legal support for manufacturing which imply different directions for policy: on the one hand, the Silicon Valley model of VC-funded growth which depends on liquid capital markets and flexible labour markets, and the northern European and Japanese model which is based on long-term innovation, stable ownership, and institutionalised worker-management cooperation. The UK has some of the legal features of the Silicon Valley model, but important parts are missing: for example, the Californian rule under which post-employment restraints (‘restrictive covenants’) are void on the grounds of their anti-competitive effects has no equivalent in the UK. Conversely, although the UK has certain elements of the northern European or east Asian model of institutionalised corporate governance, it is unlikely to be able to replicate the ‘productive coalition’ approach of these countries as long as the legal framework prioritises shareholder rights and the market for corporate control, and provides limited encouragement for job security, to the extent that it currently does.
The Silicon Valley and ‘productive coalition’ models are ideal types which can distract from the fact that most countries, the UK included, are hybrid systems with some of the characteristics of each model (Aoki and Jackson, 2008). Rather than designing laws and policies exclusively with one model or the other in mind, it may be preferable to consider specific laws and policies on their own merits, while bearing in mind that a given legal rule or policy does not operate in isolation from others and that there may be some ‘network effects’ in operation due to the way that particular rules interact.

Bearing these points in mind, the empirical evidence presented in this review suggests that there is a case for looking again at the way that the legal framework of corporate governance affects innovation and manufacturing more widely. The weight of the empirical evidence is that the current legal framework in the UK is a deterrent to certain types of innovative activity, namely those involving complementary investments in knowledge-based technologies and firm-specific human capital which generate returns over an extended time horizon. Over the past half century, as Lazonick and Prencipe (2005) noted in their study of Rolls Royce, there have been very few cases of British firms attaining preeminence in global competition in high-technology manufacturing industries requiring complementary investments of this kind. A shift in the UK legal framework away from the current emphasis on prioritising liquid capital markets and flexible labour markets, in favour of a ‘productive coalition’ approach to corporate governance, could help build a larger and more sustainable manufacturing sector going forward.

The UK has been more successful recently in generating venture capital funding for start-ups in sectors such as IT and biotech. Whether a shift in the regulatory framework towards a productive coalition model could only be achieved at the cost of deterring venture capital and related forms of start-up financing for high-tech firms is an open question, but it should not be assumed that this would be the case. Levels of venture capital funding are higher in per capita terms in several European countries which do not have the same kind of legal underpinning for financial and labour markets as the UK (Lahr and Mina, 2011). Liberal personal bankruptcy laws and fiscal support for early-stage financing (on which see Armour and Cumming, 2005, 2006) may be more important determinants of the size of the venture capital sector than laws on shareholder and employee protection.

Even in the context of a liberal-market system such as the UK, it may be that existing
levels of legal support for shareholder rights are too high and, conversely, that employment protection laws are too weak to provide necessary stimuli to firm-level innovation. In the US context, the downside of a liquid capital market which supports venture-capital based financing for high-tech start-ups is a significant degree of financial speculation in the shares of firms in sectors such as biotech (Lazonick and Sakinc, 2011). Speculation in and over-valuation of shares, leading to bubble effects, can have negative economic consequences, arising from the distortion of investment decisions and misdirection of productive resources (Jensen, 2005). UK listed firms are possibly even more exposed to these pressures than those in the US are, thanks to the operation of the Takeover Code and the increasing pro-shareholder orientation of corporate governance codes, coupled with the tendency of investors to overvalue formal compliance with standards on board structure and director independence (Arcot and Bruno, 2007). In the UK, mature high-tech firms which have undergone an IPO are not able, as their US equivalents currently are (prominent examples include Google and Facebook), to use weighted voting structures and poison pills to shield management from pressure for short-term returns. Although UK company law does not prohibit such devices, it could be argued that it does not do enough to discourage firms from following a strategy of share-price maximisation at the expense of long-term investment in produce and process innovation. Laws governing fiduciary relationships in the investment chain, similarly, do little at present to counter a widespread practice of evaluating the performance of fund managers by reference to short-term performance benchmarks.

These issues have not so far been addressed by systematic reforms. Changes to the law have occurred in the form, for example, of the reformulation of directors’ duties under section 172 of the Companies Act 2006, which, while stressing the obligation of the board to have regard to non-shareholder interests to the degree necessary to ensure the long-term success of the company, is best seen as a clarification of existing law and practice rather than a fundamental change in approach. Recent changes to the Takeover Code have also been made which could point the way to a rebalancing of the relative positions of shareholders and the board (see House of Commons BIS Committee, 2011). These include the strengthened provisions relating to disclosure of the strategies of bidder and target firms which were introduced as part of the implementation in the UK of the Thirteenth Directive, and a modification to the rules governing statements of intent by bidders, which are a response to the issues raised by the Kraft-Cadbury bid. Again, these changes, while potentially useful in reducing the likelihood of value-destroying bids, mark only a minor shift of position.
In the area of creditor rights, the UK’s generally permissive laws on personal bankruptcy appear to support small firm start-ups (Armour and Cumming, 2005, 2006), and the flexible nature of corporate insolvency law, as exemplified by the development of the ‘pre-pack’ form of insolvency, could also be a source of legal support for innovative firms, as it enables firms with complementary human and technological assets to be kept together during the process of corporate rescue (Polo, 2012). On this basis there is a good case for the law continuing to take a broadly flexible attitude towards pre-packs.

In relation to employment protection, there is growing evidence of a strong and consistent relationship between legal regulation of termination of employment and a pro-innovation environment at firm level. Acharya et al. (2012a), for example, find that the modest strengthening of unfair dismissal law in the UK in the late 1980s, which was brought about by a tightening, through case law, of procedures governing termination of employment, was correlated with a small but non-trivial increase in patenting activity (‘an increase of 0.0378 in the dismissal law index corresponds to an increase in annual number of patents, citations, and standard deviation of citations by 1.3%, 1.6%, and 2.2% respectively’). In the US context they find large effects associated with the adoption of the ‘implied good faith’ exception to employment at will in states such as California, and with the introduction of the federal-level WARN law, mandating redundancy notice and severance pay (‘we find that the adoption of the good-faith clause led to an increase in the annual number of patents and citations by 12.2% and 18.8% respectively’; ‘the adoption of the good-faith clause in a state led to an increase in the entry of establishments by 12.4% in that state when compared to the control group of states which did not adopt this particular [wrongful discharge law]’; ‘after passage of the WARN Act, all affected firms file about one additional patent every two years after the passage of WARN. Furthermore, these firms receive 14 additional citations in all’; Acharya et al., 2012b). These findings are particularly noteworthy because they relate to innovative firms, including start-ups, and so they suggest that a hire-and-fire regime is not necessarily optimal for VC-funded firms. The relationship between job security and innovation is replicated in studies which use alternative measurements of innovation, such as new products brought to market (Zhou et al., 2011) and in cross-national studies (Belloc, 2012). Cross-national studies which show that the benefits of increased product market competition, in terms of enhanced productivity and performance of firms, depend on the continuing presence of strict employment protection laws (Amable, Demou and Gatti, 2007; Gatti, 2009), also have a bearing on the labour law deregulation debate. This body of work holds out little or no prospect of increased innovation deriving from
policies of labour market deregulation; if anything, they imply that British employment protection legislation should be strengthened to bring it more into line with the north European mainstream.
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SHORT-TERMISM, IMPATIENT CAPITAL AND FINANCE FOR MANUFACTURING INNOVATION IN THE UK

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Short-Termism, Impatient Capital and Finance for Manufacturing Innovation in the UK

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Contents

Short-Termism, Impatient Capital and Finance for Manufacturing Innovation in the UK

Executive Summary

1. Introduction

2. National Financial Systems and Innovation Finance

3. Innovation Output

4. Innovation Expenditure: Capital Investment, R&D and Other Intangible Investment

5. UK Capital Markets and Finance for Investment and R&D

6. Stock Markets, Banks and Venture Capital: The UK and other Countries

7. Share ownership in the UK and other Countries

8. Dispersion of Shareholdings in the UK and other Countries

9. UK Equity Markets and Short-Termism

10. Does the Short-termism of the UK National Financial System matter for the Financing of Innovation?

11. Financial Systems and Long-Term Investment: Future Scenarios

12. Convergence in Financial Systems and the Finance of Innovation

References
Executive Summary

This report has two objectives. First, it seeks to analyse the links between financial market structures, governance systems and investment behaviour in the UK focusing in particular on investment in R&D. Second, it is designed to assess the extent to which business decision taking in the UK is as a consequence affected by ‘short-termism’. The motivation for this analysis is the concern that UK financing patterns may inhibit investment to the detriment of the innovative performance and competitiveness of UK manufacturing.

To meet these objectives the report:

Provides a framework for analysis based on an overview of conceptual approaches which have sought to draw a link between the national characteristics of financial systems and their impact on innovation finance and innovation performance.

Provides an overview of UK manufacturing performance in terms of innovation output, capital investment and expenditure on R&D and sources of finance for investment in the UK.

Reviews international comparative evidence on patterns of share-ownership, bank financing and the governance and financial structure of manufacturing businesses over the past two decades. The international coverage specified by the Foresight project in commissioning this report covers the US, the Scandinavian economies, the UK, China, Japan, Korea, Germany and France. For these economies a set of data is where possible provided on financing characteristics, share-ownership and R&D. Wider literature on these and other countries is also reviewed.

Reviews evidence and existing studies relating to the impact of international differences in patterns of share-ownership, bank financing, governance and financial structure across countries on the relative corporate time horizons used in financing and innovation decision-making in UK manufacturing. This includes a review of investment decision-making in different national systems of finance.
Assesses the extent to which there is or is not convergence between national systems arising from increased globalisation of financial markets. This is used alongside broader issues affecting capital market developments as the basis for indicating likely future trends in this area in the UK in the next two decades.

The principal focus of the report is on publicly listed companies and the relative role of equity based and public bond market finance compared to bank loans in their financial structure. It also discusses evidence on venture capital investment. The report is not concerned with issues of small business finance more generally although it provides evidence on the relative role of smaller and larger businesses in R&D activity in the UK. The report does not review the extensive literature which attempts to account for differences within countries in investment and innovation performance across companies that have different ownership and governance characteristics. Nor does the report review the large literature on the generic problems of financing innovation which has been fully covered elsewhere (see, for example, Hall and Lerner, 2010, and Hughes, 2013).

The principal focus of the report is on innovation related expenditure and in particular R&D. This is because it is in these areas that long-termist and short-termist tensions are most acute. Moreover, R&D is a key component of manufacturing innovation expenditure and manufacturing R&D accounts for a disproportionally high share of overall R&D expenditure in the UK (Hughes and Mina, 2012).

National Financial Systems and Innovation Finance

The idea that the nature of financial systems may vary across countries and may affect both the financing of innovation and the nature of innovation activity is well established. The report reviews three broad and partially overlapping approaches to the topic. These are based respectively on comparing “varieties of capitalism”; contrasting bank based (insider) with stock market based (outsider) systems; and comparing financial systems with different ‘legal origins’.

The report concludes that a principal implication of the varieties of capitalism literature, the insider and outsider models and the legal origin debate is that the analysis of the financing of innovation requires a holistic approach. In particular, it
requires an analysis of the institutional complementarity between labour markets and financial markets. It also requires an assessment of patterns of financial intermediation in the economy, and of the relationship between patterns of shareholding and the overall nature and sources of financial flows available to firms.

Each of the three approaches reviewed proceeds from certain hypothesised structural features of financial systems to potential differences in the way that financial functions are performed.

In the case of the varieties of capitalism approach a broad distinction is drawn between liberal market economies (LMEs) such as the US and the UK with large stock markets and an emphasis on ‘arms-length’ product capital and labour market relation, and coordinated market economies (CMEs), such as Japan and Germany. CMEs are argued to have: a greater reliance on inter-firm and firm-bank coordination of activities; to be less reliant on the stock market; and to be characterised by long-term contractual commitments in the labour market. On this basis the UK is typically classified as an LME. In this approach considerable emphasis has been placed on the style or form of innovation that will be financed as opposed to the overall supply of finance for innovation more generally. Thus it is argued that in LMEs like the UK radical innovation and high-technology intensive sectors will be relatively dominant and in CMEs incremental innovation and medium-technology intensive sectors will be favoured.

In the case of the bank versus stock market models and the legal origins literature a key question is how the systems and their legal origins may engender differences in governance structures and resource allocation. In each case the outcomes in terms of decision-making and incentives to fund long-term investments are mediated by patterns of corporate governance and the relative significance attached by key players in the governance system to long- and short-term outcomes. In general, the bank versus stock market based literature points to a more patient long-term approach in the bank based systems compared to stock market based systems like the UK.

In the legal origins approach it is argued that the UK as an English-legal-origin system. This implies it has a financial market with a comparative competitive advantage based on more highly developed contract and property rights protection in financial markets and weaker worker protection in labour markets. This implies a
positive impact on the scale and direction of investment flows for innovation with high stockholder protection in particular favouring an equity-based financial system at the expense of debt and banks.

An assessment of the impact of finance for innovation and of the balance of these forces in the UK compared to other countries requires an assessment of; the relative significance of internal funds and retentions compared to external capital; the relative role of banks and other financial institutions on the supply of external funds for innovation; the impact on retention policy of stock market reactions to dividend payments; the extent to which ‘external’ influences are mediated by the ‘active’ or ‘passive’ stance of external suppliers or intermediators of finance; the extent to which external capital market players become involved through board membership in corporate decision taking either in association with or separately from the direct ownership of equities; the extent to which share ownership is concentrated or dispersed across types of external shareholders; and the role played by banks as key channels of financial flows from the household to the corporate sector compared to other financial institutions and as holders of equity.

This report considers evidence relating to each of these in the case of the UK and their potential implications for short-termism compared to other countries. Prior to this analysis the report reviews the evidence of the comparative innovation performance of the UK and the linked investment inputs into the innovation process, including in particular the nature and form of the UK R&D effort.

**Innovation Output**

The UK is a medium performer in terms of innovation outputs and typically ranks at the top of a second group of innovation “follower” nations. The EU Innovation Scoreboard rankings for 2013 place the UK 9th out of the European Union 27 countries. These innovation output rankings are based on combinations of different dimensions of innovation inputs and output and span the whole economy.

Innovation measurement in relation to manufacturing alone and focusing on outputs specifically are less common. The most recent attempts to construct an indicator which includes the performance of manufacturing in terms of the contribution to trade
of high-tech and medium-tech manufacturing products as a proxy for innovation output place the UK in the middle ranks of innovating countries. The performance of the UK in terms of the contribution of medium and high-tech manufacturing products to the trade balance is particularly weak in relation to Germany and Japan and the UK also lags France in this respect.

If the focus is on high-tech exports alone as an indicator of radical innovation, then the UK has a higher share of such exports in its overall manufacturing export activity compared to Germany. However, the German economy has a much larger manufacturing export sector and as a result produces an order of magnitude greater volume of high-tech manufacturing sector products and has a much higher share of world high-tech export trade than the UK. Making a distinction between radical and incremental innovation on this basis makes little difference to the UK’s position as an innovation follower based on wider sets of indicators.

**Expenditure in Support of Innovation**

The UK ratio of capital investment to manufacturing output in the UK has been low relative to competitor economies for many decades and continues to be so. Investment since the financial crisis has been particularly poor both absolutely and in comparison with competitor countries.

The performance of ICT investment has been better and is closer to that of other economies.

The growth of capital per worker in manufacturing has also been about the average of competitor countries.

**Investment in R&D**

The UK is at the lower end of the international spectrum in terms of the ratio of overall gross expenditure R&D to GDP. It ranks below Japan, the USA and China in the overall scale of its R&D effort as well as behind Korea, Germany and France.
In the past two decades the UK has experienced a small decline in the share of gross expenditure on R&D in GDP. Finland, Korea, Japan, Denmark, the US, Germany, France and China all experienced increases over this period.

Within the overall performance of R&D in the UK economy, business expenditure on R&D is at the lowest end of the spectrum internationally.

In the period 1999-2010 there was a fall in the ratio of business expenditure on R&D to GDP.

The relatively poor performance of business expenditure on R&D is not explained by the fact that the UK has a relatively service intensive economy. When business R&D performance is corrected for differences in the share of activity between sectors of different levels of R&D intensity such as services, the UK still remains at the bottom end of the league table.

If attention is extended to include a wider range of intangible investments to include investment in intellectual property and brand equity and firm-specific human capital and organisational capital the UK’s position improves somewhat in terms of the overall innovation related expenditures to GDP. The UK still nonetheless comes joint bottom with Germany on this adjusted basis in the comparator group of countries analysed in this report.

For the manufacturing sector on its own, business R&D relative to manufacturing value added is also relatively weak. The UK is at the bottom end of the league table and the UK has experienced one of the smallest increases in this measure of manufacturing R&D intensity in the sample group.

Business expenditure on R&D is relatively concentrated in high-technology sectors in the UK, whilst in Germany such expenditure appears to be relatively concentrated in the medium-technology sectors. However, since manufacturing business expenditure on R&D as a percentage of GDP is much higher in Germany and in economies such as Japan and Korea than it is in the UK, those economies spend absolutely more on “radical” high-technology sectors than is the case in the UK.
The UK is an extreme outlier in terms of the funding of R&D by overseas businesses. The proportion of UK business enterprise R&D which is funded from overseas sources is twice as high as the next ranked country in the comparator sample and is around five times as high as is the case in Germany.

In addition to a relatively very high reliance on overseas funding, the UK is also characterised by a very high reliance on the performance of R&D in the UK by foreign owned businesses.

Between 1995 and 2011 business expenditure on R&D performed by foreign owned businesses in the UK more than doubled. By 2011 foreign owned business performed more R&D in the UK than UK-owned businesses did.

The UK is therefore more susceptible than other countries to decision making by overseas investors and the boards of directors of overseas multi-national corporations. These overseas holdings are dominated by US investors and parent companies. If US businesses and investors are subject to similar short-term pressures as UK investors and boards, this will reinforce any such tendencies which exist in the UK and vice versa if stock market strength enhances radical long-term innovation.

**Government Funding for Manufacturing R&D**

The UK is a middle ranking country in terms of the percentage of manufacturing business expenditure R&D which is financed by the government. It is around 9% in the UK compared with, for example, 14% in France, 11% in the United States and 4.5% in Germany. The potential role for the public sector to act strategically in relation to its funding for manufacturing R&D in the UK is significant.

**Large and Small Businesses and R&D**

In the UK, business expenditure on R&D is dominated by large businesses and their subsidiaries. Independent small and medium-sized enterprises in the UK which employed fewer than 250 employees are negligible in terms of the overall UK R&D
effort. They account for less than 4% of total R&D.

International comparisons of the relative role of independent small and medium-sized enterprises are not readily available, but analyses, which include the definition of small and medium-sized enterprises subsidiaries of larger firms, the UK appears to be in the middle rank in terms of importance of firms employing less than 250 employees in the overall business R&D effort.

The domination of the R&D effort in the UK by larger firms means that government financial support is similarly concentrated. As a result, in 2008 the UK had the smallest proportion of government financial support for business expenditure on R&D which went to small and medium-sized businesses.

**Higher Education Sector Expenditure R&D**

The UK ranks towards the lower end of the international spectrum in terms of higher education R&D as a percentage of GDP and has lagged behind other economies in the extent of increases in expenditure on higher education in recent decades.

The extent to which the business sector funds higher education R&D has been weakening across a number of economies, including the UK, in the period 1990-2009, but the fall was greater in the case of the UK.

**Sources of Business Finance for Investment in R&D**

In the UK as elsewhere the most important source of finance for investment in R&D are the internal cash flows available to the firm from retained profits. In the UK the issue of equity on the stock market has historically been a relatively small source of funds for new investment by private non-financial corporations. Moreover, the share of manufacturing companies in total UK stock market equity capitalisation fell significantly from 26.3% in 1998 to 16.2% in 2006 in line with the de-industrialisation of the economy.
Nevertheless, the UK has the characteristics of a liberal market economy. Thus equity accounts for around a quarter of the balance sheet value of the external financial assets of UK companies. It occupies this place, however, principally because of the equity issued at the time of public flotation or from the issue of new equity in relation to takeovers of other existing companies. Where new external finance has been raised in the UK, loans and bonds have historically been more important than equity. Around 50% of the outstanding value of debt and equity combined takes the form of bank loans, around 25% takes the form of public corporate bonds and around 25% is accounted for by equity. Banks and loans therefore have an important role to play.

The relatively small role of the stock market as a source of new funds for investment means that its principal functions in the UK are related to two other roles. The first is as a route by which investors in new businesses may exit from early stage investments and extract the value of investment by floating on the stock exchange. Second, it plays a potentially important role through the allocation of corporate control between competing management teams. In this market for corporate control takeovers are a potential means of raising the efficiency of investment activity by concentrating control in the hands of the “best” management teams.

The UK has by international standards one of the highest levels of merger and acquisition activity. There is abundant evidence that shows that this market does not typically work to improve the long-term performance of businesses that are acquired. Long-term improvements in measures of corporate performance, such as growth profitability and/or more direct measures of innovation are not the typical outcome of takeovers. It is more plausible to argue that the excessive pre-occupation with short-term share price performance to avoid the threat of takeover rather than organic investment makes the market for corporate control a hindrance rather than a help to improving UK investment and innovation performance.

**Financial Institutions, Banks and Share Ownership**

UK holdings of the shares of non-financial corporations in the UK by domestic financial institutions, such as pension funds, are much higher in the UK than elsewhere in Europe and cross holdings by non-financial corporations are much lower. The ownership of shares in non-financial corporations in the UK by banks has increased from a very low level over the period 1997-2004. It remains much lower
than in Germany, France and Sweden. Banks and intra-company shareholdings are therefore a relatively small part of the UK corporate governance structure.

**Oversea Ownership of UK Manufacturing Company Shares**

In the period 1998-2010 there was a rapid increase in the dominance of overseas shareholdings and a decline in individual holdings and in holdings by insurance companies and pension funds.

Of the world's shareholdings in UK quoted companies 84.6% were focused on the FTSE top 100 companies. These shareholdings were dominated by investors from Europe and North America. The Asian economies accounted for only 11% of holdings compared to 56% by North American and 26% by European investors. Where US funding and ownership predominates then any UK liberal market economy decision making and management and labour market practices may be reinforced and vice versa for German, Japanese and Korean investment.

The UK has not been alone in experiencing an increase in the internationalisation of its stock market. There has been some convergence towards the UK in the case of France, but more muted movements in the case of Japan and Germany. The UK difference is with the latter two systems may therefore be persistent in coming decades.

**Short-termism**

The idea that UK capital markets and corporate decision takers exhibit short-termist or myopic attitudes in relation to investment decision is of long-standing and is consistent with elements of the role played by stock markets in the varieties of capitalism and bank versus equity approaches. The essence of the argument is simply put. If individuals or businesses are compared and one places a relatively lower value on income streams earned in the future compared to another, then the former exhibits relatively myopic tendencies.

For UK investment and financing decisions to be relatively myopic, and for this to
have a detrimental effect on UK economic growth and welfare, it is necessary to show that UK financial markets and investment decision-makers have a higher rate of discount for future earnings than similar decision-makers in other countries.

For this to be a problem, it is also necessary in turn to explain how this has a deleterious effect on the kind, as well as on the amount, of investment undertaken. In the presence of very high rates of discount of future earning streams, long-lived assets and those which generate their returns in a disproportionate way towards the end of the path from development through to investment and sales will be disadvantaged. The argument has particular force in relation to investments in R&D. This is because R&D projects are likely to have returns more heavily concentrated towards the end of their overall life cycle. The link between myopic decision taking and R&D and innovation activity is therefore of particular concern.

**Measuring Short-Termism**

Attempts to measure the degree of myopia in the UK and its extent relative to other countries rely on two sorts of evidence. One sort is based on questionnaire and interview analyses of the attitudes of corporate decision-makers. This focuses on the extent to which they perceive that their actions are judged by financial market investors in a way which will penalise long-term investments compared to short-term investments. It is important to note that these perceptions may not need to be based on an objective state of affairs in the market. It is sufficient that they are perceived to be the case for corporate decision taking to be effected.

An alternative approach is to look at movements in share prices and assess the extent to which they follow a path which would be consistent with applying “appropriate” rates of discount to the future earning streams and final capital values of the companies which issue them. This approach basically involves discounting future dividends back to current values using rates of discount which would be “appropriate” in the sense that they reflect a risk free rate and a risk adjustment element based on the observable risk characteristics of the relevant company whose decisions are being examined. To the extent that current share prices are less than would be expected using those discount factors, then the implication is that the market is discounting future returns too heavily. It is acting myopically and attributing too low a present value to the future earnings stream.
Taken together, the qualitative and quantitative literature reviewed in this report provide substantial evidence for both absolute short-termism in UK financial markets and higher short-termist attitudes than in other countries. This would imply a bias against long-term innovation intensive investment in manufacturing in the UK liberal market economy. A number of aspects of the evidence reviewed is consistent with this view.

The first is that the higher sensitivity of R&D to cash flow in the UK compared to Germany is consistent with the view that UK firms avoid raising external finance by relying more on internal cash flow and may thus be restricted by their own internal profit flows.

Second, variations in financial institutional variables across countries appear to affect R&D more than investment and therefore the specific features of the UK may bear more heavily on its R&D performance.

Third, “high” corporate governance ratings enhance the responsiveness of corporate strategy to short-term financial market expectations and will be detrimental to longer term R&D. Therefore the UK which has ‘high’ governance quality rankings may do worse in terms of R&D. This is supported by analyses of the impact of higher shareholder protection.

Fourth, the absence of large equity blockholdings is associated with a weaker ability to resist short-termist financial market presence, and such holdings are rare in the UK.

Fifth, it appears that UK venture capital companies (along with those of the US) use higher required rates of return than is the case in the Netherlands, France and Belgium. This is consistent with relatively myopic behaviour in the UK.

More qualitative analyses focusing, inter alia, on sectoral patterns of investment and distribution of funds across different stages of investment find fewer systematic differences in venture capital between the UK and other countries.

The extreme openness of the UK VC market in terms of flows of funds into and out of
the UK means that compared to Germany, for example, the UK VC market is much less focused on the domestic economy and the development of domestic businesses than in the case of other countries.

Financial Systems and Long-Term Investment: Future Scenarios

In the future currently long-term oriented investors (such as private family investment offices, endowments/foundations, sovereign wealth funds, defined benefit pension funds and life insurance) may increase in significance.

However, the traditionally powerful defined benefit pension fund allocation is likely to decline because of: the shift from defined benefit plans to defined contribution plans; the associated closure and sales of such schemes to third parties and increases in defined contributions. In addition, ageing populations in countries with established pension systems will involve increased pay-outs and lower proportions of funds under management.

In addition to these trends, a number of constraints are forecast to have an adverse effect on long-term investing capacity. These are related to: a reducing appetite for uncertain long-term outcomes on the part of family offices, increasing pressures from trustees and beneficiaries in the case of endowments and foundations as they seek to move away from illiquid investments; and an offsetting movement on the part of sovereign wealth funds to slow down investment in risky and illiquid investments. Pension fund investments in the longer term are forecast to be adversely affected by regulatory changes, including mark-to-market accounting, stricter funding and solvency requirements and maturing liabilities. Similar changes associated with solvency regulations are forecast to affect the policies of life insurers.

The implications for equity markets of these changes are quite substantial and have already led to a substantial reduction in the involvement of pension funds exposure to equities. In the UK these fell as a % of total pension fund assets from around 70% in the 1990s to less than 40% by 2008. In the case of the UK these changes have as we have seen earlier led to an overall decline in the proportion of institutional investment holding of equities in the UK. There has as we have seen been a counterpart rise in the proportion of ownership of UK assets which takes the form of
overseas holdings. These, however, include pension and insurance fund and other long-term investors from overseas. Thus institutional investment *per se* may not have fallen so dramatically as the broad trends in shareholding patterns in the UK indicate. On the other hand, the fact that these investors are overseas means that it is even less likely that they will be engaged in more direct relationships with the companies whose shares they hold than UK institutional investors have been. There is also evidence to suggest that in the case of the US at least they are under similar short-termist pressures as their UK counterparts.

Reforming governance to have a stewardship rather than a shareholder value focus will play a crucial role in resisting any increasing pressure for short-term returns from these medium term changes in patterns of long-term investor behaviour.

In the medium to long-term the prognosis for the UK in the absence of such countervailing policy initiatives is for persistent short-termist pressures and a lower rate of long-term innovative investment in manufacturing than might otherwise be the case.

**Convergence in Financial Systems and the Finance of Innovation**

The idea that convergence in financial and governance systems across capitalist economies was inevitable as a result of the superior performance of the English legal origin stock market based systems has been widely canvassed. The evidence we reviewed in this report suggests that this convergence and the triumph of a particular system of stock market financial relationships and governance is exaggerated. Significant differences remain between financial systems.

Economies, such as the UK and the US which are seeking to rebalance their economies away from the services sector, face major challenges in terms of the financing of long-term R&D.

The evidence reviewed suggests that more coordinated patient capital structures such as in Germany are more productive in terms of long-term investment in R&D and innovation. Systems such as the UK which depend more on arms-length relationships and a capital market with myopic behaviour will be less likely to invest
in longer term innovation investment. The importance of the public sector in the US and the UK points to the potentially strategic role that public investment can play in ‘liberal’ market economies, such as the UK.

A critical issue for the UK is whether its finance and governance system can evolve away from short-termism pressures. Different national systems of finance and innovation have embedded in them factors which will predispose them to react to shocks in ways which are consistent with the established beliefs and practices of the firms and workers in those economies. Thus in response to an external shock a liberal market economy such as the UK may seek to pursue even more liberal market policies by more deregulation. On the other hand, in coordinated market economies the reverse may be true.

In thinking about the next 30 years, the question is whether the UK will be better served by more deregulation or by an attempt to alter structural characteristics which inhibit its pursuit of long-term investment behaviour in UK manufacturing. This is precisely the area in which the debate about industrial policy is now being conducted in the UK and elsewhere. It should lead to a fundamental re-examination of the way in which intermediate coordinating organisations can be created in a liberal market system economy such as the UK.

Current industrial policy debates emphasise the need to develop strategies around the allocation of resources to strategic sectors. Insofar as those sectors and technologies involve the accretion and consolidation of wide ranges of knowledge and expertise then the development of institutions (e.g. catapult centres) which have the potential to assist in “coordinating” these connections, become a central part of industrial policy.

The great interest in such intermediate institutions in the UK at present indicates the extent to which this message is being absorbed into industrial policy debates.

In this connection the fact that economies characterised as liberal market economies and coordinated market economies each contain within them sectors which are characterised as both experiencing radical and incremental innovation means that a view will need to be taken on a much more granular basis of the particular factors likely to inhibit or encourage innovation in each sector. Basing policy on an
aggregated view of how the economy looks on average, or on its inherited structure from the past seems less helpful. The challenges facing the development of such a disaggregated and medium to long-term policy in the UK are discussed in a companion report for the Future of Manufacturing Project (Crafts and Hughes, 2013).

1. Introduction

This report has two objectives. First, it seeks to analyse the links between financial market structures, governance systems and investment behaviour in the UK focusing in particular on investment in R&D. Second, it is designed to assess the extent to which business decision taking in the UK is as a consequence affected by ‘short-termism’. The motivation for this analysis is the concern that UK financing patterns may inhibit investment to the detriment of the innovative performance and competitiveness of UK manufacturing.

To meet these objectives the report:

1. Provides a framework for analysis based on an overview of conceptual approaches which have sought to draw a link between the national characteristics of financial systems and their impact on innovation finance and innovation performance.

2. Provides an overview of UK manufacturing performance in terms of innovation output, capital investment and expenditure on R&D and sources of finance for investment in the UK.

3. Reviews international comparative evidence on patterns of share-ownership, bank financing and the governance and the financial structure of manufacturing businesses over the past two decades. The international coverage specified by the Foresight project in commissioning this report covers the US, the Scandinavian economies, the UK, China, Japan, Korea, Germany and France. For these economies a set of data is where possible provided on financing characteristics, share-ownership and R&D. Wider literature on these and other countries is also reviewed.
4. Reviews evidence and existing studies relating to the impact of international differences in patterns of share-ownership, bank financing, governance and financial structure across countries on the relative corporate time horizons used in financing and innovation decision-making in UK manufacturing. This includes a review of investment decision-making in different national systems of finance.

5. Assesses the extent to which there is or is not convergence between national systems arising from increased globalisation of financial markets. This is used alongside broader issues affecting capital market developments as the basis for indicating likely future trends in this area in the UK in the next two decades.

The principal focus of the report is on publicly listed companies and the relative role of equity based and public bond market finance compared to bank loans in their financial structure. It also discusses evidence on venture capital investment. The report is not concerned with issues of small business finance more generally although it provides evidence on the relative role of smaller and larger businesses in R&D activity in the UK. The report does not review the extensive literature which attempts to account for differences in investment and innovation performance across companies within countries that have different ownership and governance characteristics. Nor does the report review the large literature on the generic problems of financing innovation which has been fully covered elsewhere (see, for example, Hall and Lerner, 2010, and Hughes, 2013).

The principal focus of the report is on innovation related expenditure and in particular R&D. This is because it is in these areas that long-termist and short-termist tensions are most acute. Moreover, R&D is a key component of manufacturing innovation expenditure and manufacturing R&D accounts for a disproportionately high share of overall R&D expenditure in the UK (Hughes and Mina, 2012).

2. National Financial Systems and
Innovation Finance

2.1 Introduction

The idea that the nature of financial systems may vary across countries and may affect both the financing of innovation and the nature of innovation activity is well established. In this section we review three broad and partially overlapping approaches to the topic. These are based respectively on comparing “varieties of capitalism”; contrasting bank based (insider) with stock market based (outsider) systems; and comparing financial systems with different ‘legal origins’.

2.2 Varieties of Capitalism

One well known stream of literature which has focused on issues of governance and coordination in the relationship between financing and innovation is the varieties of capitalism approach (e.g. Hall and Soskice, 2001a). This categorises national political economies on the basis of the way in which firms resolve coordination problems. These problems arise in the spheres of industrial relations, vocational training and education, corporate governance, customer and supplier inter-firm relations and, finally, internal employee coordination. From the point of view of this report, financial aspects of innovation emerge most closely in the analysis of corporate governance. This is seen as having a critical impact on the nature of finance sought; the way in which investors and the suppliers of finance interact; and the way the latter seek to monitor and assure returns on their investments (see for example Hall and Soskice, 2001b).

A core distinction in the varieties of capitalism literature is between the ideal types of “liberal market economies” and “coordinated market economies”. In the former coordination activities are primarily by a combination of competitive markets and intra-firm hierarchies. Market relationships are arms’ length and set in a competitive and formal contracting framework. In coordinated market economies, non-market relationships are more important as coordinating devices. This implies much more inter-organisational relational activities, and less complete contracting. Monitoring is based not upon market signals, but on the exchange of insider information of
various kinds. In liberal market economics, “equilibrium” outcomes in terms of firm behaviour are seen as moderated by adjustments to market prices. By contrast strategic interaction amongst firms and coordinated outcomes are seen to be the key determinants of movements towards stable outcomes in coordinated market economies. In coordinated systems, particular sets of organisations and institutions (rules of conduct, norms of behaviour) are focused on reducing the uncertainty associated with the behaviour of others so that mutual credible commitments can be made. The institutional rules of behaviour include substantial exchange of information, behavioural monitoring and sanctions for defectors from corporate behaviour. This implies strong networks across employers and labour organisations. In relation to financing this means, in particular, the development of patterns of cross-firm shareholdings and close relationships between banks and the businesses they fund.

Proponents of the varieties of capitalism hypothesis contend that there will be systematic differences in corporate strategy, including innovation behaviour, between varieties of capitalism. These are based on differences in the overall institutional framework within which those firms operate. In particular, and of most relevance, in relation to investment and innovation, they argue that

“firms and other actors in coordinated market economies should be more willing to invest in specific and co-specific assets (i.e. assets that cannot readily be turned into another purpose and assets whose returns depend heavily on the active cooperation of others), while those in liberal market economies should invest more extensively in switchable assets (i.e. assets whose value can be realised if diverted to other purposes).”

(Hall and Soskice, 2001b, p.17).

In relation to the financial system (and the closely related way in which corporate governance institutions work), it is argued that in co-ordinated market economies access to long-term “patient capital” is complementary to labour market coordination based on the long-term retention of a skilled workforce and to investment in generating long-term returns. Information considered private, or insider, information in a liberal market based system must be available in a coordinated market system to those whose investments in the business are expected to lead to long-term gains. The result is highly networked activities within the corporation and between firms.
It is also argued that this implies less scope for unilateral decision-making by top management in organisations in coordinated market economies than in liberal market economies.¹

In the case of innovation these aspects are associated with the argument that coordinated market economies will be better suited to supporting incremental innovation. In this case continuous, but small improvements are made to what are relatively stable slowly changing sets of products and processes. In liberal market economies on the other hand, the capacity for rapid top executive policy change and flexibility in the reallocation of human and other capital is taken to imply that they should be better at supporting radical innovation in sectors where there are rapid and discontinuous changes in technology (see for example Hall and Soskice, 2001a). We review the evidence of this particular aspect of innovation in Sections 3.2 and 3.3 below.

A further point which emerges from this approach is that it is not possible to assess the impact or efficiency of coordinating activities in one sector, say, for instance, financial markets without considering relational patterns in other markets. The argument here is that there are important complementarities between institutions in different parts of the economy. In a financial system in a liberal market based economy, the responsiveness of financing to short-term movements in profitability will not work well with a labour market in which firms seek to maintain long-term employment contracts. The latter would prejudice the ability of a firm to make short-term flexible reallocations or reductions of its labour inputs. In assessing the extent to which different forms of finance and different types of financial coordination are effective in inducing differences in innovation performance, it is essential, therefore to consider simultaneously the nature of coordination in labour and capital markets. Empirically this leads to the view that economies should cluster into broad groups. Those in which the employment and financing spheres are relatively highly dominated by market transactions on the one hand and those where direct coordinated activities dominate on the other.
Note: On each axis, movement away from the origin indicates higher levels of strategic co-ordination in the relevant sphere of the political economy and movement towards the origin indicates higher levels of market co-ordination. The scales on each axis are normalised scores based on the loadings from a factor analysis in which corporate governance is characterised in terms of shareholder power, share dispersion and the size of the stock market and labour relation are characterised in terms of the level and degree of wage co-ordination, and labour turnover.

Source: Hall and Gingerich (2009)

This complementary clustering is shown in Exhibit 1. It is clear that strong complementarities exist and that the UK is with US at the extreme liberal market economy end of the spectrum.

A process exposition of the way complementarity works is provided by Hall and Soskice (2001b). They provide a comparison of the US and Germany as archetypal liberal and coordinated market economies respectively. They provide the diagrammatic summary which is reproduced in Exhibit 2.

The complexity and interrelated nature of the relationships shown poses a major challenge if quantitative economic analyses are to be carried out and countries compared in terms of their variety of capitalism. Nevertheless both Hall and Soskice (2001b) and others have attempted to do so (see, for example, Allen, 2004; Allen et al. 2006; Casper and Whitley, 2004; Hall and Gingerich, 2009).
Exhibit 2 - Coordinated and Liberal Market Economies: Complementarities across sub-systems in Germany and the USA

Complementarities across subsystems in the German coordinated market economy

- Corporate governance systems, permitting LR finance without publicly assessable information, using reputational monitoring
- Education and training system which permits sunk human capital investments in firms and sometimes defined industries
- Industrial-relations system which provides employee cooperation in companies and wage moderation
- Skilled employees in powerful position in companies
- System of inter-company relations allows cooperation standard-setting and technology transfer

Complementarities across subsystems in the American liberal market economy

- LR finance allows credible commitments to LR security by employers
- Certification helps assess company viability
- Allows consensus decision-making
- Co-determination provides way to bring profitability needs into consensus decision-making
- Certification helps assess company viability
- Skilled employees in powerful position in companies
- Education and training system which permits sunk human capital investments in firms and sometimes defined industries
- Skilled employees in powerful position in companies
- Product market cooperation lowers external labour market competition
- Product market cooperation lowers external labour market competition
- Co-determination provides way to bring profitability needs into consensus decision-making
- System of inter-company relations allows cooperation standard-setting and technology transfer
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- Certification helps assess company viability
- Skilled employees in powerful position in companies
- Education and training system which permits sunk human capital investments in firms and sometimes defined industries
- Skilled employees in powerful position in companies
- Product market cooperation lowers external labour market competition
- Product market cooperation lowers external labour market competition
The idea that firms may differ in their strategies and behaviour across varieties of capitalist market economies has been challenged by the notion that internationalisation in terms of trade and financial flows will lead to the triumph of one form over another. In particular it has been argued that the growth of stock market based liberal market economies will lead to the eclipse of coordinated market economies (Hansmann and Kraakman, 2004; Dore, 2000; and for a less pessimistic view of CMEs Berger and Dore, 1996).

Varieties of Capitalism: Classifications, Convergence and Changes over Time

Schneider and Paunescu (2012) provide a recent classification exercise and also show changes over time. They analyse 26 OECD countries over the period 1990 to 2005. They take eight measures of institutional characteristics relevant to the varieties of capitalism hypothesis and using factor analysis identify five groupings which range on a spectrum from state dominated economies (SDEs) to liberal market
Exhibit 3 shows that on the basis of their classificatory procedure countries change their variety of capitalism status over time. It also appears, in line with the convergence hypothesis, that there may be a drift towards the more liberal market end of the spectrum over time. However, some major economies, including Austria, France and Germany, remain in the coordinated market economy (CME) cluster over the whole period. Moreover, between 1999 and 2005 there is a movement away for LME to LME-like in the case of Finland, Ireland, New Zealand, Australia and the Netherlands. Japan, which frequently appears in the variety of capitalism literature, as a CME is in the hybrid economy group based on this analysis. It is not clear why the particular indicators chosen in this study should produce such a distinctly different outcome in the case of Japan than in other major studies within this tradition. The significant finding from the point of view from this report, however, is that the UK is clearly in the LME group throughout the period 1990 to 2005, and on that basis may be expected to be characterised by lower rates of incremental innovation, higher rates of radical innovation and be less well supplied with “patient capital” to support cooperative investment in specific and co-specific assets.

Exhibit 3 - Varieties of Capitalism, 1990-2005

<table>
<thead>
<tr>
<th>Cluster</th>
<th>1990</th>
<th>1999</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>State-dominated economies</td>
<td>TURKEY</td>
<td>TURKEY</td>
<td>PORTUGAL</td>
</tr>
<tr>
<td>ITALY</td>
<td>PORTUGAL</td>
<td>GREECE</td>
<td></td>
</tr>
<tr>
<td>SPAIN</td>
<td>GREECE</td>
<td></td>
<td>TURKEY</td>
</tr>
<tr>
<td>Belgium</td>
<td>SPAIN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GREECE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coordinated Market Economies</td>
<td>Austria</td>
<td>Austria</td>
<td>Austria</td>
</tr>
<tr>
<td>Germany</td>
<td>Czech Republic</td>
<td>Belgium</td>
<td></td>
</tr>
<tr>
<td>Denmark</td>
<td>Italy</td>
<td>Germany</td>
<td></td>
</tr>
<tr>
<td>Finland</td>
<td>FRANCE</td>
<td>FRANCE</td>
<td></td>
</tr>
<tr>
<td>Sweden</td>
<td>Germany</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FRANCE</td>
<td>Belgium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Netherlands</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hybrid economies</td>
<td>Norway</td>
<td>South Korea</td>
<td>Poland</td>
</tr>
<tr>
<td>Japan</td>
<td>Poland</td>
<td>ITALY</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hungary</td>
<td>Norway</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Norway</td>
<td>Czech Republic</td>
<td></td>
</tr>
</tbody>
</table>
Japan  |  Hungary  |  South Korea  |  Japan
--- | --- | --- | ---
Liberal Market-like economies  |  Australia  |  Denmark  |  Spain
New Zealand  |  Sweden  |  Finland
Rep. of Ireland  |  Netherlands
Switzerland  |  Sweden
Australia  |  Rep. of Ireland
New Zealand
Liberal Market Economies  |  Canada  |  Switzerland  |  Switzerland
USA  |  Finland  |  Denmark
UK  |  Rep. of Ireland  |  UK
New Zealand  |  Canada
Canada  |  USA
Australia  |  Netherlands
UK  |  USA
Notes:
Bold:  economies discussed as CMEs by Hall and Soskice;
Italics:  economies discussed as LMEs by Hall and Soskice
Capitalised:  economies discussed as Mediterranean by Hall and Soskice
Source:  Derived from Schneider and Paunescu (2012) Table 1, p.10.

2.3 Bank Based (Insider) and Stock Market Based (Outsider) Financial Systems

The distinction between liberal market economies and coordinated market economies is readily linked conceptually to a parallel literature on the emergence and nature of financial markets. Here a distinction between bank based and stock market based systems is typically drawn. In this literature arms-length relationships in the stock market based systems are contrasted with co-ordinated long-term relationship banking in the bank based systems.

In the bank based systems a significant role is played by banks as key intermediaries in channelling household savings to the business sector. They are also seen as playing a significant role in equity markets as holders of large blocks of stock in
industrial companies. This distinction in turn relates to another approach to the analysis of corporate stock holding. This approach emphasises the distinction between “outsider” and “insider” patterns of corporate control and governance.

In “outsider”, stock market based systems dispersed shareholder influence is exercised through relative price signals. Impersonal buying and selling of shares in response to good or poor performance alters prices and the cost of capital. In extreme cases of bad performance, takeovers are an ultimate sanction for failing firm management. In contrast, in coordinated systems “insider” block holdings of shares are common. Influence is exercised directly rather than by indirect price signals and transfers of ownership on an open market. In the insider/outsider dichotomy, the block holding insiders can include financial and non-financial businesses. In addition, non-shareholding stake holders, such as the labour force and labour unions, may be included in corporate influence on decision-making through their involvement in particular models of corporate governance. This includes, for example, in the German case two tier boards (Allen and Gale, 1997; Carlin and Mayer, 2003; Mayer, 1998, 1988, 1990; Franks et al., 1990; Dore, 2000; Mayer and Sussman, 2011; Rajan and Zingales, 1995, 2001). The state may also play a coordinating role in shareholdings as part of wider patterns of industrial or economic development strategy (see, for example, Zysman, 1983).

The implications of this approach for the financing of innovation depends on whether or not the respective ‘insider’ and ‘outsider’ systems produce governance relations which favour short or long-term orientations by corporate decision takers. If outsider stock market systems lead to a focus on short-term market price fluctuations and if the UK is such a system, then it may be subject to more short-termist pressure than bank based insider systems.

Although these insider/outsider classifications have strong complementarities with the liberal market and coordinated market models, they emphasise different components of the system. These components may move in different directions at least in principle. It is, thus, possible for bank intermediation to decrease in importance, and for bank shareholdings to decline too, whilst other insider block holding relationships, including non-financial organisations, could increase or remain the same and vice versa (see, for example, Deeg, 2009). Equally, the way in which the institutions in countries placed within these broad typologies may operate their financial systems, may also be affected by the way in which the overall legal systems within which they
operate have developed (Franks et al., 2009, Cheffins, 2011, Franks et al., 2000, Franks et al., 2012).

2.4 Financial Systems and Legal Origins

In recent years a new body of literature based on the quantitative analysis of variations in legal systems across countries has developed. This has, in particular, examined the link between the “efficiency” of the legal framework within which the financial governance and insolvency systems of countries operate and in turn with their overall economic performance (La Porta et al., 1998, 2008).

In its original form this approach too has aspects which echo the coordinated market and liberal market typologies of the varieties of capitalism approach. Here, however, the contrast is made between English-law origin economies (e.g. UK, Commonwealth, USA) and Civil-Law economies (typically East Asia and most of mainland Europe). The latter in turn may be sub-divided into French, German and Scandinavian versions, although the latter two are small in number (see, for example, La Porta et al, 2008, p.290).

It is argued that the English-law origin economies have developed greater contract and property rights protection than the Civil-law origin states. The former, as a result, have a “comparative competitive advantage” in the developments of their financial markets. They may be expected to be better attuned than civil-law systems to deliver financial flows on the scale and in the form required for the efficient allocation of resources between alternative uses. This will have positive implications for the overall innovative performance and rate of growth of companies and the economy as a whole. It also implies convergence toward a superior English-law origin system.

This approach has spawned a substantial literature. Recent developments have increasingly questioned both the quality of the original underlying legal system metrics. In addition the link between legal origin and systems performance has been questioned. In particular, and in keeping with the notion of institutional complementarity, it has led to the view that the “efficiency” of one component of an overall system of capitalism (e.g. its financial market) must be seen in the context of legal regulation of other markets (e.g. labour markets) (see, for example, Acharya et
In relation to innovation, this means that empirical analyses of the links between financial markets, governance structures and innovation have increasingly involved attempts at controlling for the legal origins of the systems alongside patterns of financing and governance (Deakin and Mina, 2012).

Deakin and Mina (2012) provide a useful summary synthesis of the legal origins and variety of capitalism approaches in relation to innovation. It emphasises the complementarity between patterns of legal protection, labour and capital market developments and innovation modes.

In this stylised classification shown in Exhibit 4 in the liberal market systems have legal support which is highest for shareholder protection, followed by medium to weak for creditor protection and weak for worker protection. In the coordinated market system the degree of support or protection is reversed. These patterns are then seen as related to distinctive modes of innovation. In the liberal market system model of innovation “radical innovation” is supported by a high risk culture with high levels of Schumpeterian creative destruction in product markets supported by strong venture capital markets and flexible labour markets. In the coordinated market systems risk sharing across capital and labour is associated with long-term commitment to human capital training and incremental innovation.

The implications for financing innovation and for the relative balance of short-termist and long-termist pressures on decision takers depends upon the extent to which the resulting governance arrangements favour each. As with the varieties of capitalism approach, however, the implication is that civil law systems may be less subject to short-termist pressures than countries such as the UK which has an English-law origin system.

**Exhibit 4 - Complementarities between Corporate Governance and Modes of Innovation**

<table>
<thead>
<tr>
<th>Shareholder protection</th>
<th>Creditor protection</th>
<th>Worker protection</th>
<th>Mode of innovation</th>
</tr>
</thead>
</table>

### Liberal market systems

<table>
<thead>
<tr>
<th>High (legal support for hostile takeover bids, share buy-backs shareholder activism)</th>
<th>Medium or weak (debtor in possession laws, laws favouring corporate rescue over liquidation)</th>
<th>Weak (minimal legal support for employment protection, no codetermination)</th>
<th>Strong venture capital market ‘Schumpeterian’ creative destruction regime Higher-risk investment High incidence of radical innovation Efficient labour market matching</th>
</tr>
</thead>
</table>

### Coordinated market systems

| Weak (minimal legal support for market for corporate control, limited minority shareholder rights) | Medium or strong (legal recognition of priority for secured creditor’s rights) | Strong (effective legal support for employment protection and codetermination) | Limited use of venture capital Slower creative destruction dynamics Investment risk more spread Incremental tech development Continuous employee learning |

Source: Deakin and Mina, 2012

### 2.5 Varieties of Capitalism, Bank and Stock Market Based Systems, Legal Origins and Corporate Governance

The upshot of these developments in the varieties of capitalism literature, the insider and outsider models and the legal origin debate is that the analysis of the financing of innovation requires a holistic approach. In particular, it requires an analysis of the institutional complementarity between labour markets and financial markets. It also requires an assessment of patterns of financial intermediation in the economy, and of the relationship between patterns of shareholding and the overall nature and sources of financial flows available to firms.

Each of the approaches proceeds from certain hypothesised structural features of financial systems to potential differences in the way that financial functions are performed.

In the case of the varieties of capitalism model considerable emphasis has been placed on the style or form of innovation that will be financed as opposed to the
overall supply of finance for innovation more generally. In the case of the bank versus stock market models and the legal origins literature a key question is how the systems and their legal origins may engender differences in governance structure and resource allocation. In each case the outcomes in terms of decision-making and incentives to fund long-term investments are mediated by patterns of corporate governance and the relative significance attached by key players in the governance system to long- and short-term outcomes.

In order to capture these structural and process complexities Exhibit 5 provides a schematic overview which has been used to motivate international comparisons (Hughes and Deakin, 1997). In the exhibit the corporate board is represented at the core of the system making investment and other decisions, including dividend and retention policy. The Board is subject to labour, product and capital market forces. The corporate board may itself take different forms including two tier board structures involving, for example, employee board representation. The diagram emphasises regulatory and legal factors affecting capital and labour markets. Regulation of product markets through for example competition policy or price regulation is excluded for simplicity.

It is important to note that although international comparative studies of financial systems often focus on external suppliers of finance and financial intermediaries in terms of allocation, the company itself through retained profits has an important role to play. The relative importance of retentions compared to external finance and the governance forces affecting retentions are also key financial system features.

Exhibit 5 - Capital Markets, Labour Markets and Corporate Governance: A Systems Overview
Key: CEO = Chief Executive Officer; FD = Finance Director; ESOPS = Employee Share Ownership Plans

Source: Deakin and Hughes (1997)

The role of the capital market and the sources and pathways of ‘insider’ and ‘outsider’ influence from capital market players are shown on the right-hand side of the diagram. The influence of the ultimate ‘outsider’ financial stakeholders is indirect and mediated by a variety of investment managers and analysts. They respond to market signals and provide interpretative advice and exercise influence by exit (selling shares) and/or voice (interacting directly with the board on an individual or collective basis). Bank influence is mediated through covenants and loan reporting processes. Variations across countries in the institutional architecture, nature of capital market and legal framework saving will affect the balance between different ultimate financial stakeholders shown on the right of the Exhibit, as will the nature of advice and management intermediation (Deakin and Hughes, 1997).

An assessment of the impact of finance for innovation and of the balance of these forces in the UK compared to other countries requires an assessment of; the relative significance of internal funds and retentions compared to external capital; the relative role of banks and other financial institutions on the supply of external funds.
for innovation; the impact on retention policy of stock market reactions to dividend payments; the extent to which ‘external’ influences are mediated by the ‘active’ or ‘passive’ stance of external suppliers or intermediators of finance; the extent to which external capital market players become involved through board membership in corporate decision taking either in association with or separately from the direct ownership of equities; the extent to which share ownership is concentrated or dispersed across types of external shareholders; and the role played by banks as key channels of financial flows from the household to the corporate sector compared to other financial institutions and as holders of equity.

This report considers evidence relating to each of these in the case of the UK and their potential implications for short-termism compared to other countries in Sections 6-12.

Prior to that, Sections 3-5 assess innovation performance, fixed capital formation performance and R&D in manufacturing in the UK in an international comparative framework.

3. Innovation Output

3.1 Measuring Innovation Output

The multi-dimensional nature of innovation means that comparisons of innovation performance across economies can require comparisons of multiple indicators. The Global Innovation Index for example is based on five ‘input pillars’ (institutions, human capital and research; infrastructure, market sophistication and business infrastructure) and two ‘output pillars’ capturing knowledge and technology outputs and creative outputs). These are then 84 sub-pillars within these (Dutta and Lanvin, 2013). The EC Innovation Union Scoreboard 2013 is somewhat simpler. It distinguishes between three main types of innovation indicator and eight innovation dimensions. This produces a total of 25 different indicators ranging from innovation enablers, through firm activities, to innovation outputs. Innovation outputs incorporate indicators of the number of innovators (with sub-categories for: the number of small or medium-sized enterprises with product or process innovations; the proportion with
marketing or organisational innovations; and the proportion of high-growth innovative firms in an economy). Output related indicators also include estimates of employment in knowledge intensive activities, the contribution of medium and high-tech sectors to the trade balance, the role of knowledge intensive service sectors in exports, and the extent to which the sales of firms are characterised by new to the market and new to the firm innovations; and, finally, the extent of licensing and patenting revenues from abroad (European Commission, 2013a).

Analyses of this kind usually place the UK in the category of innovation “followers” ranked behind the Nordic economies and Germany which are classified as innovation leaders (BIS, 2011b). Thus, in the EU Innovation Scoreboard rankings for 2013, the UK ranks 9th out of the EU 27 (European Commission, 2013a, Figure 2, p.5). The UK has also been a moderate grower in terms of changes in innovation performance amongst the innovation follower group. It lags behind the Netherlands and France in this respect, but ranks ahead of Belgium, Luxemburg, Austria and Ireland (European Commission, 2013a, Table 2, p.12).

The most recent attempt at focusing attention on innovation output and identifying a narrower group of consistent and key indicators has been made by the European Commission (European Commission, 2013b). They propose an indicator which consists of four components. The first component is technological innovation as measured by patents. These are taken to represent the ability of the economy to transfer knowledge into technology. The indicator used is the number of patent applications per billion of GDP. The second component focuses on the number of persons employed in knowledge intensive activities as a ratio to total employment. This is interpreted as a proxy for the innovative content of output. The third component focuses on the competitiveness of knowledge intensive goods and services. It combines in equal weights first the contribution to the trade balance of high-tech and medium-tech manufacturing products and second the contribution of knowledge intensive service sectors as a share of the total services exports of a country. These are taken to reflect respectively the extent of the export of manufacturing products with high value added and the ability to take part in knowledge intensive global value chains. The final and last component of the composite indicator attempts to identify employment in fast growing firms in innovative sectors. This indicator is based on the identification of the level of innovativeness of sectors and employment growth in those sectors. This is used as a proxy for distinguishing innovative enterprises per se for which adequately consistent cross-country data is not available.
Neither the wider EC Scoreboard indices nor the more narrowly focused innovation output composite measures have a specific focus on manufacturing. However, the most recent composite indicator does identify the contribution of medium- and high-tech manufactured products to the trade balance.

Exhibit 6 (a)-(d) presents innovation output performance data based on the latest composite output indicator. The comparator countries are, by the Foresight Programme for which the data is available. The UK appears from this exhibit as a moderate performer in terms of each of the indices shown. It is notable that on each of these measures economies which are typically classified as in the co-ordinated market economy group appear at the top end of the indicator spectrum whilst the UK and the US appear as moderate performers. The poor performance of the UK in terms of the contribution of medium- and high-tech manufacturing products to the trade balance is particularly striking in relation to Germany and Japan. The UK also lags France in this respect. At first blush these data suggest that the UK and LME type economies have weaker overall innovative performance.

Exhibit 6 - UK Innovation Performance 2010-11

Source: EC (2013)
3.2 Radical versus Incremental Innovation

So far the discussion has focused on measures of innovation output without addressing the nature of the innovation *per se*. The varieties of capitalism literature in particular has, as we have seen, been used to argue that coordinated market economies will be characterised by radical innovation and coordinated market economies will be characterised by incremental innovation. In the case of the UK the implication is that the UK will do relatively well at radical innovation and relatively badly at incremental innovation whatever its overall level of innovation output.

A major problem in assessing the evidence in relation to this proposition is how to make an operational distinction between radical innovation and incremental innovation.

Two broad approaches have been adopted to classify country innovation patterns. One is based on the intensity of patenting across sectors or on the types of patents used. The other is based on patterns of output or export specialisation across industries classified as Hi-Tech or Medium-Tech (based primarily on the intensity of their R&D or technical labour force characteristics). These are then taken to correspond to radical and incremental innovation respectively.

Patent Based Studies

Akkermans et al. (2009) use patent data to form several indicators of the radical or incremental nature of innovation. Following Trajtenberg (1990) and Trajtenberg et al. (1997) they propose three ways of measuring ‘radical innovation’. The first is simply the number of patents citations received, the second (generality) is a measure of the numbers of different patent classes which cite a patent, and the third (originality) is a measure of the diversity of patents cited in the patent application. This patent data and set of measures are analysed in aggregate and at the level of individual industries. They group 22 economies using Hall and Soskice’s 2001 classification into LMEs, CMEs, and Mediterranean market economies (MMEs). The latter is defined as featuring strong reliance on non-market mechanisms and corporate finance alongside a focus on market mechanisms in labour relations. This group includes France, Greece, Italy, Portugal, Spain and Turkey. The UK is in the LME
group. Their results confirm the hypothesis for the manufacturing sector as a whole that LMEs are relatively more specialised in producing “original” innovations with diverse patent citations. These results would suggest that as an LME the UK would be expected to be relatively more involved in innovation based on combining multiple sources of knowledge compared to other non-LME economies. However, this overall result conceals divergences from the predicted LME/CME bifurcation when individual industries are analysed. The aggregate result is confirmed in relation to chemicals and related products and electronics industries. In metals, machinery and transport equipment industries, however, the CMEs outperform the liberal market economies in terms of “original” innovation. Fewer differences of significance were found using measures of radicalness emphasising “generality” of application or the number of citations.

Griffith and Macartney (2012) focus on the employment protection aspect of the varieties of capitalism literature and its impact on radical versus incremental innovation. They do not consider financial aspects, but they do focus on patenting and are interested in the two edged nature of employment protection legislation. High employment protection legislation may increase firm specific investment in human capital and hence have a positive impact on incremental innovation. On the other hand by increasing the costs of laying off labour in the face of variations in future demand it may inhibit ‘radical’ innovation which is seen as more likely to produce unpredictable effects. To test the net outcome of these influences they examine the patenting behaviour of a large sample of subsidiaries of multinational corporations in Europe. Their analysis covers the period 1997-2003 and the sample contains 1,084 subsidiaries of 231 multinational firms in 12 countries (80% of the subsidiaries are in France, Germany and the UK and they account for a similar proportion of the patent applications filed). They make a distinction between the number of patents as a measure of incremental innovation and the proportion of patents which cite non-patent literature (i.e. make references mainly to scientific journals and the science base) as a measure of radical innovation. Their argument is that the latter category of patenting involves greater uncertainty and therefore should be negatively related to employment protection legislation. Their results are consistent with employment protection legislation supporting incremental innovation by encouraging firm specific investment, but discouraging more radical innovation, which is negatively correlated with employment protection legislation. They interpret this as a reaction by firms to the higher lay-off costs associated with adjustments in the face of potential failures of more radical innovation. The results, however, are somewhat sensitive to the inclusion or exclusion of the major economies in the sample. Thus when the UK
is removed from the analysis, the results become statistically insignificant. When France is removed, the incremental innovation variable changes sign and becomes insignificant. On the other hand the removal of Germany does not alter the overall pattern of results. Possibly confounding or complementary effect of financial markets are not considered whereas in the two previous studies discussed they were included in classifying economies.

**Revealed Comparative Advantage**

Allen et al. (2006) compare indicators of revealed comparative advantage\(^7\) across a large sample of finely disaggregated sectors in 22 OECD economies. They group the economies according to Hall and Soskice (2001b). They group the sectors into those previously identified in the varieties of capitalism literature as predisposed to incremental or radical innovation. Some results are shown in Exhibit 7 for incremental innovation sectors and in Exhibit 8 for radical innovation sectors. Whilst there is some broad support for the hypothesized groupings, there are notable exceptions. Thus, Japan ranks highly in some radical and incremental innovation sectors and so does Germany. The US also performs relatively well in some of the “incremental” as well as “radical” sectors. This suggests a very loose set of correlations between varieties of capitalism and innovation type, at least as characteristics by the industry groupings.\(^8\)

**Exhibit 7 - Comparative advantage in sectors characterised by incremental innovation, 2002**

<table>
<thead>
<tr>
<th>Country</th>
<th>Non-electrical machinery Rank</th>
<th>Electrical machinery Rank</th>
<th>Communications equipment &amp; semiconductors Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel A: ‘co-ordinated market economies’</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Germany</td>
<td>1</td>
<td>3</td>
<td>14=</td>
</tr>
<tr>
<td>Japan</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Switzerland</td>
<td>4</td>
<td>4</td>
<td>14=</td>
</tr>
<tr>
<td>Austria</td>
<td>5</td>
<td>6</td>
<td>12=</td>
</tr>
<tr>
<td>Sweden</td>
<td>7</td>
<td>8</td>
<td>5=</td>
</tr>
<tr>
<td>Denmark</td>
<td>9</td>
<td>16=</td>
<td>8=</td>
</tr>
<tr>
<td>Finland</td>
<td>12</td>
<td>11=</td>
<td>5=</td>
</tr>
<tr>
<td>Netherland</td>
<td>13</td>
<td>14=</td>
<td>7</td>
</tr>
<tr>
<td>Country</td>
<td>Rank</td>
<td>Rank</td>
<td>Rank</td>
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<tr>
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</tr>
<tr>
<td>Belgium</td>
<td>14</td>
<td>16</td>
<td>12</td>
</tr>
<tr>
<td>Norway</td>
<td>20</td>
<td>20</td>
<td>21</td>
</tr>
</tbody>
</table>

**Panel B: ‘liberal market economies’**

<table>
<thead>
<tr>
<th>Country</th>
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<th>Rank</th>
<th>Rank</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
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<td>2</td>
<td></td>
</tr>
<tr>
<td>UK</td>
<td>11</td>
<td>9</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Canada</td>
<td>15</td>
<td>22</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>New Zealand</td>
<td>16</td>
<td>14</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Australia</td>
<td>21</td>
<td>21</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Ireland</td>
<td>22</td>
<td>16</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

**Panel C: unclassified countries**

<table>
<thead>
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<th>Country</th>
<th>Rank</th>
<th>Rank</th>
<th>Rank</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
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<td>Italy</td>
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<td>21</td>
<td></td>
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<tr>
<td>France</td>
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<td>5</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Spain</td>
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<td>10</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Portugal</td>
<td>17</td>
<td>11</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Greece</td>
<td>18</td>
<td>16</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Turkey</td>
<td>18</td>
<td>13</td>
<td>17</td>
<td></td>
</tr>
</tbody>
</table>

| TOTAL No. Countries | 22 |
| TOTAL No. Sub-sectors in analysis | 377 | 126 | 36 |

Source: Derived from Allen, Funk and Tüselmann (2006) Table 1, p.10.

### Exhibit 8 - Comparative advantage in sectors characterised by radical innovation, 2002

<table>
<thead>
<tr>
<th>Country</th>
<th>Rank</th>
<th>Rank</th>
<th>Rank</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>5</td>
<td>9</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>Austria</td>
<td>6</td>
<td>15</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>Switzerland</td>
<td>8</td>
<td>12</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Denmark</td>
<td>11</td>
<td>9</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>Japan</td>
<td>11</td>
<td>4</td>
<td>15</td>
<td>4</td>
</tr>
<tr>
<td>Sweden</td>
<td>11</td>
<td>6</td>
<td>13</td>
<td>9</td>
</tr>
<tr>
<td>Belgium</td>
<td>16</td>
<td>21</td>
<td>6</td>
<td>17</td>
</tr>
<tr>
<td>Finland</td>
<td>16</td>
<td>15</td>
<td>21</td>
<td>12</td>
</tr>
<tr>
<td>Netherlands</td>
<td>16</td>
<td>2</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Norway</td>
<td>16</td>
<td>15</td>
<td>17</td>
<td>13</td>
</tr>
</tbody>
</table>

**Panel B: ‘liberal market economies’**

<table>
<thead>
<tr>
<th>Country</th>
<th>Rank</th>
<th>Rank</th>
<th>Rank</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>
The UK is in Panel B of each exhibit and confirms well to the expected pattern in terms of radical innovation. Thus in high tech sectors it is third ranked in revealed comparative advantage in aerospace and computers, joint second in pharmaceuticals and fifth in scientific instruments. The pattern for incremental innovation is less clear. Thus the UK ranks mid-table in non-electrical machinery and electrical machinery (11th and 9th respectively) which is consistent with the variety of capitalism hypothesis, but is 3rd in communications equipment which is inconsistent with the varieties hypotheses.

In a later study Schneider and Paunescu (2012) also use a revealed comparative advantage approach. They analyse 26 OECD countries over the period 1990 to 2005. Using the country classification shown in Exhibit 3 above they examine the relationship between the groupings and comparative specialisation in terms of High-tech and Medium High-tech export intensity\(^\text{9}\). It is clear from their data that economies may change over time in the relative extent to which they export high technology goods, and thus the extent to which they may be characterised as radically or incrementally specialised economies. However, when they pool their cross section data for 1990, 1995, 1990 and 2005, they report regression results in which LME economies, such as UK, are shown as having a revealed comparative advantage in the high tech sector compared to CME (and State Dominated) countries. They have a revealed comparative disadvantage in medium high tech sector.
compared to CMEs alone. These differences are both statistically and economically significant.

Taken as a whole these results based on patenting and revealed comparative advantage are broadly consistent with the relative radical incremental specialisation between LMEs and CMEs hypothesized in the literature. There are, however, considerable overlaps in terms of disaggregated sectoral results. Thus the discussed examination of detailed sector patterns of, for example, patenting) reveal that (even taking these patent proxies at face value) CME economies in many cases demonstrate comparative advantages in radical as opposed to incremental innovation (see, for example, the detailed discussion in Akkermans et al., 2009). In general in the case of the UK the evidence is broadly consistent with a relative emphasis on radical innovation.

However, these studies say little about the overall absolute innovative performance of the UK compared to other countries on either type of innovation. We have seen that in terms of overall innovation the UK is a follower economy and a relatively weak performer. Moreover a relative advantage in radical innovation does not mean the UK has an absolute advantage.

**Comparative and Absolute Advantages**

The fact that the UK has a “comparative advantage” in radical innovation does not, of course, mean that as a system it is absolutely better at carrying out or financing radical innovation than, say, Germany. In fact as Exhibit 9 (based on Schneider et al. (2010)) shows there has been over time an increase in all the major OECD economies in exports of high-tech industries as a share of total manufacturing exports. Irrespective of the variety of capitalism, it is clear that across a wide range of economies it has been possible to increase exports in these “radically” innovative sectors. In the case of economies such as Switzerland, the share of such exports rose fourfold between 1998 and 2003. Moreover, in Germany (a supposedly “incremental” specialised innovative economy) the share doubled.

The fact that countries can raise their share of high-tech activity and the share of such exports in their overall activity shows that both LMEs and CMEs are capable of
making such transitions and that the latter may be absolutely superior in both. Thus other organisational and networked based approaches to innovation performance have argued that the tight interconnections in coordinated economies such as Japan and Korea have been central in the past to their ability to outperform US firms in radical innovation rather than inhibit them (Aoki, 1988; Hager and Hollingsworth, 2000, Nonakka and Konno, 1998).

**Exhibit 9 - Percentage of exports in high-tech industries as a share of total manufacturing exports in 1990 and 2003**

![Graph showing percentage of exports in high-tech industries in 1990 and 2003](Source: Derived from data in Schneider et al. (2010) Table 1 p.253)

The importance of looking at absolute measures of performance is brought out most directly if we compare the UK and Germany in terms of the technology intensity of exports. This is done in Exhibits 10, 11 and 12 drawn from Kneller (2012).

**Exhibit 10 - UK manufacturing exports, by technology 1990-2008**
Exhibit 11 - German manufacturing exports, by technology 1990-2008
Exhibit 12 - World market shares of high-tech exports for EU member states

The exhibits show the shares of manufacturing exports of different levels of technological intensity in the UK and Germany and the share of each in total world trade. A visual comparison of Exhibits 10 and 11 reveals that the UK has a higher share of high-tech exports in its overall manufacturing exports and that this has been growing over time. A glance at the left hand scale of each exhibit also reveals, however, that the German economy produces an order of magnitude greater volume of high-tech manufacturing sector exports compared to the UK. As a result, if we look at world market shares of high-tech exports, Germany is easily the leading EU economy in this respect. The German variety of incremental innovation capitalism does not inhibit the German economy from being an exceptionally powerful competitor in these ‘radical’ high-tech sectors. This is not consistent with the view that the German coordinated market economy inhibits “radical” innovation (insofar as high-tech exports are taken as a proxy for that characteristic) or that the UK LME system promotes it.

3.3 Radical v. Incremental Innovation: An unhelpful
The usefulness of making links between varieties of capitalism or financial systems and radical and incremental innovations as measured by the proxies used above is questionable when the insights arising from the study of innovation per se are considered. In this wider innovation literature radical innovations are most often defined in terms of fundamental shifts in the relationship of performance to price; the development of new industries, products or processes, and/or the pervasiveness of their effects across sectors. They are also linked to fundamental organisational changes within firms as well as between them. Radical innovations are, however, also frequently associated with subsequent long processes of incremental innovation within the firms and sectors where they occur. This makes simple binary classifications of sectors questionable (Fagerberg, 2005; Verspagen, 2005; Powell and Grodal, 2005; Sorescu et al., 2003; McDermott and O’Connor, 2002).

Salter and Alexy (2013) provide a useful overview. They point out that where detailed attempts have been made to measure the frequency of radical innovations, it appears that they may take decades to develop and are extremely infrequent, maybe occurring once in every three decades (Anderson and Tushman, 1990; Tushman and Anderson, 1986; McDermott and O’Connor, 2002). The implication is that in the average industry firms may operate and workers may work their entire lives without ever experiencing a radical innovation. Moreover, it appears that such innovations are best thought of as not specific to certain sectors and therefore not easily revealed in patterns of relative comparative advantage across sectors. Instead they are pervasive across many sectors, i.e. that they are what are known as general purpose technologies (Helpman, 1998).

It also appears to be the case that appropriating the value from radical innovations when they do occur depends critically upon the ability to implement and develop competitive strategies around substantial investment in incremental innovation. This has led to the emergence of a substantial literature on sectoral systems of innovation. This eschews simple twofold binary distinctions between sectors and their innovation systems. Instead it favours a more granular approach emphasising, inter alia, the interplay between technological opportunity and appropriability conditions (i.e. how a value is captured by businesses). It also emphasises the way in which the nature of a sectoral system and the types of innovation it embodies can vary over time (Malerba, 2004 and 2005). Competition and competitive advantage shifts from ‘radical’ product
innovation to ‘incremental’ product and process competition over a sector life cycle (Utterback, 1994). This has more to do with the maturity of a sector than its ‘high-tech’ status. There is also abundant evidence to suggest that sectors which are classified as low-tech are also characterised by innovations of a transformative or radical kind (see, for example, the discussion in Von Tunzelmann and Acha (2005). A particularly striking example here is the role of information technology in transforming business models and productivity in retailing and wholesaling in the United States in particular as well as in other economies.

It is also apparent that innovation in general is increasingly influenced by the pursuit of open collaborative and networked models. Rather than emphasising a contrast between liberal markets and coordinated markets this suggests a cross national move towards more inter-firm collaboration arrangements (Chesborough, 2003 and 2006) in which CME economies may be at an advantage.

Aoki (2010) also argues that similar organisational 'architectures' are emerging in the world’s leading businesses which are global in character rather than defined by national boundaries. Moreover, when more direct measures of innovation outputs rather than indirect measure such as patents are used it appears that company level variables dominate with few signs of country effects (see, for example, Tellis et al., 2009) (see also Streeck (2009) and Carlin (2009) more generally).

This suggests that discretions between radical and incremental innovation trajectories linked to ‘national’ system characteristics may not be a helpful framework in thinking through future innovation financing scenarios for the UK. These convergence issues are discussed further in Section 12 below.

4. Innovation Expenditure: Capital Investment, R&D and Other Intangible Investment

Given the UK’s modest performance in terms of innovation output, it is appropriate to turn to the extent to which it engages in investment in assets to support innovation
and which the financial system must fund.

4.1 Tangible and Intangible Expenditure in Support of Innovation

Expenditure to support innovation can be classified into a number of categories. Official survey data collected from business enterprises in the UK provides data on expenditure on R&D carried out internally by the company; external R&D and knowledge purchased from other external organisations; acquisition of capital equipment; training for innovation activities; design expenditure and expenditure on marketing innovation.

Exhibit 13 shows that in the case of manufacturing the two most significant categories of expenditure are internal R&D and the purchase of capital equipment, although their respective importance varies across individual sectors. In this section we therefore focus in turn on capital investment and R&D.

Exhibit 13 - Shares of expenditure of UK firms’ Innovation-related activities by sector (2008-2010)
4.2 Capital Investment

An analysis of capital investment for the Foresight Programme on the Future of Manufacturing discusses capital investment in manufacturing in detail (Driver and Temple, 2012). We therefore briefly summarise their key conclusions here. They show that the UK share of capital investment in output has been low relative to competitor economies for many decades and continues to be so, both for the whole economy and for manufacturing. The growth rate of the fixed capital stock was negative for the period 2000-07. For ICT investment, however, the trend was better and closer to that of other economies. They also show that the growth of capital per worker in manufacturing has been about the average of competitor countries, but that there is a large gap between UK manufacturing in terms of the capital shortfall to match the top EU 15 countries. Their analysis of overseas ownership shows that nearly one half of UK manufacturing investment (46.5% in 2009) and nearly a third of employment is accounted for by foreign owned multinational enterprise. Finally,
they show that investment since the financial crisis has been particularly poor both absolutely and in comparison with competitor countries. Business investment remains around 20% below where it would have been had it continued to grow at its pre-2008 average rate and projections for investment growth in the next four years are around 6%, little more than half that forecast by the Offer for Budget Responsibility in late 2012. This suggests that the UK economy’s moderate innovation performance is associated with a weak performance in terms of capital expenditure.

4.3 Investment in R&D

In this section we provide a more detailed overview of the UK R&D in an international comparative context. A sample of 11 countries is analysed which includes those which are most consistently referred to and analysed in the literature on comparative financial systems and includes the US, the Scandinavian economies, the UK, China, Japan, Korea, Germany and France. The exhibits revise and update those in Hughes and Mina (2012).

It is conventional in discussing R&D expenditure patterns to distinguish a number of categories of R&D expenditure. The first of these is Gross Domestic Expenditure on R&D (GERD). This represents the overall R&D expenditure effort and is broken down into three sub-categories. The first of these is Business Expenditure on R&D (BERD), the second is Higher Education Expenditure on R&D (HERD) and the third is the government’s own direct expenditure on R&D (GovERD). It is possible within BERD and for some categories of expenditures to provide comparative analyses for manufacturing alone and we do this wherever possible in the following discussion.

In addition to analyses of the conduct of R&D expenditure, it is also possible to examine patterns of funding for R&D at a broad macro level. Thus each of the categories of expenditure, for example BERD or HERD, can be considered from the point of view of who funds their R&D by UK business itself, government, or overseas funders etc.). We therefore present data on government funding for BERD and overseas funding for BERD. We also provide data for the extent to which HERD is financed by flows of funds from the business sector. Each of these is relevant to an assessment of the impact of financial sources upon the scale and direction of the R&D effort across countries.
Finally, it is possible also to identify variations across countries in the extent to which businesses of different sizes account for the bulk of R&D and also to examine the distribution of government support for R&D expenditure by size of the firms receiving that support. Data on each of these aspects of the UK R&D effort is included in this section.

It is not always possible to provide a breakdown of expenditure of funding by manufacturing alone. However, as is shown below, manufacturing R&D is by far the largest component of overall R&D expenditure in the UK. Most of the trends which apply to BERD also apply to manufacturing R&D as a sub-sector of BERD.

### 4.3.1 Gross Expenditure on R&D (GERD)

Exhibit 14 provides an overview of the relative position of the UK in terms of R&D expenditures (GERD). The data is shown as a percentage of GDP to allow comparisons across countries of different sizes. The exhibit also shows the number of researchers per 1,000 employees. In this and the following exhibits the data is for the latest year available. It is clear from Exhibit 14 that the UK is at the lower end of the spectrum in terms of R&D intensity and in terms of researchers per 1,000 employees. It is also substantially below Japan, the USA and China in the overall scale of its R&D effort (represented by the size of the balloons) and lags behind in absolute terms in relation to Korea, Germany and France. Although in the last case the difference is relatively small.
Exhibit 14 - GERD: Gross domestic expenditures and researchers per 1,000 employees, 2009 or latest available Year

Source: OECD

Exhibit 15 shows the pattern of GERD across countries in 1999 and 2010. This shows that whilst the UK was at the lower end of the R&D intensity spectrum, it also suffered a small decline in GERD as a percentage of GDP whilst in the cases of Finland, Korea, Japan, Denmark, the US, Germany, France and China increases occurred. The UK’s position therefore worsened relatively to the majority of its international comparator countries.

Exhibit 15 - GERD: gross domestic expenditure on R&D, 1999 and 2010 (as a % of GDP)
This tendency for a weak and worsening R&D performance is revealed in Exhibit 16 which focuses on the UK alone and shows trends in the four aspects of R&D that were identified earlier. Thus it is apparent that in the course of the past 20 years the overall R&D effort has weakened and that this is mirrored in the weakening performance of BERD. Although there was some modest recovery after 2004 in BERD, this has not acted to offset the long-term decline. The only modest sign of improvement over the period is in the share of Higher Education R&D as a percentage of GDP. This has risen more or less in line with the trajectory set out in the 2004 10-Year Investment and Innovation Framework. This, however, reflects in part increased funding to cover the full economic cost of the R&D rather than an increase in the volume of HERD per se.

Exhibit 16 - UK R&D expenditure as a percentage of GDP
4.3.2 Business Expenditure on R&D (BERD)

If we focus on BERD alone, Exhibit 17 shows once again that the UK is at the lowest end of the spectrum and has had a decline in R&D intensity in the business sector over the period 1999-2010. All of the other economies with the exception of Norway and Sweden have shown increases of varying significance. The US has basically marked time in this period. It could be argued that the weak and weakening R&D performance of the UK economy is a reflection of the fact that it is relatively dominated by low R&D intensive services sectors and/or that its relatively service intensive nature means that other forms of intangible investments besides R&D are relatively more important.

Exhibit 17 - Business enterprise expenditure on R&D, 1999 and 2010 (as a % of GDP)
Exhibit 18 shows the share of services in overall business R&D in the UK and the comparator countries. The UK is fourth in terms of R&D in services and the share of business services rose between 2000 and 2009.

Source: Authors calculations based on OECD STI database
The counterpart to this is Exhibit 19. This shows that the UK was towards the lower end of the share of manufacturing in business R&D. The UK’s overall performance may therefore simply be a compositional effect due to its relatively large services sector.

It is possible to correct the share of business R&D in an economy for differences in its industrial structure both between manufacturing and services and between more or less R&D intensive sectors within manufacturing.

Exhibit 19 - Share of manufacturing in business R&D, 2000 or latest available year

![Graph showing share of manufacturing in business R&D](image)

Source: Authors calculations based on OECD STI database

Exhibit 20 shows that when a comparison of business expenditure R&D is carried out which allows for those structural differences, the UK still remains a below-par player and is ranked third from the bottom on this adjusted basis. It thus appears that the UK remains a low R&D intensity economy, even when its service oriented structure is allowed for.

Finally, it is still possible to argue that R&D is perhaps not the best indicator of overall intangible asset investment or at least that it is not the only indicator to consider. It may thus be argued that if account is taken of other types of intangible investment,
the UK might look better.

Exhibit 20 - Business R&D intensity adjusted for industrial structure, 2008 (as a % of value added in industry)

Source: Authors calculations based on OECD STI database

Exhibit 21 provides a comparison of the UK with other economies in terms of investment in machinery and equipment; investment in software and databases; R&D and other intellectual property products; and brand equity, firm specific human capital and organisational capital. The exhibit ranks the countries from left to right in terms of investment in machinery and equipment (tangible assets). The UK’s relative position is improved by its relatively high expenditure in non-R&D intangible assets. It still nonetheless comes joint bottom with Germany in this adjusted investment activity.

Exhibit 21 - Investments in tangible and intangible assets as a share of GDP, 2006
4.3.3 Manufacturing R&D

Exhibits 22 and 23 focus on manufacturing R&D. The first shows manufacturing R&D, as a percentage of GDP in 1999 or/and the latest year available. The UK is bottom but one of this particular league table and UK manufacturing R&D as a % GDP share has fallen since 1999.

Exhibit 22 - Manufacturing R&D as a percentage of GDP, 1999 and latest available year
Exhibit 23 looks at R&D expenditures relative to value added in the manufacturing sector itself in the year 2000 and the most recent available. The data mostly relates to the period before 2009. The UK is once again at the bottom end of this league table and has experienced one of the smallest increases in R&D intensity within manufacturing amongst the comparator countries.

The UK thus appears to have a relatively low level of overall BERD. This performance has been weak or stagnant over time and is not primarily accounted for by differences in the UK’s industrial structure. The performance of BERD in the UK manufacturing sector has been weak and it has amongst the lowest levels relative to manufacturing value added of the sample of companies analysed. The extent to which this might be accounted for by an unwillingness of its private financial system to invest in long-lived risky investment projects is examined later in this report.

Exhibit 23 - R&D intensity in manufacturing using value added, 2000 and latest available year
Exhibit 24 looks at the distribution of UK R&D across sectors within manufacturing. Where the sectors are defined in terms of the level of technological intensity (based upon their R&D/sales ratio or technical intensity of the labour force).

Exhibit 24 - Business R&D in the manufacturing sector by technological intensity, 2008 (as a % of manufacturing BERD
The exhibit shows that the United States and the UK have R&D relatively concentrated in high technology sectors whilst Germany is relatively concentrated in the medium to high technology sectors. Thus, column 1 shows that business R&D in the high technology sector as a percentage of manufacturing R&D is 68.9% in the case of the US and 62.8% in the case of the UK compared to 31% in the case of Germany. Equally, business R&D in medium high technology manufacturing sectors as a percentage of manufacturing R&D is over 60% in the case of Germany compared to 22% in the case of the USA and 28.3% in the case of the UK. Similarly, Japan, as an example of a coordinated market economy, has a somewhat higher share of its manufacturing R&D in the medium high technology sectors than in the high technology sectors, although the differences are much smaller than in the case of Germany. However, Korea is closer to the UK and France than it is to either Germany or Japan. The most high technology intensive economy in the sample as a whole is Finland. In each of these cases it is important to note the earlier finding that Manufacturing R&D as a percentage of GDP is much higher in Japan, Korea and Germany than in the UK. As a result the absolute level of high technology R&D in the UK was $10.6bn, whereas it was $16.3bn in Korea, $39bn in Japan and $13.5bn in Germany.

Source: Authors calculations based on OECD STI database
4.3.4 Foreign Ownership and Funding of UK R&D

The discussion so far has focused on R&D expenditure by sector rather than which UK sources of finance fund the R&D carried out and the nationality of business carrying out the R&D. Exhibits 25 and 26 therefore look at overseas involvement in the UK R&D effort. Overseas funding of R&D is one indicator of the internationalisation of the UK R&D effort. Another is based on the ownership characteristics of the businesses carrying out R&D expenditure in the UK. Exhibit 25 looks at funding *per se* and shows the extent to which business BERD in a particular country is funded from overseas sources. Exhibit 26 looks at the extent of overseas ownership of the companies carrying out R&D in the UK.

It is apparent from Exhibit 25 that the UK is an extreme outlier in terms of overseas funding. The proportion of UK BERD which is funded from overseas sources is twice as high as the nearest country shown in the exhibit and is around five times as high as is the case in Germany. Comparable data is not available for the United States. The exhibit also shows that overseas funding of R&D is negligible in the cases of Japan and Korea.

**Exhibit 25 - R&D funds from abroad, 2010 (as a % of business enterprise R&D)**

*Source: Authors calculations based on OECD STI database*
Exhibit 26 plots trends over time in R&D carried out in businesses which were UK owned and foreign owned respectively. Between 1995 and 2011 business R&D performed by foreign owned businesses more than doubled. Over the same period R&D carried out by UK owned businesses remained virtually stable. The upshot was that in 2011 for the first time foreign owned businesses performed more R&D in the UK than UK owned businesses did.

Exhibit 26 - Ownership of businesses who perform R&D in the UK (in 2011 prices)

Source: ONS data

This changing importance for overseas owned businesses is even more striking in the case of manufacturing. Thus Exhibit 27 shows the distribution of R&D accounted for by UK owned and overseas owned firms in manufacturing and services separately. Whilst UK owned R&D was more important than overseas owned R&D in services, the reverse was true in the case of manufacturing.

To the extent that decisions affecting overseas sources of finance are relatively free of the institutional factors affecting the UK financial markets and to the extent that the parents of foreign owned subsidiaries are also relatively free of those pressures then the influence of UK’s variety of capitalism might be attenuated. To track the effect of internationalisation, however, requires a finer grained analysis than can be attempted.
within this report, since effects may vary from sector to sector and parent company to parent company. Where US funding and ownership predominates then liberal market capitalism and management practices may be reinforced and vice versa for German, Japanese or Korean involvement (see for example Child et al., 2001). In general comparisons of UK with US owned businesses in the UK suggest superior innovation performance and management practices of the latter based primarily on “tougher” labour market practices (Giffith and McCarney, 2012), Bloom et al, 2007, Bloom et al., 2012). Equally there is evidence for the US that the presence of institutional investors in the share ownership of larger corporations enhances innovation as measured by patent performance. Equally there is evidence for the US that the presence of institutional investors in the share ownership of larger corporations enhances innovation as measures to patent performance (Aghion et al, 2013).

Exhibit 27 - Foreign and Domestic Ownership of Services and Manufacturing UK R&D 2011

The extent to which UK BERD is carried out by overseas businesses and is funded from overseas is therefore a significant and distinctive feature of the UK manufacturing system.\(^{10}\)
4.3.5 Public Sector Funding of R&D

Government funding for manufacturing R&D also varies substantially across countries. Thus, Exhibit 28 shows that the percentage of manufacturing BERD which is financed by government is around 14% in France, around 11% in the United States, and around 9% in the United Kingdom and 4.5% in Germany\textsuperscript{11}. It is striking that the percentage is so high in the United States given the liberal free market credentials typically attributed to that country. The role of the public sector as a direct source of, and support for, venture capital in the US has been typically underplayed in interpretations of that country’s innovation performance. Major departments of state in particular through programmes such as the Small Business Innovation Research Programme (SBIR) have played a key role in the direct development of early stage technologies and helped to de-risk investments by later stage private sector venture capitalists (see, for example, Lerner, 1998; Connell, 2006, Hughes, 2008).

Exhibit 28 - Government-financed R&D in business, 1999 and 2009 (as a % of R&D performed in the business sector)

Source: Authors calculations based on OECD STI database

4.3.6 The Distribution of R&D Expenditure and Public Sector
Support for R&D by Size of Firm

So far this report has focused on the aggregate picture within the broad categories of BERD. It is, however, possible to examine the extent to which business expenditure on R&D is carried out by firms of different sizes. Exhibit 29 shows that in the UK BERD is dominated by larger businesses and their subsidiaries. It is thus apparent that independent small and medium-sized enterprises employing fewer than 250 employees are negligible in terms of the overall UK R&D effort. They accounted for less than 4% of total R&D. If we define small and medium-sized enterprises to include the subsidiaries of larger firms, then they account for a somewhat greater percentage, but the vast bulk of R&D in the UK is accounted for by the largest businesses.

Exhibit 29 - BERD in UK is dominated by larger businesses and their subsidiaries

It is not possible to do an international comparison of R&D by size class of independent small firms. It is, however, possible to do a comparison based on small and medium-sized enterprises employing fewer than 250 employees where subsidiaries of larger companies are included in the definition. Exhibit 30 shows that the US, Germany and Japan are all at the lower end of the spectrum in terms of the
role of small firms compared with Norway, Denmark and Korea which are grouped at the other end with the UK in the middle.\textsuperscript{12}

Exhibit 30 - Business R&D by size class of firms, latest year (as a % of total BERD)

![Bar chart showing R&D distribution by size class of firms](chart)

Source: Authors calculations based on OECD STI database

The distribution of the R&D effort by size of firm means that there is a similar concentration of government financial support for R&D. Even given the overall distribution of R&D activity by size of firm, it is striking in Exhibit 31 that the UK has the smallest proportion of government financial support for R&D going to small and medium-sized businesses.

Exhibit 31 - Government Financial Support for R&D by Size Class of Firm (%)
4.3.7 Higher Education R&D (HERD)

So far the discussion has focused on business and manufacturing R&D. An important component of the R&D effort of a country, however, is the R&D which is carried out in the Higher Education sector. This is not readily classifiable into the contribution it makes to manufacturing or other sectors, but is important to examine in its own right, since it contributes to the manufacturing innovation effort. Exhibit 32 shows the proportion of higher expenditure on Higher Education R&D as a percentage of GDP between 1995 and 2010. In the UK and elsewhere there has been an increased tendency for Higher Education R&D to rise as a percentage of GDP with Japan being the sole exception to this trend. The UK ranks towards the lower end of the spectrum in terms of Higher Education R&D as a percentage of GDP.

Exhibit 32 - HERD as a % of GDP 1995, 2005 and 2010
Moreover, as Exhibit 33 shows the UK has lagged behind other economies in the extent of changes in expenditure on Higher Education. The exhibit compares the change in HERD as a percentage of GDP in 2005-10 compared with a similar change in 1995-2005. The UK lies below the 45 degree line which would imply the same rate of growth between the two periods. It shares this position with Finland and with China. All of the other economies had a faster rate of growth of HERD as a percentage of GDP in the later than in the earlier period. The UK’s position has thus relatively worsened.

Exhibit 33 - Changes in HERD as a % of GDP 1995-2005 and 2005-2010

Source: Authors calculations based on OECD STI database
It is also possible to look at the extent to which business funds Higher Education R&D. Here Exhibit 34 shows a notable deterioration in this aspect of the funding of R&D in the UK. Whereas several countries show some weakening of business funding of Higher Education R&D, the fall over the period shown was an order of magnitude greater in the case of the UK. These results may be sensitive to the end years analysed and the extent to which the UK data reflects a longer period over which the impact of the financial crisis and austerity policies may have had an effect. Nonetheless, the weakening of the Higher Education R&D effort as well as the weakening of the connection between business R&D and the university R&D effort may suggest a weakening of the connection between the science base and industrial sectors, including manufacturing sector.

Exhibit 34 - Business-funded for R&D in the higher education and government sectors, 1999 and 2009 (as a % of R&D performed in these sectors (combined))
The relative importance of business funding for university R&D alongside other sources summarised in Exhibit 35. The exhibit shows all forms of funding for university research in the UK. The most important sources are quality related funding (QR) and funding from the research councils. The latter has a strong upward trend in
the middle of the period shown which reflects in large part an increase in the proper funding for university R&D brought about by the introduction of full economic costs. A condition of this was in principal that it would not be associated with increasing the volume of research funded. The impact of recent ring fencing in money terms, but decline in real terms is also shown in the exhibit. The diagram confirms the weak position of industry as a funding source, but also shows that as with the funding of business R&D itself, there has been an upward trend in the extent to which the University/Higher Education sector has been able to attract funding from overseas.

Summary Findings on Investment and R&D

Taken together this analysis of R&D suggests that as with overall investment the UK has occupied a relatively weak and worsened position in terms of the overall R&D effort. This is a characteristic of the manufacturing as well as of the overall business R&D spend. The UK’s R&D effort, especially in manufacturing, is massively reliant on overseas funding and also is carried out disproportionately by the subsidiaries of overseas organisations. The vast bulk of R&D is carried out by a relatively small number of large firms. To extent that manufacturing may be expected to have benefitted from R&D expenditure in the Higher Education sector, it is a matter of concern that the UK’s relative pattern of expenditure on Higher Education R&D has also been relatively worsening, whilst the connection between businesses and university R&D through the provision of funding has fallen. The UK (and the US) show relatively high degrees of public sector funding of manufacturing R&D by the public sector and it is noticeable that the extent to which government funds R&D in manufacturing is much higher in those two countries and France than in, for example, Germany Japan and Finland. This aspect of the UK variety of capitalism implies considerable and potentially strategic state support in these liberal market economies.

As with business R&D, so with Higher Education R&D, there is evidence of the relative attractiveness of the UK as a target for overseas funding.

Taken together the analysis of trends in fixed investment and in R&D suggests that the UK has performed relatively weakly by international standards and that its performance as measured in terms of R&D intensity has fallen over time. The extent to which this relative performance and pattern over time is attributable to the
particular nature of UK financial markets is analysed in the remaining sections of this report. The focus on R&D and innovation is consistent with an emphasis on the role of public capital markets, since it is large firms in particular that dominate the R&D spending pattern and it is public capital markets which provide High Initial Public Offerings (IPOs), the exit route for early stage venture capital and other investors in small non-quoted businesses.

5. UK Capital Markets and Finance for Investment and R&D

5.1 Sources of External Finance: Debt, Equity and Retentions

Companies may fund their activities by internal retention of cash flows or by raising funds externally from either debt or equity sources. It is useful to summarise briefly the forms and sources of external finance (i.e. in addition to retained profits) available to UK businesses as a backdrop to analysing the evidence.

Equity finance involves the issue of shares to new or existing shareholders. Debt may take the form of loans from banks and other financial intermediaries or bonds issued on the bond market.

Bonds and shares can be issued to and traded by investors in general on public capital markets. It is also possible to make private placements with smaller groups or individual investors.

It is important to note that the use of public markets to raise external finance is restricted in practice to a small number of companies. Thus of an estimated 1.2 million public non-financial companies only 1,257 or 0.1% issue public external finance. These 1,257 companies, however, employ 3.7 million people or 16% of UK private sector employment and account for around 47% of UK domestic investment (Pattani and Vera (2011) p.322).
Exhibit 36 shows that in the UK around 50% of the outstanding value of debt and equity takes the form of bank loans, around 25% takes the form of public corporate bonds and around 25% is accounted for by equity.

### Exhibit 36 - UK Public Non-Financial Corporations public debt and equity (a)(b)

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount outstanding (£billions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memo: bank loans</td>
<td>722</td>
</tr>
<tr>
<td>Public corporate bonds</td>
<td>338</td>
</tr>
<tr>
<td>of which</td>
<td></td>
</tr>
<tr>
<td>Secured</td>
<td>5</td>
</tr>
<tr>
<td>Unsecured</td>
<td>333</td>
</tr>
<tr>
<td>and of which:</td>
<td></td>
</tr>
<tr>
<td>Stand alone bonds</td>
<td>316</td>
</tr>
<tr>
<td>Programme bonds (medium-term notes)</td>
<td>22</td>
</tr>
<tr>
<td>Public equity</td>
<td>346</td>
</tr>
<tr>
<td>Of which</td>
<td></td>
</tr>
<tr>
<td>Common equity</td>
<td>345</td>
</tr>
<tr>
<td>Preferred equity</td>
<td>1</td>
</tr>
</tbody>
</table>

Sources: Dealogic, ONS, Thomas Reuters and bank calculations

1. Total corporate bonds and bank loans are from the ONS *Financial Statistics* for 2010. The amount of secured bonds was estimated by scaling the total by the share of bonds of the same type reported by Dealogic for the period 1980-2011 – and similarly for unsecured, stand alone bonds and medium-term notes*. Total public equity is estimated as a total face of value of common stock and preferred stock, including capital surplus, as reported by UK PNFCs covered by the Thomason Reuters Worldscope database in fiscal year 2010.

2. Includes foreign currency issuance.

* Medium-term notes are another type of public debt, less common in the UK. Unlike bonds, they are offered on a recurring basis by the company, often with a menu of maturities and rates from which investors can choose.

Source: Pattani and Vera (2011)

Although equity accounts for around a quarter of the balance sheet value of external financial assets, it occupies its place principally because of the equity issued at the time of public floatation, or from the issue of new equity in relation to takeovers. It
plays a very small role in the subsequent financing of investment for expansion.

Historically a very high proportion of investment in the UK has been funded from retained earnings and, where external finance is raised, loans and bonds have historically been more important than equity. For example, Exhibit 37 shows that net external finance rose between 1996 and 2011. It is apparent that equity is relatively insignificant, especially compared to loans. The exhibit also shows significant variations in the extent to which bond finance has been used over time: It also shows a major increase in loans in the period 2004-2008 and a subsequent massive deleveraging following the financial crash. Since the turn of the current century the exhibit shows that there has been a preponderance of years in which companies have reduced the amount of equity outstanding through share buy-backs.

Exhibit 37 - UK PNFC net external finance raised (a)

(a) Includes sterling and foreign currency issuance.
(b) Non seasonally adjusted.
(c) Includes stand alone and programme bonds.

Source: Pattani and Vera (2011)
Exhibit 38 shows the pattern of equity issue and repurchase since 2003. The net equity issues in 2009 represent the replacement of bank loan finance which was scarcer after the financial crisis.

Exhibit 38 - Equity issuance and repurchases by UK private non-financial companies (a)

(a) Quarterly gross repayments and issues of all currency shares in sterling, non seasonally adjusted.

Source: Pattani and Vera (2011)

The growing importance in the medium-term of the stock of bank loans and corporate bonds is shown in Exhibit 39. The sharp contraction in bank lending after the crisis was associated with an increase in the issues of corporate bonds in an attempt to replace bank loans.

Exhibit 39 - UK PNFC stock of bank loans and corporate bonds
Exhibit 40 shows the sectoral breakdown of net funds raised by UK businesses in 2009 and shows the massive reduction in loans experienced in manufacturing and the relatively small net increase in funds for that sector from bonds and equity. Manufacturing has thus been relatively hard hit compared to the rest of the economy.

Exhibit 40 - Analysis of net funds raised by UK businesses in 2009 by industrial sector (a)
5.2 Equity Markets and Initial Public Offerings

Although the issue of equity on the stock market has historically been a relatively small source of funds for new investment by private non-financial corporations, the existence of the stock market represents an important means whereby the founders of and investors in new businesses may exit and extract the value of their investment by floating on the stock exchange. A healthy rate of establishment and financing of new ventures may therefore depend on a healthy market for equities.

Exhibit 41 plots the number of initial public offerings (IPOs) over the period 1996-2011. The cyclical volatility of IPOs and their dramatic reduction after the financial crash is at once apparent. It remains to be seen how this aspect of the market
5.3 Equity Markets and Takeovers

Although the stock market may not be the source of significant new issues of equity to fund business expansion, the stock market may nonetheless play a significant role in resource allocation by influencing the allocation of corporate control between competing management teams.

The UK has, by international standards, one of the highest levels of merger and
acquisition activity (Conn et al., 2005) so that the way in which the market for corporate control operates is of considerable significance.

Exhibit 42 shows long run trends in the value of domestic and overseas acquisitions by UK firms. Both series exhibit major waves and a rising proportion for overseas acquisition since the late 1990s.

**Exhibit 42 - Value of Domestic and Cross-border Acquisitions**

The values used are expressed in 2007 sterling values (billions), deflated using the FTSE All-Shares Index.

Source: ONS M&A Database

Exhibit 43 compares the outward M&A flow with the inward flow of acquisitions of UK companies by business based overseas. Between 1987 and 2003 the value of acquisitions abroad by UK companies was greater than the value of inward acquisitions. After 2005, however, the position has been reversed so the UK as an inward focus of merger and acquisition activity has outstripped investment in the opposite direction. The result is that a substantially higher proportion of the control of UK assets in the UK system has been transferred abroad.

**Exhibit 43 - Value of Acquisitions**
The values are expressed in 2007 sterling values (billions), deflated using the FTSE All-Shares Index.

Source: ONS FDI Database

The argument for believing that this level of takeover activity may have a positive effect is relatively straightforward in principle. Management teams which do not maximise the best interests of their stock holders will experience a decline in relative equity prices compared with companies whose equity holders are more content with their managers’ performance. Companies with relatively high share prices will be able to use their highly priced equity to buy the equity of firms with low prices and take control of their assets. Thus managers who are not acting in their shareholders’ interests will be removed from control and overall corporate performance, including innovation performance, will improve.

There are a number of implications which follow from this view of the market for corporate control. The first is that one should expect to see acquired companies on the stock market being poor performers in terms of innovation efficiency or profitability. They should also be relatively low in value compared to those who are not acquired (although it is important to note that this may not be the same as being under-performers in efficiency terms). Equally acquiring firms should be relatively high-performing high-valued businesses. Finally, to the extent that the reallocation of assets between competing managements in the market for corporate control leads to assets being operated more in their shareholders’ interests, we would expect to find improvements in corporate performance and market value in the aftermath of takeover.

There are a number of difficulties with these arguments. The first is that they assume
there is a clear relationship between the pricing of a company’s shares and the underlying performance of the assets under the management of its top executive team. Secondly, it is assumed that stock prices and movements in stock prices can be interpreted as reflecting the underlying efficiency with which managers use, for example, the assets under their control. Stock prices may diverge from underlying performance characteristics, because of excessive short-term volatility. Decisions that are perceived as in the interests of the shareholders, may not be consistent with underlying longer term gains in the interests of other stakeholders in the firms. Divergences of interest may then occur between those who hold the equity and other actors involved directly in the company in a variety of stakeholder roles, such as employees, bond holders, customers and supplies, or the communities in which the firms are based. This latter divergence lies at the heart of recent debates about the need to move away from shareholder value focused imperatives in judging company performance towards more stakeholder or stewardship contexts (Mayer, 2013).

In the case of the UK (and also of the US) there is abundant evidence that even in its own terms of share price performance the market for corporate control is extremely inefficient. There are large overlaps in the performance and share price characteristics of acquired and acquiring firms. Acquiring firms’ shareholders typically lose value as a result of takeover and there is no evidence for systematic performance gain after takeover.\textsuperscript{13} There are, in any event, substantial divergences between performance measured in terms of share price movements, in particular over the short-term, and movements in underlying measures of corporate performance, such as sales growth, profitability, innovation and/or productivity. It is more plausible to argue that the excessive pre-occupation with takeovers rather than organic investment makes the market for corporate control a hindrance rather than a help to improving UK economic performance (Kay, 2012).

The evidence on equity finance and takeovers in the UK is consistent with the financial markets acting as a constraint on innovative activity and long run time horizons in corporate decision taking.

6. Stock Markets, Banks and Venture
Capital: The UK and other Countries

6.1 Internal Sources of Finance

In an influential series of studies comparing international financing patterns in the 1970s and 80s it was argued that in terms of sources of finance firms overwhelmingly rely on internal finance (see, for example, Mayer, 1988; Edwards and Fischer, 1994). Thus, estimates for the period 1970-89 suggest that internal finance accounted for 40% of gross sources of funding for new fixed investment in Japan, 62.4% in Germany, 60.4% in the UK and 62.7% in the US. This suggests that, with the exception of Japan, there is significant congruence between financial systems in the importance of internal finance. As a result what becomes of central importance is the effects of governance arrangements and the market of corporate control on decision making in relation to retentions and long-term investments.

6.2 Financial Market Structures, Intermediation and Share Ownership

Bearing the significance of internal finance in mind, we can now turn to a comparison of the principal external financial structural features of the UK compared to selected financial systems elsewhere. Thus, Exhibit 44 compares the nature of the external funding in the financial system of the UK with the sample of countries whose R&D performance was analysed above. A number of differences emerge in terms of the relative importance of stock markets, banks leverage and venture capital. Differences between the UK and the US on the one hand and Germany and Japan on the other are apparent. Thus, the two “Anglo-Saxon” economies have substantially higher stock market capitalisations and stock market turnover relative to GDP compared to Japan and to Germany in particular. Germany and Japan are also much less reliant on private bond market activity than the US. In this case, however, the UK differs significantly from the United States. It has one of the lowest ratios of bond market capitalisation to GDP of the sample of countries as a whole. Levels of leverage in the UK and the US are relatively low, especially compared to Japan and the Nordic countries. There is not, however, a particularly important difference between these two countries and Germany.
Finally the exhibit shows venture capital as a percentage of GDP. It is of course well known that the largest market for venture capital in absolute terms is to be found in the USA followed some distance behind by the UK. It is also well known that this form of finance is exceptionally sensitive to the state of the stock market. The final two columns therefore show VC funding as a percentage of GDP pre and post the global financial crisis. Prior to the crash the US was indeed the most VC intensive country consistent with its stock market orientation. However, it lost that position after the crash. The Nordic economies were strikingly able to maintain their VC intensity as did the UK (though this reflects a collapse in both the numerator and the denominator). Japan and Germany as predicted by the complementarity thesis have low VC intensity to match their bank-dominated financial systems.

Overall, these broad indicators suggest that there are significant, but complex variations across countries which do not always correspond to simple two way ideal type divisions. This suggests that analyses of the financing of innovation in the UK as elsewhere need to be rooted in detailed contextual approaches of a country’s overall innovation and economic system.

**Exhibit 44 - Financing R&D: Stock Markets, Bond Markets, Stock Markets, Leverage and Venture Capital**

<table>
<thead>
<tr>
<th>Country</th>
<th>Stock Market Capitalisation / GDP</th>
<th>Rank</th>
<th>Stock Market Total Value Traded / GDP</th>
<th>Rank</th>
<th>Private bond market capitalisation / GDP</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finland</td>
<td>106.5</td>
<td>3</td>
<td>129.5</td>
<td>4</td>
<td>23.8</td>
<td>9</td>
</tr>
<tr>
<td>Korea</td>
<td>68.4</td>
<td>7</td>
<td>143.2</td>
<td>3</td>
<td>57.7</td>
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<tr>
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<td>45.5</td>
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<tr>
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<td>6</td>
<td>88.8</td>
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<td>41.8</td>
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<tr>
<td>Denmark</td>
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<td>8</td>
<td>50.3</td>
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</tr>
<tr>
<td>Germany</td>
<td>46.4</td>
<td>10</td>
<td>65.5</td>
<td>8</td>
<td>39.6</td>
<td>7</td>
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<tr>
<td>US</td>
<td>124.4</td>
<td>2</td>
<td>259.3</td>
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<td>107.5</td>
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<tr>
<td>France</td>
<td>81.2</td>
<td>5</td>
<td>81.8</td>
<td>7</td>
<td>44.0</td>
<td>5</td>
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<tr>
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<td>127.5</td>
<td>1</td>
<td>175.7</td>
<td>2</td>
<td>16.0</td>
<td>10</td>
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<td>9</td>
<td>60.1</td>
<td>9</td>
<td>25.2</td>
<td>8</td>
</tr>
<tr>
<td>Country</td>
<td>Listed Companies Median Leverage Ratios</td>
<td>Venture Capital % GDP</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>----------</td>
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<td></td>
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</tr>
<tr>
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<td>0.3</td>
<td>4</td>
<td>0.20</td>
<td>5</td>
<td>0.23</td>
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<tr>
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<td>0.27</td>
<td>2</td>
<td>0.07</td>
<td>8</td>
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<tr>
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<td>0.24</td>
<td>3</td>
<td>0.21</td>
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<tr>
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<td>0.3</td>
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<td>0.03</td>
<td>10</td>
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<td>10</td>
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<tr>
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<td>NA</td>
<td>0.13</td>
<td>6</td>
<td>0.30</td>
<td>1</td>
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<tr>
<td>Germany</td>
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<td>7</td>
<td>0.10</td>
<td>9</td>
<td>0.05</td>
<td>9</td>
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<tr>
<td>US</td>
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<td>9</td>
<td>0.38</td>
<td>1</td>
<td>0.12</td>
<td>6</td>
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<tr>
<td>France</td>
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<td>5</td>
<td>0.11</td>
<td>8</td>
<td>0.09</td>
<td>7</td>
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<tr>
<td>UK</td>
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<td>8</td>
<td>0.22</td>
<td>4</td>
<td>0.21</td>
<td>3</td>
</tr>
<tr>
<td>Norway</td>
<td>0.4</td>
<td>2</td>
<td>0.12</td>
<td>7</td>
<td>0.13</td>
<td>5</td>
</tr>
</tbody>
</table>

Source: Authors calculations based on Demirgüç-Kunt et al., World Financial Structure Database (Cols 1-3), Fan et al., 2010 (Col 4) and OECD Science and Technology Indicators (Col 5).
In their analysis of external finance in the 1970s and ‘80s Mayer (1988), Edwards and Fisher (1994) and Corbett and Jenkinson (1994) showed that bank finance was more important source of the flow of funds in Japan than in the UK and the US. Germany was, however, if anything, less reliant on bank finance than the UK and the US. It accounted for 18% of all gross sources of finance in that country compared to 23% in the UK, 34.5% in Japan and 14.7% in the US (see, for example, Corbett and Jenkinson, 1994, Table 2, p.9). This position was even more striking when net sources of finance were calculated by subtracting companies’ acquisition of financial assets from equivalent increases of liabilities.

More recently using recent harmonised national accounts data Byrne and Davis (2002), however, show that significant differences in financial market structures and in the intermediary role of banks exist between the UK and Germany. These differences are broadly consistent with the former falling into the coordinated insider system and the UK into the more dispersed shareholder liberal market economy system. Thus, in terms of household sector ownership of financial assets (adjusted for patterns of institutional holdings in the two countries), the UK household sector held 52% of its assets in the form of equities compared to only 27% in the case of Germany. Bank deposits accounted for 45% of such holdings in Germany and only 25% of assets of the household sector in the UK. Similarly, in the case of Germany loans amounted to 42.8% of the company sectors’ liabilities in 2000 compared to 22.5% in the case of the UK. Even though this marked a substantial decline in the use of loan finance in Germany from just below 70% in 1980 and 1990, it still remained substantially higher than in the UK. By contrast 70% of the UK company sectors' liabilities took the form of equity compared to only 55% in Germany in 2000. Whilst this difference is relatively clear cut, the differences between the UK, France and Italy in terms of these patterns is much less clear with the UK much more like them than Germany (see also Deeg 2009).  

Exhibit 45 based on Carlin (2009) provides further evidence on the nature of share ownership for six European countries for the period 1997-2004. The breakdown focuses on banks, non-financial companies, individuals and the public sector as well as showing the split between foreign and domestic ownership.

Exhibit 45 - Market Capitalisation by Type of Shareholder: Selected European Countries
<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>Foreign</th>
<th>Domestic, of which Financial institutions</th>
<th>of which banks</th>
<th>Non-Financial company</th>
<th>Individual / family</th>
<th>Public Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK</td>
<td>1997</td>
<td>24.0</td>
<td>56.3</td>
<td>0.1</td>
<td>3.1</td>
<td>16.5</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>2004</td>
<td>32.6</td>
<td>51.5</td>
<td>2.7</td>
<td>1.7</td>
<td>14.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Germany</td>
<td>1996</td>
<td>15.3</td>
<td>20.6</td>
<td>9.5</td>
<td>37.5</td>
<td>15.7</td>
<td>10.9</td>
</tr>
<tr>
<td></td>
<td>2004</td>
<td>21.0</td>
<td>15.0</td>
<td>6.6</td>
<td>42.9</td>
<td>14.5</td>
<td>6.6</td>
</tr>
<tr>
<td>France</td>
<td>1996</td>
<td>24.9</td>
<td>27.6</td>
<td>8.7</td>
<td>29.3</td>
<td>12.4</td>
<td>2.6</td>
</tr>
<tr>
<td></td>
<td>2004</td>
<td>39.6</td>
<td>31.4</td>
<td>9.9</td>
<td>16.3</td>
<td>6.3</td>
<td>6.3</td>
</tr>
<tr>
<td>Sweden</td>
<td>1996</td>
<td>31.6</td>
<td>30.3</td>
<td>1.6</td>
<td>10.8</td>
<td>19.1</td>
<td>8.3</td>
</tr>
<tr>
<td></td>
<td>2004</td>
<td>33.9</td>
<td>28.5</td>
<td>3.4</td>
<td>10.5</td>
<td>17.8</td>
<td>9.5</td>
</tr>
</tbody>
</table>

Source: Adapted from Carlin (2009). FESE Share ownership data of companies listed on European stock exchanges. The main information sources are: registers of significant shareholdings and of the entities regulating the market; central banks; national statistical offices; official registries of international transactions; central registry entities.

The difference between the UK and the mainland European economies in terms of bank ownership is at once apparent. It is noticeable that bank holdings have increased from a very low level in the UK over this period. In general, the internationalisation of stock markets is reflected in an increase in foreign shareholdings, particularly in the case of UK, Germany and France. The latter has also seen an unwinding of shareholdings by non-financial companies. There have also been noticeable changes in the role of the public and of the foreign sectors.¹⁷

One of the most striking developments in patterns of equity investment has been the growth of sovereign wealth funds. The increasing significance of sovereign wealth funds, in particular those based on the Middle East economies and in China, have led to major changes in equity holding patterns in Europe and the USA. The largest Sovereign Wealth Funds (SWFs) in the period 1985-2009 were based in Singapore, China and UAE - Abu-Dhabi. Total SWF investments in this period focused on the USA ($58.3bn), China ($32bn) and the UK ($20.8bn). The UK was the third biggest recipient of such funds. The implications for governance and short-termism are not clear. Prior to the financial crisis of 2007-8 SWFs had a track record of passive investment, a desire to avoid political backlash and of being relatively long-term stable shareholders. There is little systematic evidence of impact on decision making or performance of the firms in which they invest (Fotak et al., 2013). Nevertheless, in
the USA the magnitude of SWF investments has led to pressure to protect the liberal market based US economy from what is interpreted as a mercantilist intrusion by state owned or strategically focused sovereign wealth fund investment activity. Such actions include, for example, the call for voting rights to be suspended for sovereign wealth fund holdings until such holdings are returned to non-state ownership (see, for example, Pistor, 2009, and Gilson and Milhaupt, 2008).

Taken together these studies suggest that the UK is characterised by relatively low levels of bank share ownership, and cross shareholdings by non-financial institutions. It has in contract high levels of share ownership by both domestic financial institutions and overseas investors. It thus appears to fit the model of an open stock market based relatively globalised financial system.

There are, however, signs of convergence towards UK in terms of the effects declining cross firm holdings and increased foreign ownership (e.g. France).

7. Share ownership in the UK and other Countries

Given the significance of the stock market and the role of shareholders in the UK, it is useful to examine trends in share ownership in manufacturing in the UK on a consistent basis since 1998 to identify the interests potentially involved in governance issues by virtue of holding equity. Exhibit 46 begins by showing the distribution by total market value of companies quoted on the UK stock exchange classified to the non-manufacturing sector, the financial sector and manufacturing. The share of manufacturing companies in total UK stock market capitalisation fell significantly from 26.3% in 1998 to 16.2% in 2006 in line with the de-industrialisation of the economy. This fall was briefly interrupted by the impact of the financial crisis which led to a relative collapse in the share prices of financial companies and a consequent rise in the shares of manufacturing and to a lesser extent non-manufacturing companies.

Exhibit 46 - The Distribution of the Market Value of UK Publicly Listed Company Shares by Sector, 1998-2010 (in %)
Exhibit 47 shows who holds the shares in quoted manufacturing companies and the evolution of shareholding from 1998 to 2008 (the latest year for which this breakdown is published). The most striking change is in the increasing dominance of overseas shareholdings and the decline in individual holdings and in particular insurance companies and pension funds holdings. There was also a rise in ‘Other Financial institutions’. These include: shares held by brokers and security dealers investing on their own account; venture capital companies; and unauthorized investment and unit trusts. Their share rose significantly in 2000 to 2001 as they purchased shares disposed of by individual pension funds and insurance companies (ONS Share Ownership Survey 2001, p.11). The growth of institutional investment in the OECD economies as a whole has nonetheless been substantial with assets held by institutional investors increasing from around US$25 billion in 1995 to around US$65 billion by 2009. A significant proportion of the overseas holdings will therefore consist of holdings by overseas financial institutions. This trend observed reflects increased holdings by overseas sovereign investment funds as well as the extensive diversification into the UK stock exchange by individuals and institutional investors in other countries. When an analysis is carried out of the largest 100 companies (irrespective of sector) which dominate UK R&D, it turns out that these are the corporations in which the rest of the world’s holdings are greatest. Thus, at the 31st December 2010, 84.6% of the rest of the world’s shareholders in UK quoted companies taken as a whole were within the FTSE 100. Although great interest has centred on the role of newly emerging financial powers such as India, Russia and the Asian economies, it is important to note that the breakdown of the rest of the world’s holdings of UK shares shown in Exhibit 48 reveals that Europe and North
America continue to be the dominant overseas holders of UK equity. Thus the whole of the Asian economies account for only 11% of holdings compared to 56% in North America and 28% in Europe. To the extent that the US which dominates overseas holdings is a stock market based system and to the extent also has a predisposition to short-termist takeover strategies and breaches of trust between stakeholders, little might be expected in terms of socially efficient takeover outcomes (Hatsopoulous et al., 1988, Dallas, 2011; Shleifer and Summers, 1988). The evidence on takeover outcomes does in fact suggest little change in the generally abject performance outcomes from merger and acquisition over time (Cosh and Hughes, 2008; Croce et al., 2011).

The use of asset managers to manage the portfolios of institutional investors in the UK and elsewhere has, moreover, put an emphasis on short-term returns and arms-length dealings with the companies in whose shares they ultimately have ownership rights. This has been intensified by the extent to which institutional investors themselves have chosen to increase their exposure to investments in hedge funds and private equity funds, alongside the use of index management techniques (Kay, 2012). This increase in relatively passive investment on the part of institutional investors has been associated with a substantial fall across the OECD stock markets in the length of time for which shares are held on average. By 2008 in all the main OECD stock exchanges the average holding period was less than a year and in the case of the USA had fallen from 5 years in the 1980s to around 5 months by 2011. This is consistent with a focus on relatively short time windows in the allocation and reallocation of funds by key investors in the UK and elsewhere (Croce et al., 2011, p.7).

Exhibit 47 - Shareholders in Manufacturing Companies
Rest of the world investors owned 41.2% of the value (or £732.6bn) of the UK stock market at the end of 2010, up from 30.7% in 1998.

At 31 December 2010 the UK stock market was valued at £1,777.5bn.

Source: Authors calculations based on ONS Share Ownership Data ONS (2012)

International Convergence in the Internationalisation of Equity
Holdings?

The UK has, as we noted earlier, not been alone in experiencing an increase in the internationalisation of its stock market. In the case of France, the decade following 1995 was associated with a substantial reconstruction of the interlocking shareholding patterns connecting major corporations. Thus, analyses of major networks, such as the BNP network and the Société Générale network, show holdings of these institutions in their so-called “hardcore” industrial groups halved from the late 1990s onwards after being stable or increasing in previous years. This reflects the increasing weight of foreign institutional investors on the French stock exchange (Culpepper, 2005).

The growth of overseas investment in equities has also had a significant impact in Japan. By the early 2000s around 20% of the issued shares of major Japanese corporations were held by foreign institutional investors. This was associated with accompanying changes in governance practices either induced by their presence or introduced in order to make them more attractive for overseas investors (Arikawa and Miyajima, 2007). However, dependence on bank borrowing was maintained as an important element in corporate financing, even though main bank relationships were less well maintained. Nevertheless, it appears that the hard budget constraints associated with bank lending were positively associated with industrial reconstruction attempts in the Japanese economy from the late 1990s onwards. Even so, in some circumstances main bank dependence as opposed to bank lending per se may have shielded some corporations by acting as a “softer” budget constraint (Arikawa and Miyajima, 2007; Ahmadjian, 2007).

Finally, Goyer (2011) throws light on the impact of internationalisation on the variety of capitalism hypothesis by examining the investment allocation of short-term investors in France and Germany. Goyer examines the relationship of the pattern of their investments to the evolution of corporate governance in those countries. He highlights hedge funds and actively managed mutual funds as short-term investors. His analysis focuses on equity stakes above 5% held by these UK and US type investors in French and German corporations from 1997 to 2009. The analysis covers the 60 largest firms in both France and Germany in terms of stock market capitalisation in 2003. The upshot of the analysis is that these impatient shareholders have targeted France over Germany in the ratio of 2:1. Thus out of the top 60 French firms by market capitalisation there were 39 instances of holdings
in excess of 5% in the top 60 French firm compared to only 19 instances in the German case. The pattern of mutual fund holdings which had low average turnover rates in their portfolios (and therefore could be considered medium- or long-term oriented investors) were much closer between the two economies. There were 59 instances in the case of France and 42 in the case of Germany. Goyer attributes this pattern to the relatively constrained chief executive and senior management decision-making capacities in the stake holder based German system compared to the increase in chief executive operating freedom associated with recent evolution in the French corporate governance system. In keeping with the emphasis on complementarity in institutional design he shows the extent to which labour market coordination mechanisms, including vocational training, firm level works council adjustments and experimentation with work organisations have been consistent with the German system’s focus on agreed coordinated change in incremental innovation. This is contrasted with a relatively exclusionary series of corporate governance developments in France.

These analyses suggest some evidence of convergence toward external stockholders based systems in France, but a more resistant response in Japan and Germany (see also Buchanan et al, 2012). The UK differences with the latter two systems may therefore be persistent in coming decades

8. Dispersion of Shareholdings in the UK and other Countries

So far we have focused on shareholding by broad category of holder. Governance systems and interpretations of insider/outsider models also emphasise the dispersion of shareholdings, with more concentrated shareholdings implying potentially greater and more effective force in governance arrangements and, a lower, inclination to ‘passive’ shareholding and arms-length relationships.

Analysis of shareholding dispersion for the US (where the data analysis covers both the top 500 and a larger sample of 3,000 listed companies), the UK, Denmark, Finland, Norway, Sweden, Germany, Japan, South Korea and France are shown in Exhibit 49.
The analysis looks at the distribution of individual holdings of over 10% of the stock of a company. Where there is no single holder of 10% or more, a company is described as having a dispersed shareholding pattern. This is shown in the final column. Only 2% of the German sample and 3.7% of the French sample have companies without a single holding over 10%. In contrast, in the UK over 28% of companies have no such single holding and in the case of the largest 500 US firms that was true in 42% of the cases. In Japan and Korea around 30% of companies have no single block holdings over 10%. Although the holding company structures in those countries are well known, they have a much higher proportion of “dispersed” ownership than is the case in France and Germany. Similarly, the size of the largest holding in Japan and South Korea is much less than is the case in Germany and France and is similar to that in the UK. There is thus no simple reading across from groupings in terms of liberal market and coordinated market economies in terms, for example, of bank finance to groupings in terms of dispersed shareholdings.

**Exhibit 49 - Company Shareholdings: the Median Size of the Largest Shareholding and the Distribution of Companies by the Identity of the Largest Shareholding Over 10%**

<table>
<thead>
<tr>
<th>Country</th>
<th>No. firms</th>
<th>Median largest holding over 10%</th>
<th>Family holdings</th>
<th>A Financial holding</th>
<th>A Non-financial holding</th>
<th>A State holding</th>
<th>% of companies with no holdings over 10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK</td>
<td>687</td>
<td>11.8</td>
<td>17.9</td>
<td>37.0</td>
<td>15.1</td>
<td>1.8</td>
<td>28.2</td>
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<tr>
<td>US</td>
<td>3,070</td>
<td>16.8</td>
<td>47.3</td>
<td>25.9</td>
<td>14.6</td>
<td>0.9</td>
<td>11.3</td>
</tr>
<tr>
<td>US (largest)</td>
<td>500</td>
<td>11.0</td>
<td>12.4</td>
<td>43.2</td>
<td>18.6</td>
<td>0.2</td>
<td>42.6</td>
</tr>
<tr>
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<td>40</td>
<td>15.0</td>
<td>25.0</td>
<td>12.5</td>
<td>25.0</td>
<td>2.5</td>
<td>35.0</td>
</tr>
<tr>
<td>Finland</td>
<td>34</td>
<td>20.7</td>
<td>5.9</td>
<td>17.6</td>
<td>38.2</td>
<td>23.6</td>
<td>14.7</td>
</tr>
<tr>
<td>Norway</td>
<td>42</td>
<td>26.9</td>
<td>16.7</td>
<td>23.8</td>
<td>47.6</td>
<td>7.1</td>
<td>4.8</td>
</tr>
<tr>
<td>Sweden</td>
<td>54</td>
<td>25.0</td>
<td>16.7</td>
<td>38.9</td>
<td>33.3</td>
<td>3.7</td>
<td>7.4</td>
</tr>
<tr>
<td>Germany</td>
<td>240</td>
<td>51.7</td>
<td>26.7</td>
<td>15.4</td>
<td>48.8</td>
<td>7.0</td>
<td>2.1</td>
</tr>
<tr>
<td></td>
<td>Japan</td>
<td>South Korea</td>
<td>France</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>----</td>
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<tr>
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<td>1,036</td>
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<tr>
<td></td>
<td>8.9</td>
<td>12.8</td>
<td>50.0</td>
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<td>58.1</td>
<td>25.0</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>0.2</td>
<td>12.4</td>
<td>2.3</td>
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<td>29.2</td>
<td>31.3</td>
<td>3.7</td>
<td></td>
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</tr>
</tbody>
</table>


Financial institutional holdings are much more important in the UK, US (especially the largest firms), Norway and Sweden than is the case in Denmark, Finland or Germany and, especially, in Japan and South Korea. The counterpart to this is a much greater significance of companies with large non-financial holdings over 10%. Thus, 58% of Japanese companies and 48% of German companies had a largest shareholder holding over 10% of the stock which was a non-financial company. Such companies are much rarer in the UK and the US. This pattern is consistent with a more ‘coordinated’ system in the case of Germany and Japan.

Where holdings over 10% exist, it is noticeable that family holdings still persist so that substantial proportions of companies in all economies, except Finland, have large family holdings over 10%. This is a neglected feature of discussions of varieties of capitalism which deserves more attention than it has hitherto received.

**Summary Conclusion on Financial Systems and Shareholding**

This review of structural features of financing and shareholdings suggest that at a national level we might still expect businesses to be funding R&D and innovation in distinctive national contexts. There has been some convergence in features over time, but what remains perhaps more compellingly is that differences in financial structures and in financing and ownership patterns remain. This is so especially in terms of bank funding and patterns of block holding. This suggests that differences in financing for innovation and the incentives and constraints faced by decision makers therefore may be expected to occur across countries. Moreover, the importance of
internal financing means that national stock markets “matter” insofar as they impose short-term pressures on corporate decision makers to avoid, for example, takeover pressures. The evidence as to whether UK capital markets can be shown to exhibit short-termism in relation to long-term investments in innovation in manufacturing in an absolute or relative sense is discussed in the next section.

9. UK Equity Markets and Short-Termism

“Short-termism in business may be characterised both as a tendency to under-investment, whether in physical assets or in intangibles such as product development, employee skills and reputation with customers, and as hyperactive behaviour by executives whose corporate strategy focuses on restructuring, financial re-engineering or mergers and acquisitions at the expense of developing the fundamental operational capabilities of the business.”

Kay (2012) p.10

The idea that UK capital markets and corporate decision takers exhibit short-termist or myopic attitudes in relation to investment decision is of long-standing. The essence of the argument is simply put. If individuals or businesses are compared and one places a relatively lower value on income streams earned in the future compared to another, then the former exhibits relatively myopic tendencies. There may be a large number of reasons for there to be a discount applied to future earning streams, not least for example concerned with the likelihood of individuals surviving to enjoy them or, more generally, the desire to consume jam today rather than jam tomorrow. For UK investment and financing decisions to be relatively myopic and for this to have a detrimental effect on UK economic growth and welfare, it is necessary to show that UK financial markets and investment decision-makers have a higher rate of discount for future earnings than similar decision-makers in other countries. For this to be a problem, it is also necessary to explain how this has a deleterious effect on the kind as well as on the amount of investment undertaken. In the presence of very high rates of discount of future earning streams, long-lived assets and those which
generate their returns in a disproportionate way towards the end of the path from development through to investment and sales will be disadvantaged. The argument has particular force in relation to investments in R&D. This is because R&D projects are likely to have returns with those returns more heavily concentrated towards the end of their overall life cycle. The link between myopic decision taking and R&D and innovation activity is therefore of particular concern.

Attempts to measure the degree of myopia in the UK and its extent relative to other countries rely on two sorts of evidence. One sort is based on questionnaire and interview analyses of the attitudes of corporate decision-makers. This focuses on the extent to which they perceive that their actions are judged by financial market investors in a way which will penalise long-term investments compared to short-term investments. It is important to note that these perceptions may not need to be based on an objective state of affairs in the market. It is sufficient that they are perceived to be the case for corporate decision taking to be effected. An alternative approach is to look at movements in share prices and assess the extent to which they follow a path which would be consistent with applying “appropriate” rates of discount to the future earning streams and final capital values of the companies which issue them. This approach basically involves discounting future dividends back to current values using rates of discount which would be “appropriate” in the sense that they reflect a risk free rate and a risk adjustment element based on the observable risk characteristics of the relevant company whose decisions are being examined. To the extent that current share prices are less than would be expected using those discount factors, then the implication is that the market is discounting future returns too heavily. It is acting myopically and attributing too low a present value to the future earnings stream.

We examine evidence for the UK on both these bases and also review comparative international evidence. This allows us to see whether there is evidence of short-termism in terms of perception or practice, whether it has been increasing, and whether the UK appears to be more susceptible to short-term or myopic influences than other countries.

**9.1 Survey Based Evidence of Short-Termism**

Grinyer et al (1998) surveyed the finance directors of 246 Times 1,000 companies in
Exhibit 50 tabulates the responses to 7 statements capturing potential short-termist perceptions. The exhibit shows the percentage agreeing strongly or agreeing; the percentage disagreeing or disagreeing strongly; and the balance between those two. There is a substantial spread of opinions, but in each case the balance agreeing or strongly agreeing with perceptions of short-termism is positive.

<table>
<thead>
<tr>
<th>Statement</th>
<th>(1) % Agree or Strongly Agree</th>
<th>(2) % Disagree or Strongly Disagree</th>
<th>Balance (1) - (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top management will not accept proposals for increasing expenditures in research and development if it results in a significant fall in profits from the previous year</td>
<td>49.2</td>
<td>34.3</td>
<td>14.9</td>
</tr>
<tr>
<td>Top management will not accept proposals for increasing expenditures in research and development if it results in a significant shortfall in earnings growth below capital market expectations</td>
<td>53.3</td>
<td>30.2</td>
<td>23.1</td>
</tr>
<tr>
<td>Top management will not undertake a product development project if it results in a significant fall in profits from the previous year</td>
<td>43.8</td>
<td>35.1</td>
<td>8.7</td>
</tr>
<tr>
<td>Top management will not undertake a product development project if it results in a significant shortfall in earnings growth below capital market expectations</td>
<td>49.4</td>
<td>29.5</td>
<td>19.9</td>
</tr>
<tr>
<td>A 10% increase in expenditure on research which results in a 15% reduction in the net earnings figure expected by the capital markets will adversely affect a company’s share price</td>
<td>56.0</td>
<td>17.4</td>
<td>38.6</td>
</tr>
<tr>
<td>The undertaking of an innovative project which results in a 15% reduction in the net earnings expected by the capital markets will adversely affect a company’s share price</td>
<td>67.1</td>
<td>18.1</td>
<td>49.0</td>
</tr>
<tr>
<td>The capital market values companies primarily by reference to the current year’s prospective earnings</td>
<td>66.3</td>
<td>21.0</td>
<td>45.3</td>
</tr>
</tbody>
</table>

Source: Authors calculations based on Grinyer et al. (1998) Tables 2 and 3, pp. 19-20. Views are those of the Finance Director of 246 Times 1000 UK Companies responding to a postal questionnaire survey in 1991. Of the sample 47% operated in 2 or more industrial sectors, 37% were in manufacturing, 9% in property and building firms and 7% in retailing. There were no significant differences in responses by sectors, business, size or speed.
Demirag (1998) conducted a postal survey of directors of 226 of the largest companies listed on the UK R&D Scoreboard for 1992. His analysis consists of responses to a number of statements reflecting the perception of capital market short-termist pressures. It then provides a cross-correlation of those perceptions of pressures with directors’ statements of factors, such as sales, profits and company objectives, influencing the sizes of their R&D budgets.

Exhibit 51 shows the responses to the questions relating to perceptions. These provide quite a mixed picture and the balance between those agreeing or agreeing strongly with suggestions of short-termist pressures are outweighed by those disagreeing with the perception of short-termist pressures in three out of the five statements considered. By itself this is weak evidence for the existence of perceptions of short-term pressures. However, Demirag is more interested in the spread of perceptions and how differences in perceptions may in turn be related to the directors’ statements of the factors which influence the scale of their R&D activities.

Exhibit 51 - R&D intensive Company Directors’ Perception of Pressures from Capital Markets in the UK 1992

<table>
<thead>
<tr>
<th></th>
<th>(1) % Agree or Strongly Agree</th>
<th>(2) % Disagree or Strongly Disagree</th>
<th>Balance (1)-(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is difficult to provide profit figures which satisfy shareholders while funding R&amp;D projects which are right for the business</td>
<td>31.5</td>
<td>45.5</td>
<td>-14.0</td>
</tr>
<tr>
<td>We frequently experience pressures for short-term profit maximization from our owners and therefore sometimes cancel projects which ought to be undertaken in the long-term interest of the company.</td>
<td>33.4</td>
<td>48.3</td>
<td>-15.1</td>
</tr>
<tr>
<td>Analysts and major shareholders are able to make decisions based upon adequate technically informed analysis of the quality and value of R&amp;D undertaken</td>
<td>22.4</td>
<td>52.2</td>
<td>-29.8</td>
</tr>
</tbody>
</table>
Analysts and major shareholders often exhibit a strong bias against high-risk long-term research in favour of lower-risk short-term product development

<table>
<thead>
<tr>
<th></th>
<th>51.1</th>
<th>19.5</th>
<th>31.6</th>
</tr>
</thead>
</table>

My company is perceived as being a possible candidate for take-over and this exacerbates the problem of pressures to deliver short-term profits at the expense of long-term R&D

<table>
<thead>
<tr>
<th></th>
<th>20.5</th>
<th>56.5</th>
<th>-36.5</th>
</tr>
</thead>
</table>

Source: Authors calculations based on Demirag (1998) Table 2, p. 205. 226 R&D Scoreboard Companies.

Exhibit 52 reproduces Demirag's findings on the factors affecting the R&D budgets decision. The first two rows relate to last year's sales and last year's profit respectively which may be taken as short-term decision criteria, whereas the third row (company objectives for growth and market share) are interpreted as more longer term objectives. Answers are on a scale ranging from 1 of no importance to 5 crucial. The balance of companies scoring 4 or 5 compared to those scoring 1 or 2 suggests short-termism in relation to profits, but not in relation to the other two. When a correlation analysis is carried out, linking perceptions of pressures from capital markets to factors determining the size of the R&D budget, those businesses most likely to have strong perceptions of market short-termism in Exhibit 52 on each measure are also those which are emphasising last year's sales and profits as key factors determining the size of the R&D budget.

Exhibit 52 - R&D intensive UK Quoted Company Directors’ Views of Factors Determining the Size of the R&D Budget 1992

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Control mechanisms</strong></td>
<td>Of no importance</td>
</tr>
<tr>
<td>Rate each of the following as determinants of the size of the R&amp;D budget</td>
<td>1  2  3  4  5</td>
</tr>
<tr>
<td>Last year’s sales</td>
<td>37  59  69  47  10</td>
</tr>
<tr>
<td></td>
<td>16.7%  26.6%  31.1%  21.2%  4.5%</td>
</tr>
<tr>
<td>Last year’s profit</td>
<td>23  35  73  68  22</td>
</tr>
<tr>
<td></td>
<td>10.4%  15.8%  33.0%  30.8%  10.0%</td>
</tr>
</tbody>
</table>
Marston and Craven (1998) also carry out a survey of corporate perceptions of short-termism for the year 1991. They survey a sample of 547 companies by market value drawn from Datastream and the Financial Times UK top 500 list of companies in 1991. This sample is wider than the sample considered by Demirag since it is not focused solely on those companies listed as significant R&D intensive companies. They focus on responses to a set of questions concerned with finance directors’ perceptions of the attitudes of three types of financial analysts. These are sell-side/brokers’ analysts, buy-side analysts and fund managers. The first category are essentially stockbrokers working in research departments, the second category are investment analysts working for institutional investors and the third category are individuals working for institutional investors who may have analysts reporting to them. They report the results for sell-side analysts and buy-side analysts and these are shown in Exhibit 53. The evidence presented shows that only a minority of finance directors perceive the market as too short-termist. The paper therefore goes on to examine the extent to which perceptions of short-termism amongst the sample are related to company characteristics which indicate vulnerability to the effects of short-termism. They find that directors of companies in the capital goods sector are significantly more likely than other companies to perceive that sell-side analysts are not sufficiently interested in long-term prospects and that sell-side analysts are over-concerned with the short-term profit opportunities. This was not the case in relation to buy-side analysts or fund managers. They were unable to find any relationships between size of company and short-term perception nor between share price volatility or the ratio of marketable value as a proxy of vulnerability to takeover. In a multivariate analysis allowing for interactions between these indicators of company vulnerability, the capital goods sector variable was again the most important. Moreover, a positive relationship with share volatility also emerged.

<table>
<thead>
<tr>
<th>Company objectives for growth, market share, etc.</th>
<th>6</th>
<th>9</th>
<th>37</th>
<th>107</th>
<th>63</th>
<th>222</th>
<th>3.955</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.7%</td>
<td>4.1%</td>
<td>16.75</td>
<td>48.2%</td>
<td>28.4%</td>
<td>100.0%</td>
<td></td>
</tr>
</tbody>
</table>

Source: Authors calculations based on Demirag (1998). 226 R&D Scoreboard Companies
<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>Balance (1)-(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree or Strongly Agree</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sell-side analysts are too concerned with short-term profit</td>
<td>59.9</td>
<td>22.1</td>
<td>37.8</td>
</tr>
<tr>
<td>opportunities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disagree or Strongly Disagree</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sell-side analysts are not sufficiently interested in the long-</td>
<td>40.3</td>
<td>40.1</td>
<td>0.2</td>
</tr>
<tr>
<td>term prospects of my company</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buy-side analysts and fund managers are too concerned with short-</td>
<td>21.1</td>
<td>52.9</td>
<td>-31.8</td>
</tr>
<tr>
<td>term profit opportunities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buy-side analysts and fund managers are not sufficiently</td>
<td>13.8</td>
<td>65.7</td>
<td>-51.9</td>
</tr>
<tr>
<td>interested in the long-term prospects of my company</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Authors calculations based on Marston and Craven (1998) Table 2, p. 242. 547 companies from Datastream and Financial Times Top 500 in 1991

Kay reviews a wide range of other qualitative evidence on the forces which lie behind the perceptions and whether the way in which shares are managed has exacerbated the situation over time. He argues that shareholders have become increasingly divorced from active involvement in the companies whose shares they hold and that these and other factors have been conducive to arms-length passive short-termism shareholder behaviour.

He concludes that

“Asset managers – specialist investment intermediaries – have become the dominant players in the investment chain, as individual shareholding has declined and pension funds and insurers have responded to incentives (including demographic changes and regulation) to reduce their investments in equities. Asset managers typically play a key role in exercising the attributes of share ownership most relevant to company decision-making: the right to vote and the right to buy or sell a given share.”

Kay (2012) p.11
“The appointment and monitoring of active asset managers is too often based on short-term relative performance. The shorter the timescale for judging asset manager performance, and the slower market prices are to respond to changes in the fundamental value of the company’s securities, the greater the incentive for the asset manager to focus on the behaviour of other market participants rather than on understanding the underlying value of the business.”

Kay (2012) p.11

“We conclude that the quality – and not the amount – of engagement by shareholders determines whether the influence of equity markets on corporate decisions is beneficial or damaging to the long-term interests of companies. And we conclude that public equity markets currently encourage exit (the sale of shares) over voice (the exchange of views with the company) as a means of engagement, replacing the concerned investor with the anonymous trader.”

Kay (2012) p.10

Taken as a whole, this evidence suggests pervasive perceptions of short-termist pressures by UK corporate decision takers and that these are of long standing. Moreover, they are consistent with objective trends in the underlying manner and nature of the management of equity assets in the UK stock market. These perceptions and asset management practices are consistent with a financial market which will inhibit the kind of long-term capital intensive innovation expenditure necessary for manufacturing to thrive.

9.2 Econometric Estimates of Short-Termism

Miles (1993) analyses a sample of 477 UK non-financial firms over the period 1980-1988. The sample accounts for around a half of the market value of all UK quoted companies. Current share price is explained in terms of future dividends and end year share price. These are represented in the estimated equation of the
determinants of current share prices by instrumental variables based on lagged share prices, lagged dividends and lagged earnings per share. The effects of myopia are identified by comparing the estimated coefficients on these future earning streams with a discount rate based on a company risk adjusted market rate of discount. A coefficient of less than 1 implies myopia. The analysis shows a consistent pattern of short-termism. The results imply “that discount rates that apply to longer term cash flows (expressed at an annual rate) are more than 15 full percentage points higher than discounts applied to short-term flows. Put another way, discount rates applied to longer-term flows are about double the rates applied to shorter term flows.” (Miles, 1993, p. 1390). In every year, apart from 1981, the parameter measuring the degree of short-termism was below 1. The average estimated value of the short-term myopic parameter was around 0.9 which implies that cash flows accruing six months in the future are underestimated by 5% relative to non-myopic discounting. Cash flows which do not accrue for five years are “systematically underestimated by almost 40%”. (Miles, 1993, p. 1394). In effect, projects with five years to maturity would need to be around 40% more profitable using the myopic discount rates than would be optimal using non-myopic rates.

Haldane and Davies (2011) update the econometric analysis of Miles (1993). Their data set consists of a panel of 624 firms listed on the UK FTSE and the US S&P stock markets over the period 1980-2009. The sectors include both financial and non-financial industries. As in Miles (1993) lagged share prices, lagged dividends per share, and lagged earnings per share are used as instruments for future dividends and equity prices along with estimates of company risk measured by beta values and gearing. They estimate a similar index of short-termism parameter which indicates the extent to which current share prices differ from those which would be estimated based on the future path of expected dividends given the companies’ specific risk profile and an estimate of the risk free rate of discount. Their analysis clearly shows that there was statistically significant evidence of short-termism in the period 1995-2004. This was not the case in the previous decade. This suggests that short-termist influences had increased in importance in the two decade period covered by their analysis. They do not report results separately for the UK and the US so their results for the 1980s are not directly comparable with Miles (1993).

As with Miles (1993) the results of Haldane and Davies are not only statistically significant, but economically significant. They amount to excess discounting of between 5% and 10% per year. These have significant economic impacts. They illustrate the impact of excess discounting of 5% and 10% per year compared
to rational discounting (i.e. the risk-free rate plus a company specific premium). They consider an investment project costing $60 and with $10 cash-flow in each of 10 years returned to the investment. Under rational discounting the cumulative discounted cash-flows rise to $61 by year 9. With mild myopia the discounted cash-flows only surpass $60 after 15 years and with severe myopia the $61 payback criterion is never met.

The increase in myopia identified in these studies has been accompanied by a significant increase in stock market volatility in both the UK and the US. This is shown in Exhibit 54.

### Exhibit 54 - Volatility in many equity markets has increased in recent years

Volatility in many equity markets has increased in recent years

Number of days per year that daily price change exceeded 3%

- **United States**
  - 1980: 1
  - 1985: 5
  - 1990: 3
  - 1995: 2
  - 2000: 4
  - 2005: 1
  - 2010: 3

- **United Kingdom**
  - 1980: 2
  - 1985: 5
  - 1990: 2
  - 1995: 0
  - 2000: 4
  - 2005: 2
  - 2010: 3

Source: McKinsey (2013) based on data from Datastream; McKinsey Global Institute

### 9.3 Short-Termism: UK compared to other Countries

There are very few direct international comparisons of short-termism. Black and
Fraser (2002), however, analyse the relationship between movements in the stock market indices of major stock markets in Australia, Germany, Japan, UK and USA over the period 1973 Quarter 1 to 1994 Quarter 1. They also disaggregate the analysis for the UK into five broad sectors (resources, general industries, consumption goods, services, and financials). They follow a similar methodology at a country level to that followed by Miles (1993) and Haldane and Davies (2011) using individual company data. They find that in each economy the estimated short-termism coefficient is less than 1 and therefore each market displays myopic characteristics. The UK has, however, by far the highest short-termism estimate. The analysis by sector for the UK shows that the most significant effects of short-termism are found in the financial sector, although each of the sectors displays significant indications of myopia. For the UK the expectations of future cash flows five years into the future are only 13.2% of the rational valuation or ‘correct’ value. The short-termist estimate for the UK at a country level is much higher for than those reported by Miles and Haldane and Davies using individual company data. Even allowing for a major overestimate it is substantially below the estimates for the other countries. Thus in Germany, for example, the market expectations of future cash flows five years in the future are 96% of the rational or ‘correct’ value. Both Germany and Japan exhibit lower short-termist tendencies than the US and the UK, although the differences with the US are smaller than those with UK. These results are similar to those of Cuthbertson et al. (1997) for the period 1918-1993.

Exhibit 55 - Qualitative Evidence on perceptions and Quantitative Estimates of ‘Short-Termism’ in the UK

<table>
<thead>
<tr>
<th>Authors</th>
<th>Time Period</th>
<th>Sample</th>
<th>Method</th>
<th>Illustrative Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grinyer et al. (1998)</td>
<td>1991</td>
<td>246 of Times top 1000 companies</td>
<td>Qualitative survey of perceptions</td>
<td>Balance of answers indicate directors agreement with statements that UK capital market is “short-termist”</td>
</tr>
<tr>
<td>Demirag (1998)</td>
<td>1992</td>
<td>226 large companies on UK R&amp;D scoreboard</td>
<td>Qualitative survey of perceptions</td>
<td>Directors perceptions of short-term pressures on R&amp;D spend is positively related to use the last year’s sales and profits as determinant of R&amp;D budgets</td>
</tr>
<tr>
<td>Marton and Craven</td>
<td>1991</td>
<td>547 large UK companies</td>
<td>Qualitative survey of perceptions</td>
<td>Directors of capital goods companies more likely to perceive that sell-side stock market analysts emphasise short-term performance</td>
</tr>
<tr>
<td>Source</td>
<td>Time Period</td>
<td>Sample</td>
<td>Method</td>
<td>Short-termism Estimate</td>
</tr>
<tr>
<td>--------</td>
<td>-------------</td>
<td>--------</td>
<td>--------</td>
<td>------------------------</td>
</tr>
<tr>
<td>Miles 91993)</td>
<td>1980-88</td>
<td>477 UK non-financial companies</td>
<td>Econometric estimate of short-termism</td>
<td>Discount rates applied to long-term earnings flows are twice as high as those applied to short-term flows</td>
</tr>
<tr>
<td>Haldane and Davies (2011)</td>
<td>1980-2009</td>
<td>624 large UK and US financial and non-financial companies</td>
<td>Econometric estimate of short-termism</td>
<td>Significant excess discounting of long-term earnings of between 5% and 10% per annum in the period from 1995</td>
</tr>
<tr>
<td>Black and Fraser (2002)</td>
<td>1973-1994</td>
<td>Stock Market Index Movements Australia, Japan, Germany, US, and UK</td>
<td>Econometric estimate of short-termism</td>
<td>All sample countries show some myopic excess discounting with UK greatest and Germany and Japan the least</td>
</tr>
</tbody>
</table>

Source: See text for full discussion of the results and their interpretation.

Exhibit 55 summarises the qualitative and quantitative studies we have reviewed. Taken together, these studies provide substantial evidence for both absolute and relative short-termism in UK financial markets. This would imply a bias against long-term innovation intensive investment in UK manufacturing.

10. Does the Short-termism of the UK National Financial System matter for the Financing of Innovation?

There have been a small number of studies which have explicitly focused on micro-analyses of cross country differences in the financing of innovation at the corporate level and which include the UK for comparison with other economies. Bhagat and Welch (1995) analyse the determinants of corporate R&D in a sample of 1,484 large companies in US, Canada, UK, Europe and Japan in the period 1985-90. They find few differences between US, Canadian, UK and European firms in terms of the influence of debt, stock returns, cash flow or tax liabilities. However, they observe significant differences in relation to Japanese companies where previous debt levels were positively rather than insignificantly or negatively related to R&D expenditures.
They conjecture that this suggests that the high debt firms in Japan were not concerned about the implications of the intangibility of R&D in relation to bankruptcy whereas firms in the other countries and in particular small firms in those countries protected their R&D investments by avoiding accumulating large amounts of debt. This is consistent with an insider interpretation of funding for R&D.

Bah and Dumontier (2001) analysed evidence on the cross sectional pattern of corporate policy choices of firms that spend a high proportion of their net revenue on R&D. They compare the behaviour of such R&D intensive firms with non-R&D intensive firms in samples drawn from the US, the UK, Japan and Europe for the financial year ending in 1996. There are around 900 intensive R&D and non-intensive R&D firms in their samples. They find that on a univariate basis there is little to choose between Europe, the UK and the US in terms of their reliance on short-term debt financing which is higher in the case of R&D intensive than non-R&D intensive firms. This, however, is not the case in Japan and they argue that this supports the notion that in the Japanese insider system there is a substantial reduction in information asymmetries between managers and debt providers which enables them to rely to a greater extent on long-term than short-term debt. Thus in the case of Japan alone they find that R&D intensive firms exhibit the same proportion of short-term debt and the same level of dividend payments as non-intensive R&D ones.

Bond, Harhoff and Van Reenen. (2003) analyse the relationship between cash flow, investment in fixed capital and R&D using a sample of 900 firms drawn from the German and UK manufacturing sectors in the period 1985 and 1994. They find that whereas cash flow is positively related to investment in R&D intensive firms in the UK, this is not the case in Germany implying that the latter variety of capitalism has a financial system which is conducive to investment to R&D intensive businesses. This effect manifests itself in the sense that British firms which do engage in R&D are a self-selected group which significantly better cash flow and where financing constraints tend to be less binding.

Carlin and Mayer (2003) analyse 14 OECD countries (Italy, Japan, Finland, Spain, US, Canada, Australia, Netherlands, France, Denmark, Sweden, Germany, Norway and the UK). They consider the comparative growth and the investment characteristics of 27 industries in those countries over the period 1970 to 1995. They estimate equations which relate respectively growth, fixed investment and R&D to a variety of institutional factors. The analysis is carried out using cross sectional
regressions. The right-hand side variables include proxies for information disclosure, concentration of the banking sector, concentration of ownership, each measured at country level, and variables measured at an industry level which capture the extent to which equity financing, bank financing and inputs from other stakeholders are important for industry. Industry measures of the dependence of equity finance are based on US data, bank loans on Japanese data, and skills on German data. The results for R&D are only available for 15 of the 27 industries and for 14 countries. They find that equity dependent industries have lower R&D shares in countries with highly concentrated banking systems and the same is true in relation to R&D shares in skill dependent industries. On the other hand ownership concentration is associated with high R&D in industries which depend on equity and with faster growth in skill dependent industries. It thus appears “concentrated, rather than dispersed, ownership is associated with faster growth of equity and skill dependent industries and with higher R&D shares of equity-dependent industries. These results suggest that it is concentrated (rather than dispersed) shareholders who provide commitments to external investors and stakeholders. (Carlin and Mayer, 2003, p.217). They find, moreover, that the interaction between country financial and ownership structures and industry characteristics is not important for fixed investment whereas it is for R&D. They draw on the work of Rajan and Zingales (2001) to interpret this in terms of the difficulty of collateralising R&D compared to fixed investment. Countries with underdeveloped financial markets and institutions would have to rely far more on collateral. Equally, it could be argued that insider information based systems would face fewer difficulties in supporting decisions to invest in R&D.

Honoré, Munari and van Pottelsbergh de la Potterie (2011) analyse the relationship between governance ratings and R&D intensity in a sample of 279 European companies with R&D activity. They measure corporate governance using an index constructed by a private sector rating agency firm (Vigio). This index combines indicators relating to board of directors’ practices, audit and internal controls shareholders’ rights and executive remuneration. The database covers the period 2003-07 and includes 1,315 observations on firms from the UK, Ireland, Germany, France, Belgium and Luxemburg. The firms are in financial services, consumer services, industrial goods and services and the utilities energies sector. The corporate governance index scores more highly practices relating to implementation of shareholder protection measures. They find that corporate governance characteristics related to the performance of the board of directors committees and to audit and control are not related to a firm’s propensity to invest in R&D. On the other hand, high corporate governance scores related to enhanced shareholder protection
devices and executive remuneration systems have a negative impact on the propensity to invest in long-term R&D projects. They conclude therefore that finance related governance practices intended to enhance responsiveness of corporate strategy to short-term expectation of financial markets will be detrimental to long-term R&D investments. Therefore UK may be expected to do worse and this is consistent with the intra UK study of Driver and Guedes.

In a similar vein Belloc (2013) argues that strong shareholder protection will weaken rather than encourage R&D investments, because their higher specificity will be less highly valued by dispersed shareholders. Enhanced shareholder protection will increase short-term shareholder activism by highly diversified institutional shareholders as well as strengthen the position of minority shareholders. His analysis for 48 countries in the period 1993 to 2006 shows that stronger shareholder protection is associated with larger stock market capitalisation, but also with lower innovative activity. These results are robust to controlling for a variety of other factors and for the sensitivity of the results to a variety of measures of legal systems and innovation performance and imply a weaker performance for the UK.20

Manigart et al. (2002) analyse the determinants of the required rate of return in a sample of 200 venture capital companies (VCCs) in the US, UK, Netherlands, France and Belgium. They show, ceteris paribus, that location of a VCC in the UK or the US is associated with imposing a higher required rate of return. This is consistent with relatively high myopia in those countries.

Mayer et al. (2005) analyse qualitative data for 500 venture capital funds in UK, Israel and Germany in 2000 and for Japan in 1999. Their results are not consistent with simple market versus bank based analyses. For example, in terms of the type of investment activity, VCs in Israel and Japan invest predominantly in IT and software whereas in the UK and Germany there is a more even distribution across broad sectors and the two countries are much more alike than Germany is to Japan. Thus, manufacturing and chemicals are relatively predominant in the latter two countries. Israel has the highest concentration in the single sector, namely IT and software. Similarly analyses of the stage of investment and the significance of institutional holdings of VCs show that the UK and Germany are again more alike than Germany and Japan. The early stage investment by Israeli VC funds (compared to the UK which tends to focus on the latest stages) is inconsistent with the Black and Gilson (1998) view that the stock markets are particularly suited to the higher risks of
early stage investments compared to more bank oriented traditional late stage investments. Equally, the similarity of the VC patterns of investment in Germany and the UK are inconsistent with the views, for example, of Allen and Gale (1999) who argue that banks exploit particular advantages in acquiring information in sectors and firms where there is a high degree of agreement about opportunities and returns whilst stock markets permit a wider range of diverse views to be incorporated in investments. This is inconsistent with the similarity with VC investments in Germany and the UK (see also Lerner; 2009). It is in terms of the importance of the internationalisation of VC activity that a striking result emerges for the UK, The UK, has the largest VC market in this sample, and it is also the most international. Around 60% of funds in the UK have some investment outside the UK whereas two thirds of the German funds invest only in Germany or in a German region.

Munari et al. (2010) analyse 1,000 publicly quoted companies in France, Germany, Italy, Norway, Sweden and the UK for the mid-1990s. They find that widely held businesses tend to have higher R&D activity than more tightly held, and in particular family held, businesses. Most significantly from the point of view of the varieties of capitalism hypothesis they find that this positive impact is much weaker in the UK than in other European countries. They link this to the absence of large block shareholders in the UK to act as a buffer against short-term performance pressures in its more dispersed market based governance systems.

Miozzo and Dewick (2002) provide an interesting sector based qualitative assessment of the relationship between corporate governance and innovation. They focus on detailed interviews with major contractors in the construction industry in Denmark, Sweden, Germany, France and the UK. They analyse share ownership and control patterns, the proportion of income derived from overseas, the degree of centralisation and decentralisation of management structures and the forms of cross shareholding. They focus on the way that patterns of ownership finance and management structures affect the interrelationships between stakeholders. They contrast, in particular, the UK where the contractors are principally owned by institutional investors with strong pressures to maintain dividends with Germany and Sweden. In Germany banks, non-financial firms and workers have involvement in an overall governance structure and labour market context. This facilitates contractors’ involvement in long-term research and development and stable labour force contracts. In Sweden banks and family ownership combined with large internal cash flows and overseas expansion have also allowed contractors to develop long-term commitments to R&D while still maintaining dividend payments to shareholders. In
contrast the UK exhibits strong short-term pressures to maintain dividends and a lack of more structured governance relationships. This has led to a greater focus on the management and control of construction processes and cost reduction and a lesser focus on investments in new production technologies.

Taken as a whole the studies reviewed and summarised in Exhibit 56 imply a bias against financing long-term innovation related investment in the UK. The evidence has a number of specific implications.

Exhibit 56 - Cross-country studies of corporate effects on R&D

<table>
<thead>
<tr>
<th>Authors</th>
<th>Focus of study</th>
<th>Sample</th>
<th>Illustrative findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bhagat and Welch (1995)</td>
<td>Determinants of corporate R&amp;D.</td>
<td>1,484 large companies in US, Canada, UK, Europe and Japan, 1985-90</td>
<td>Few differences between firms in the influence of debt, stock returns, cash flow or tax liabilities, but significant differences in Japanese companies where high leverage is positively linked to R&amp;D</td>
</tr>
<tr>
<td>Bah and Dumontier (2001)</td>
<td>Corporate policy choices of firms that spend a high proportion of their net revenue on R&amp;D.</td>
<td>900 R&amp;D intensive and non R&amp;D intensive firms from US, UK, Japan and Europe, 1996</td>
<td>European, UK and US similar in reliance on short-term debt financing which is higher in the case of R&amp;D intensive than non-R&amp;D intensive firms. This is not the case in Japan, which has relatively higher reliance on longer-term debt.</td>
</tr>
<tr>
<td>Bond, Harhoff and Van Reenen (2003)</td>
<td>Relationship between cash flow, investment in fixed capital and R&amp;D.</td>
<td>900 German and UK manufacturing firms, 1985 and 1994</td>
<td>Cash flow is positively related to investment in R&amp;D intensive firms in the UK, but not in Germany</td>
</tr>
<tr>
<td>Carlin and Mayer (2003)</td>
<td>Comparative growth R&amp;D and investment characteristics of sectors in different financial systems</td>
<td>27 industries in 14 OECD countries, 1970-95</td>
<td>Concentrated, rather than dispersed, ownership is associated with faster growth of equity and skill dependent industries, and with higher R&amp;D shares in industries dependent on equity. Equity dependent industries have lower R&amp;D shares in countries with highly concentrated banking systems</td>
</tr>
</tbody>
</table>
The first is that the higher sensitivity of R&D to cash flow in the UK compared to Germany is consistent with the view that UK firms avoid raising external finance by relying more on internal cash flow and may thus be restricted by their own internal profit flows.

Second, variations in financial institutional variables across countries appear to affect R&D more than investment and therefore the specific features of the UK may bear more heavily on its R&D performance.

Third, “high” corporate governance ratings enhance the responsiveness of corporate strategy to short-term financial market expectations and will be detrimental to longer term R&D. Therefore the UK which has ‘high’ rankings may do worse in terms of R&D and this is supported by analyses of the impact of higher shareholder protection.
Fourth, the absence of large equity blockholdings is associated with a weaker ability to resist short-termist financial market presence, and such holdings are rare in the UK.

Fifth, it appears that UK venture capital companies (along with those of the US) use higher required rates of return than is the case in the Netherlands, France and Belgium. This is consistent with relatively myopic behaviour in the UK. More qualitative analysis focusing, inter alia, on sectoral patterns of investment and distribution of funds across different stages of investment finds fewer systematic differences between the UK and other countries. However, the extreme openness of the UK VC market in terms of flows of funds into and out of the UK means that compared to Germany, for example, the UK VC market is much less focused on the domestic economy, and the development of UK businesses.

11. Financial Systems and Long-Term Investment: Future Scenarios

The evidence on financial structures that has been reviewed suggests a number of trends that will persist in the medium and longer term.

Internal financing of investment will continue to be a core source of funding for investment in tangible and intangible assets including R&D in the foreseeable future. Reforming governance to have a stewardship rather than a shareholder value focus will play a crucial role in resisting increasing pressure for short-term returns which may rise as a result changes in patterns of long-term investor behaviour.

Thus, the World Economic Forum (2011) provide estimates of the distribution of the assets of long-term investors and their likely future investment stance. Their estimates of current assets of currently long-term oriented investors are as follows: private family investment offices (US$1.2 trillion), endowments/foundations (US$1.3 trillion), sovereign wealth funds (US$3.1 trillion), Defined benefit pension funds (US$11 trillion), Life Insurance (US$11 trillion).
In the future (see World Economic Forum (2011) pp.67ff) they expect family offices, endowments/foundations and sovereign wealth funds to increase in significance. This reflects sales of family businesses and the increasing wealth of high net worth families; donations from such families to endowments; and in the case of sovereign wealth funds, the growing reserves and account surpluses to be transferred to sovereign wealth funds and the increased interest in establishing such funds by emerging economies. On the other hand the traditionally powerful defined benefit pension fund allocation is likely to decline because of the shift from defined benefit plans to defined contribution plans; the associated closure and sales of such schemes to third parties and increases in defined contributions. In addition, ageing populations in countries with established pension systems will involve increased pay-outs and lower proportions of funds under management. They do not anticipate significant changes in life insurance funds and their management as a proportion of the total. This is because they foresee a trade-off between increased wealth in particular and emerging markets which will increase assets and the ageing populations of economies which will increase pay-outs.

In addition to these trends in terms of underlying demographics, a number of constraints are forecast to have an adverse effect on long-term investing capacity. These are related to a reducing appetite for uncertain long-term outcomes on the part of family offices, increasing pressures from trustees and beneficiaries in the case of endowments and foundations as they seek to move away from illiquid investments, and an offsetting movement on the part of sovereign wealth funds to slow down investment in risky and illiquid investments. Pension fund investments in the longer term are forecast to be adversely affected by the regulatory changes, including mark-to-market accounting, stricter funding and solvency requirements and maturing liabilities. Similar changes associated with solvency regulations are forecast to affect the policies of life insurers.

The implications for equity markets of these changes are quite substantial and have already led to a substantial reduction in the involvement of pension funds exposure to equities.

In the UK these fell as a % of total pension fund assets from around 70% in the 1990s to less than 40% by 2008 (World Economic Forum (2011) Fig. 18, p.69). In the case of the UK these changes have as we have seen earlier led to an overall decline in the proportion of institutional investment holding of equities in the UK. There has
as we have seen been a counterpart rise in the proportion of ownership of UK assets which takes the form of overseas holdings. These, however, include pension and insurance fund and other long-term investors from overseas (as well as corporate and sovereign wealth holdings). Thus institutional investment per se may not have fallen so dramatically as the broad trends in shareholding patterns in the UK indicate. On the other hand, the fact that these investors are overseas means that it is even less likely that they will be engaged in more direct relationships with the companies whose shares they hold than UK institutional investors have been. There is also evidence to suggest that they are under similar short-termist pressures as their UK counterparts.

In the medium to long-term the prognosis for the UK in the absence of counterveiling policy initiatives is for persistent short-termist pressures and a lower rate of long-term innovative investment in manufacturing than might otherwise be the case.

12. Convergence in Financial Systems and the Finance of Innovation

The idea that convergence in financial and governance systems across capitalist economies was inevitable as a result of the superior performance of the English legal origin stock market based systems has been widely canvassed (see, for example, Baumol, 2002, and Hansmann and Kraakman, 2004). The evidence we have reviewed suggests that this convergence and the triumph of a particular system of stock market financial relationships and governance is exaggerated. Significant differences remain between financial systems. Whilst these differences do not lead to simple characterisations in terms of ideal types of varieties of capitalism, they do suggest significant differences between nation states.

These differences are significant in relation to policy debates about the future structure of industrial economies in the aftermath of the global financial crisis. Economies, such as the UK and the US which are seeking to rebalance their economies away from the services sector, face major challenges in terms of the financing of long-term R&D. To the extent that the evidence we have reviewed suggests that more coordinated patient capital structures are productive in terms
of investment in R&D and innovation, then care is required in focusing on systems which depend on stock market financing and arms-length relationships alone. The importance of the public sector in the US and the UK also points to the importance of the potentially strategic role that public sector investment can play in ‘liberal’ market economies.

Even if market and/or socio-political forces for convergence persist, the evidence suggests that there will be significant obstacles to overcome in imposing a one-size-fits-all solution. First of all, in some cases, aggressive attempts to impose shareholder activism through, for example, hedge fund activity has in the case of Japan led to a reassertion of the benefits of firm-centric governance structures. This has re-emphasised the importance of the firm and its long-term performance rather than the short-term financial needs of particular groups of equity holder (see, for example, Buchanan et al., 2012). More generally, analyses which focus on issues of complementarity between institutional forms in different components of the economic system have emphasised that change in one dimension may be slow. They will also be ineffective unless they are combined with, or are congruent with, changes in other sectors. Thus, for example, the introduction of shareholder norms of behaviour associated with dispersed stock market systems may be ill-suited to the development insider systems emphasising more coordinated forms of labour market process. They may also sit uneasily alongside governance structures which embed stakeholder representation and participation. The process by which new or changing norms of behaviour associated with shareholder maximisation may infiltrate previously coordinated or insider systems will also be diverse. They will depend on the role played by groups with varying elements of power, both in the corporate governance system and in the political system more generally (see, for example, the discussions in Gordon and Roe, 2004; Amable, 2009; and Dore, 2000). To the extent that these differences persist and influence the financing of research and development and innovation, we may expect differences in innovation performance across firms and their national contexts to also persist. In the case of the UK this would imply a persistent constraint on long-term investment in innovation in manufacturing

A critical issue for the UK is whether perceptions and the finance and governance system can evolve away from short-termism pressures. Different national systems, however, have embedded in them factors which will predispose them to react to shocks in ways which are consistent with the established beliefs and practices of the firms and workers in those economies (Hall and Gingerich, 2009). Thus in response to an external shock a liberal market economy, it may be hypothesised will seek to
pursue even more liberal market policies by more deregulation. On the other hand, in coordinated market economies the reverse is posited to be true.

In thinking about the next 30 years, the question is whether a liberal market economy such as the UK will be better served by more of the same or by an attempt to alter structural characteristics which inhibit the future development of the economy. This is precisely the area in which the debate about industrial policy is now being conducted in the UK and elsewhere. It should lead to a fundamental re-examination of the way in which intermediate coordinating organisations can themselves be created in LME varieties of capitalism.

Current industrial policy debates emphasise the need to develop strategies around the allocation of resources to strategic sectors. Insofar as those sectors and technologies involve the accretion and consolidation of wide ranges of knowledge and expertise then the development of institutions (e.g. catapult centres) which have the potential to assist in these connections, become a central part of industrial policy.

The great interest in such intermediate institutions in the UK (and the USA) at present indicates the extent to which this message is being absorbed into industrial policy debates. In this connection the fact that economies characterised as liberal market economies and coordinated market economies each contain within them sectors which are characterised as both experiencing radical and incremental innovation means that a view will need to be taken on a much more granular basis of the particular factors likely to inhibit or encourage innovation in each sector. Basing policy on an aggregated view of how the economy looks on average, or on its inherited structure from the past seems less helpful. The challenges facing the development of such a disaggregated and medium to long-term policy in the UK are discussed in a companion report for the Future of Manufacturing Project (Crafts and Hughes, 2013), which is included as Paper 8 in this e-book.
Endnotes

1. Lazonick has, however, argued that patient financial commitment is essential for the support of a productive innovation process in a stock market system and that when this is lacking the “virtuous” circle is broken. In his view an appropriate framework for analysing the function of the stock market must be broken down into the analysis of five sub-functions, namely the creation, control, and combination of assets, patterns of compensation and the role of cash and the implication of these for high technology industries in particular. In a series of contributions he has argued that the way these functions operate may vary significantly both over time, in a particular national system and within the corporations in different sectors. His analysis in particular points to the view that the US stock market in recent decades has been over-focused on cash and compensation in the pursuit of managers’ self-interests. This has been at the expense of the development of a framework of financing and governance capable of supporting long-term investment in high-risk innovative environments (see, for example, Lazonick, 2007, 2009 and the references therein).

2. The institutional characteristics measure employment protection; the average length of employment contracts; collective bargain coverage; occupational training; graduate rates in tertiary education; cross-border and domestic joint ventures and alliances relative to GDP; the market value of cross-border mergers and acquisitions relative to GDP; and stock market capitalisation of indigenous firms (excluding mutual funds) as a share of GDP.

3. BIS, 2011b, also provides comparisons UK across several input and output dimension with US, Sweden and Germany. The UK lags each in terms of the two output variable analysed (Triadic Patents and % of firms with new to the market product innovation).

4. The UK ranks higher on the more complex Global Innovation Index which combines inputs and outputs, but this reflects its relatively high performance in terms of citations of academic papers, and university quality. It scores less well in terms of labour productivity growth (rank 102 in 2011) and gross capital formation rated 127th in 2012).
5. The Innovation Output index is a weighted composite of patents per billion GDP; trade performance in medium and high tech goods; trade performance in knowledge intensive services, and % of employment in fast growing firms in innovative sectors (EC 2013).


7. Such indicators compare the share of an industry in total exports in a country to the share of that industry in total country exports in the whole sample of countries being analysed. Allen et al. (2006) scale this variable to have values between -1 and +1.

8. There is in general a problem with classifying whole sectors as radical or incremental, since sectors may be characterised by a relatively preponderance of each type at different stages of the sectors’ development or transformation (see e.g. Taylor, 2004).

9. They use export shares or indices of revealed comparative advantage for sectors grouped into high-tech and medium high-tech sectors respectively based on an OECD classification using measures of R&D and technological intensity.

10. It is interesting to note that there is some evidence that overseas investment by UK companies in the US has allowed them to access knowledge spillovers from the US R&D effort and enhance their productivity performance (Griffith et al., 2006).

11. The latest data for public sector funding of R&D in manufacturing in the US is for the year 2000. Data is not available for Germany on this basis after 1999. However, in that year the share of the public sector in funding manufacturing R&D was exactly the same as the public sector share in funding business R&D as a whole. The data for Germany shown in the exhibit assumes that the share of manufacturing R&D financed by the public sector in that year was the same as the public sector share of business R&D as a whole.
12. Differences across countries may reflect differences in the extent to which subsidiaries are specifically created to carry out R&D, but there is no systematic comparative evidence to suggest whether this biases the results in Exhibit 30.

13. For a detailed review of UK merger activity in the period 1950-1990 see Hughes (1993) and for a review covering subsequent UK studies and the role of governance in (not) influencing outcomes see Cosh and Hughes (2008) and Cosh, Guest and Hughes (2008) and for the impact of takeovers on innovation per se see Desyllas and Hughes (2010).

14. International comparisons of financial and governance systems are fraught with empirical and conceptual difficulties. Divergent results can occur both because conceptual categories differ or are very loosely defined. Major efforts at standardising national accounts flows of financial funds data and at developing measures of financial markets scale and depth have improved matters over time (see, for example, Byrne and Davis, 2002; Demirgüç-Kunt and Levine, 2004). So too have major efforts been made to increase the range and quality of data on share ownership patterns and the ‘quantification’ of legal codes (see, for example, La Porta et al., 1998, 2008; Armour et al., 2009; Gugler et al., 2004; Goyer, 2010; Morgan, 2010). Nevertheless significant differences between studies may be accounted for by differences in the availability and form of data and more recent studies are more likely to reflect the impact of more and better data.

15. The exhibit focuses on the first decade of the current century. It is therefore affected by the financial crash. A separate calculation for the period 1991-2000, however, revealed almost identical rankings so that the characterisation based on the first decade of this century is a relatively stable one.

16. As we have discussed above in the case of the UK, the global financial crisis of the first decade of the 21st century was followed by a significant fall in bank lending to the corporate sector as the banking sector retrenched. Large corporations responded by increasing equity and especially bond issues largely supported by the Bank of England’s active intervention to support this market. On the other hand, initial public offerings or first time equity issues collapsed. The crisis in the case of the UK and elsewhere has led to particular difficulties in the case of small and medium-sized enterprises where the pressure on banks to reconstruct their balance sheets has increased the tension between pressures to
increase lending for smaller businesses and the pressure to improve the stability of the banking system (see, for example, Wehinger, 2012).

17. See, for example, O’Sullivan (2003); Goyer (2011) and Culpepper (2005).

18. See, for example, BIS (2011a) and the discussion and sources listed in Miles (1993), Myners (2001), Haldane and Davies (2011), Kay (2012) and Rose (2013).

19. Hall and Lerner (2010) review a large number of studies which are predominantly focused on analysing financial constraints on R&D funding within countries, but also include some international comparisons. They conclude that “Anglo-Saxon” economies, with their thick and highly developed stock markets and relatively transparent ownership structures, typically exhibit more sensitivity and responsiveness of R&D to cash flow than continental economies; third, and much more speculative, this greater responsiveness may arise because they are financially constrained, in the sense that they view external sources of finance as much more costly than internal, and therefore require a considerably higher rate of return to investments done on the margin when they are tapping these sources.” This is consistent with a short-termist bias in these markets. They also suggest that this excess responsiveness may be a rapid response to demand signals and that this ‘excess’ responsiveness occurs “because firms are more sensitive to demand signals in thick financial equity markets; as a result they conclude that it is a definitive explanation of the “excess sensitivity” result awaits further research.” This alternative explanation is less consistent with the qualitative evidence we have reviewed on management perceptions or asset management practices and in the market for corporate control than the myopia explanation. Nor would it easily explain the increasing volatility of equity markets over time.

20. This is confirmed in the case of the UK in the study by Driver and Geddes (2012). They investigate the determinants of R&D expenditure in a sample of high R&D expenditure UK listed companies in the period 2000-05. They form a corporate governance index for each company which is the sum of a set of 0/1 dummy variables over 6 different governance components. These components include board size, the separation of CEO and chair of the board, whether or not the company observes the Higgs code of practice, whether a clear majority of directors are independent or non-executive directors, whether or not the bonus
component of total executive pay is over 20%, and whether or not the stock options component of total compensation is over 30%. They also separately calculate a set of stock ownership variables which, again, is a set of dummy variables equal to 1 where at least one shareholder is holding more than 5% of the total stock or where the chief executive share ownership is over 1%. They report an inverse relationship between R&D and ‘better’ corporate governance.

References


KNOWLEDGE SPILLOVERS AND SOURCES OF KNOWLEDGE IN THE MANUFACTURING SECTOR:

Literature review and empirical evidence for the UK

BY DR ELIF BASCAYUSOGLU MOREAU & DR QUIAN CHER LI
Knowledge Spillovers and Sources of Knowledge in the Manufacturing Sector: Literature Review and Empirical Evidence for the UK

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Contents

Knowledge Spillovers and Sources of Knowledge in the Manufacturing Sector: Literature Review and Empirical Evidence for the UK

Abbreviations

Executive Summary

1. Concepts and Definitions

2. Internal Knowledge Assets

3. External Knowledge Assets and Knowledge Spillovers

3.1 Formal Collaborations and Cooperations

3.2 Measuring Spillovers

4. The Spatial Dimension and Mechanisms of Spillovers


6. The Use of Knowledge Sources in Innovation by UK Manufacturing Firms

7. Cooperation on Innovation Activities in UK Manufacturing Firms

7.1 Cooperation in Innovation at the National Level

7.2 Cooperation in Innovation at the International Level

8. Absorptive Capacity in UK Manufacturing Firms

8.1 Absorptive Capacity – Sectoral Disparity

8.2 The Spatial Distribution of Absorptive Capacity in UK Manufacturing

9. The Nexus between Knowledge Sources, Innovation Input and Output

10. Concluding Remarks
Executive Summary

This report was commissioned by the Government Office for Science to conduct a review of knowledge spillovers and sources of knowledge in the manufacturing sector.

This first part of the report delivers a literature review on knowledge spillovers and sources of knowledge in the manufacturing sector, on the basis of the research specification.

Section 1 defines and discusses the key concepts that are used throughout the review. Section 2 focuses on the importance of internal knowledge and knowledge-assets in determining productivity and competitiveness. It covers recent developments in the theoretical and empirical literature.

The evidence reviewed indicates the importance of intangible investments in firms’ internal knowledge assets. Besides investments into in-house R&D and the share of R&D personnel that have been traditionally considered as the main component of the internal knowledge assets, recent evidence highlights the importance of other types of intangible investments. UK firms spend more on non–R&D intangible assets than
on R&D; 50% of UK firms spend on non-R&D intangible assets, whereas only 8% spend on R&D (Awano et al. 2010).

The impact of in-house R&D investments on firm productivity is substantial; the rate of return on R&D is estimated to be around 14% - 40% for UK firms. Intangible assets account 10%-20% of the labour productivity growth at the firm level (Riley and Robinson 2011). Firms with patents have growth rates that are on average 10% higher than firms without patents (Hall et al. 2012). Holding a trademark or a design right is associated with a performance premium of 16-17% (Greenhalgh and Rogers 2007; Bascavusoglu-Moreau and Tether 2011). At the national level, intangible capital accounts for 15-20% of labour productivity growth (Marrano, Haskel, and Wallis 2009).

Another concept that is very closely linked to intangible assets is the notion of absorptive capacity. Throughout the report, the weight of evidence emphasises the importance of firms’ absorptive capacity in increasing internal capabilities and in benefiting from external knowledge sources. The reviewed evidence suggests that more direct measures of absorptive capacity as constructed by Harris and Li (2009) are clearly needed.

Section 3 focuses on the importance of external knowledge and knowledge-assets (i.e., knowledge spillovers) in determining productivity and competitiveness. We first review the literature on engaging in formal collaborative agreements and using external knowledge sources. Evidence suggests that UK firms are increasingly engaging in formal collaboration with different types of partners. The reviewed studies indicate that vertical linkages, through customers and suppliers are considered as the main sources of knowledge for innovation in UK firms. Firms that are more open to external collaboration are more likely to innovate and innovate better. Vertical linkages and cooperation within the business group is found to account for 50% of the total factor productivity growth (Crespi et al. 2008) and cooperation with higher education institutes, for 16.3% (Harris, Li, and Moffat 2012).

Firms can also benefit from knowledge developed by other firms and/or institutions without engaging in collaborative agreements or economic transactions. These are spillover effects, because the user who benefits does not pay the full economic cost of producing them. The review of the literature suggests that spillovers may vary in importance and occur through different routines. Trade appears to be an important
channel of spillovers. There is some evidence on R&D spillovers via imports, and exporting is found to be associated with learning effects and higher productivity. Regarding FDI-spillovers, although foreign-owned firms are found to be more productive than their domestic counterparts, the empirical evidence reviewed is mixed. The positive impact of FDI-spillovers is closely linked to the domestic firms’ absorptive capacity and the type of FDI.

Section 4 focuses on the spatial dimension of knowledge flows and the identification of the specific mechanisms by which spillovers are transmitted and their variation across locations. The literature surveyed indicates a positive effect of being located in a cluster, however; studies reviewed present a mixed picture of local knowledge spillovers. There is some evidence on the importance of labour market dynamics and social interaction at the level of the individual in firms’ and clusters’ knowledge creation processes. However, the positive impact of knowledge spillovers seems to be closely dependent on sectoral and institutional characteristics. The main mechanism of knowledge diffusion is through labour mobility. This finding highlights the importance of the tacit knowledge embedded in people. In this sense, clusters act as a hub for the attraction of global talents. High-technology clusters are found to be more likely to generate knowledge spillovers. However, the nature of the technology is closely related to the issues of intellectual property. Excessive non-disclosure agreements act as a barrier to knowledge diffusion. The regional science-base and university-industry interactions also arise as an important factor. Geographic proximity appears to facilitate personal interactions, however knowledge flows are not confined to geographical spaces; successful firms access knowledge regardless of its geographical location, through digital communication technologies. However, local and global networks should not be seen as conflicting, they both have important but different and sometimes complementary roles to play (Christopherson, Kitson, and Michie 2008). Successful clusters enable local firms to be embedded simultaneously in knowledge exchanges at different geographic scales.

The second part of the report presents an empirical analysis of firms’ knowledge sourcing and cooperation behaviour for innovation activities in the UK manufacturing sector, using establishment-level data from recent four waves of the UK Innovation Survey (henceforth UKIS), covering the 2002-2010 period. In terms of inter-sectoral differences, manufacturing firms represent the largest users of knowledge from most sources. Suppliers and clients represent main sources of knowledge to around half of manufacturers. Higher tech manufacturers leverage knowledge across a wider spectrum of sources at a higher rate than lower tech ones. Also there is an
especially notable difference in the percentage of high tech respondents (vis-à-vis low or medium-low tech firms) stating that they utilise knowledge transfer from HEIs, scientific journals and conferences.

In terms of the evolution of firms' knowledge sourcing behaviour over time there was a general downward trend in the utilisation of knowledge within most categories across the economy. The decline seemed most substantial during the 2006-2008 period of economic recession before an incremental upswing was seen in the most recent 2008-2010 period.

Suppliers, clients and competitors are very important sources for respondents across all UK regions. Furthermore, evidence suggests that there is a very strong correlation between the size of a manufacturing firm and its orientation of knowledge linkage with external sources. In contrast, the relationship between firm age and knowledge sourcing may not be a distinctive one.

Foreign subsidiaries in UK manufacturing routinely outperform their indigenous counterparts in leveraging external knowledge across all sources. Exporters are also found to be often twice as likely to make use of various knowledge sources in innovation; and even exporters in the low tech industries systematically utilise various knowledge sources at a higher rate compared with their non-exporting high tech counterparts.

Within manufacturing suppliers and clients are by far the most important means of international cooperation across all sectors and many sectors appear to have especially low values for cooperation with HEIs and government at the global level. Advanced manufacturers are around twice as likely to cooperate internationally with all partners relative to average manufactures.

Following the approach developed in Harris and Li (2009), we have constructed an empirical multi-index of absorptive capacity to measure a firm's ability to internalise and appropriate external knowledge for innovation activities. Overall manufacturing firms appear to have the highest absorptive capacity for general external knowledge (the principal type of absorptive capacity) and also a noticeable advantage in its absorptive capacity for national and international cooperation, and business strategy and practice. Another sector that stands out is the Knowledge-Intensive Services
(KIS) which dominates in its absorptive capacity for business strategy and practice, national and international cooperation and is second only to manufacturing in its principal capacity for general external knowledge.

A number of ‘heat maps’ showing performance of absorptive capacity for UK manufacturers within local authorities provide powerful insights into the geographical variation. In terms of the absorptive capacity for general external knowledge, it is suggested that the areas with strong manufacturing component tend to have higher capacity. The areas with higher level of capacity in the manufacturing sector are seen around the UK periphery (Scotland, Wales and parts of Northern England) as well as strong areas embedded within the Midlands, South East and South West.

Our findings here echo those highlighted by Harris and Moffat (2012c), who found that knowledge spillovers in the UK were distributed across the country and not just confined to the Capital or other major cities. As to the capacity for cooperation at the international level, the strongest areas are similar to those found at the national level - there are clusters of relative strength in Wales and Scotland, the North East and a band in the Midlands. Given the ‘hub’ effect of London and the South East, these regions perform more strongly on their absorptive capacity for business strategies and practices. Lastly, in terms of the regional absorptive capacity for specialist knowledge from HEIs and government, Scotland is associated with higher scores as are the North East and North West and the South of Wales.

Lastly, we also investigate the nexus between knowledge sources, cooperation partners used in innovation activities, formal R&D strategies, innovation output, and finally IP protection strategies. Our results suggest that product innovators are also likely to be process innovators (and vice versa), and that the more radical innovators (with ‘blue sky’ innovations) turn to combine ‘make’ (intramural R&D) and ‘cooperation’ in their R&D investment strategy. Further results suggest a clear and close association between ‘blue sky’ innovation and exploiting value from such path-breaking innovation by registering patents and industrial designs. In terms of firms’ cooperation behaviour in innovation, the firms engaged in cooperation with one national partner tend to also collaborate with other types of partners at national level; and those that participate in cooperation with overseas partners in one form are also more likely to engage in international cooperation in another form.

Overall, our results suggest that manufacturing (especially higher tech or advanced)
makes the strongest use of knowledge sources and is associated with highest levels of absorptive capacity followed by Knowledge-Intensive Services (KIS), where the UK has a strong comparative advantage. There is evidence that manufacturers responded to external market conditions in their utilisation of knowledge sources and more specifically, firms were making greater use of knowledge sources in response to the recent economic recession. However, the challenge for all sectors of the economy will be to continue to make the best use of all sources of knowledge as economic conditions in the UK and abroad improve.

1. Concepts and Definitions

The ability to create, store and use knowledge allows firms to exploit the unique properties of knowledge to gain competitive advantage. Knowledge has similar properties to public goods, in the sense that it is non-rival and non-excludable. The non-rival nature of knowledge implies that it is not depleted by use. Its non-excludable nature means that once knowledge is created, it is impossible -or very costly- to prevent others to benefit from it. A useful feature to bear in mind regarding the nature of knowledge is the distinction between codified and tacit knowledge. Codified or rule based knowledge can be written down and stored, whereas tacit knowledge is acquired by experience and resides with the individual as know-how and experience.

One approach to assess the impact of knowledge on competitive performance begins with the work of Griliches (1979; 1986). He analyses a knowledge production function which defines the relationship between the inputs into the production of knowledge and its output that is economically useful new technological knowledge (Acs, Anselin, and Varga 2002). The rate of production of economically new knowledge (innovation) depends on the existing stock of “knowledge” assets, including the labour force committed to research and development (R&D) activities. Knowledge assets can be broadly defined as a combination of tangible and intangible assets. Tangibles are the assets that are physical in nature, such as land, machinery, equipment and capital. Intangibles are the assets that are not physical in nature, defined as “non-material factors that contribute to enterprise performance in the production of goods or the provision of services, or that are expected to generate future economic benefits to the entities or individuals that control their deployment” (Eustace 2000, 31). In their seminal work on the measurement of intangibles, Corrado et al.
(2005) categorize investments in intangible capital into three broad categories; computerised information, innovative property and economic competencies. Here we follow a simpler categorisation, and distinguish between formal and informal intangible assets, depending on the nature of knowledge involved. Formal intangible assets relate to codified knowledge and are often proxied by R&D expenditures or intellectual property data, such as brands, patents or trade-marks. Informal intangible assets refer to tacit knowledge, and they are, therefore, more difficult to measure (Howells 1996).

Besides internal assets, firms also need external inputs to innovate. There are various ways for the firms to access external knowledge. They can obtain external inputs for knowledge via market transactions; they can buy external knowledge assets from other firms and organisations by paying the full price or they can collaborate by means of formal agreements. Or they can benefit from external knowledge without getting involved in any form of formal transactions via externalities.

Externalities arise when the activities of one agent induce (positive or negative) external effects on other agents in the market that are not fully reflected or “internalized” in market prices (Conlon et al. 2012). This idea of capturing benefits from other parties’ investment in knowledge without paying its full price is called “spillovers” by the economists; knowledge can “spill over” from one firm/institution to another. For example, competing firms that imitate a successful innovation, and firms whose own research benefits from observation of the successes and failures of others’ research efforts all gain such spillover benefits (Jaffe 1998).

The concept of spillovers is very closely related to the public good nature of knowledge. As knowledge is non-rival, spillovers imply that the benefit of the new knowledge to society as a whole outweighs the loss of potential economic gains the knowledge-creator could have made from keeping it. However, the creator’s ex-post inability to capture the full benefits of new knowledge will diminish the incentive to invest in developing knowledge in the first place. At the limit, the benefits of an activity may be so diffuse that no individual or firm would undertake the activity on their own.

Spillovers can arise in multiple ways. They can be intentional on the part of the innovator such as the publication of scientific papers, or can be disclosed in a patent
as a quid pro quo for the granting of monopoly rights, or they can occur despite any desire of the inventor via the sales of the new product (Jaffe 1998).

However, in order to recognise, access, adopt and benefit from these external sources of knowledge, via either market internalised transactions or by externalities, firms need to have a certain level of absorptive capacity. Absorptive capacity is defined as capability to identify, assimilate, and exploit external new information. It is this combination of internal tangible and intangible assets with external sources of knowledge through the absorptive capacity of the firm that yields innovations which, in turn, will increase firms’ (and regions, sectors, countries) productivity.

Analyses of firms’ access to external knowledge have frequently emphasized the importance of spatial proximity, particularly knowledge spilling from one firm and/or institution to another. Despite its public good properties, knowledge does not flow instantaneously from one firm/organisation to another. The transfer of tacit knowledge especially requires direct, face-to-face interaction, and hence, geographical proximity (Audretsch and Feldman 1996). These positive externalities arising from geographical proximity are generally called agglomeration economies. In the context of innovation activities, it leads to local knowledge spillovers defined as “knowledge externalities bounded in space”, which allow firms close to key knowledge sources to be more innovative than firms located elsewhere (Breschi and Lissoni 2001b). Specific modes of local interactions between firms, universities, venture capitalists may generate specific informal institutions, and enhance information flows among agents located within the same geographical agglomeration (Doring and Schnellenbach 2006). Because the ability to absorb and adopt new knowledge depends on the institutional framework which may vary across regions, these differences may help to account for growth rate differences.

A schematic framework describing the relationships between knowledge, innovation and productivity is schematised in Figure 1. We will discuss internal knowledge assets, as well as absorptive capacity in the following section. The third section will focus on external knowledge assets and spillovers. The final section will explore the geographic proximity, particularly the mechanisms through which the knowledge flows.
2. Internal Knowledge Assets

Tangible assets, such as capital and labour, are no longer the generating factors of competitive advantage as they are easily available. Intangible assets have been receiving increasing attention as a key input in firms' performance (Goodridge, Haskel, and Wallis 2012; Awano et al. 2010; Borgo et al. 2012; Corrado, Hulten, and Sichel 2009; Harris and Moffat 2012a).

Within the formal intangible assets, investment in in-house R&D and the share of R&D personnel have been considered as the main input to explain firms (sectors, countries)’ innovative performance (Griliches 1986; Griliches 1979). However, R&D spending is highly skewed; only a very small number of firms report investing in in-house R&D. Bloom and van Reenen (2002) show that 12 largest UK firms account for 80% of R&D expenditures between 1968 and 1996. Similarly, Criscuolo and Haskel (2003) report that the median firm in the two UK waves of Community Innovation Survey (UKIS) 1994-1996 and 1998-2000 spends nothing on R&D. These numbers are confirmed at the aggregate level by a recent survey on the conduct of R&D in the UK by business, government and higher education sectors (Hughes
and Mina 2012). Hughes and Mina (2012) report that the largest 10 business R&D spenders account for 34% of all UK R&D in 2009, and the largest 50 spenders for 56%. They also show that business and government expenditures on R&D (as a percent of GDP) have been decreasing whereas the share of higher education is increasing since 1990s.

Other formal intangible assets include factors over which legal rights have been assigned, such as patents, marks and copyrights. UK firms’ patenting behaviour also follows the trends in R&D spending. Bloom and van Reenen (2002) show that most of their sample (firms who had at least one patent during 1968-1996) involved in very small amount of patenting activity, with half the sample receiving more than 25 patents. This finding has been confirmed for a more recent period of analysis (1996-2008); only 1.7% of all registered firms in the UK patent (Hall et al. 2012). The distribution of trademarks seem more homogenous; in a sample of 1600 large UK firms Greenhalgh and Rogers (2007) report that the average propensity to apply for a UK trademark is around 42% in manufacturing.

Overall, intangible investment is reported to have risen sharply in the UK, especially in the areas of computerised information, design, training and business process re-organisation (Marrano, Haskel, and Wallis 2009). A recent survey aiming to measure the investments of UK firms in intangible assets find that the incidence of non–R&D intangible spending is much more widespread than R&D spending; 50% of UK firms spend on non-R&D intangible assets, whereas only 8% spend on R&D (Awano et al. 2010). The overall level of intangible spending is considerable, around £39bn in this survey, distributed between software (£11bn), branding (£10bn), R&D (£10bn), training (£7bn) and design and business process improvement (£1bn each) (Awano et al. 2010).

Table 1: Intangible Investment in the UK per category as a share of total intangible investments

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<td></td>
<td>£bn</td>
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<td>Software</td>
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<td>development</td>
<td>£6bn</td>
<td>11%</td>
<td>£10bn</td>
<td>14%</td>
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<tr>
<td>R&amp;D</td>
<td>£8bn</td>
<td>14%</td>
<td>£9bn</td>
<td>13%</td>
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These findings confirm that firms can gain access to knowledge elsewhere, and that formal intangible assets are not the only source of knowledge creation. Other types of investments not counted as R&D are also important such as organisational, network or human capital. For example, Corrado et al. (2005) categorize investments in intangible capital into three broad categories; computerised information, innovative property and economic competencies. Computerised information includes knowledge embedded in computer software programs and computerised databases. Innovative property corresponds to knowledge acquired through scientific R&D and non-scientific inventive and creative activities. Economic competencies relate to the value of firm-specific human and structural resources. Having assessed the extent of intangible assets, we will now review the studies evaluating the impact of different intangible assets.

In one of the first studies evaluating the impact of R&D on UK productivity, Wakelin (2001) estimates that every additional pound spend on R&D will increase the output by £1.27, for the 1988-1992 period. However, the rate of return on R&D (estimated around 29%) varies considerably following firms’ innovation history and sectoral characteristics. Innovative firms spent more on R&D expenditure relative to sales than non-innovating firms (2.3% against 0.8%) and have a higher rate of return than the R&D expenditure of non-innovating firms, particularly in sectors which are net users of innovations (Wakelin 2001, 1089). Griffith et al. (2006) calculate a rate of return for the R&D of 14% for the mean firm in the sample, Bond et al. (2003) estimate the R&D rate of return to 38%, and Rogers (2009) find that it ranges between 40% to 58% in the manufacturing sector (See also Table A1 in the Annex). Positive effect of in-house R&D expenditure on firm productivity via higher innovative sales have been confirmed by other studies based on the UK wave of the Community

<table>
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<tr>
<th>Design</th>
<th>£13bn</th>
<th>23%</th>
<th>£13bn</th>
<th>19%</th>
<th>£15bn</th>
<th>16%</th>
<th>£23bn</th>
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<tr>
<td>Mineral exploitation/ Copyrights</td>
<td>£3bn</td>
<td>5%</td>
<td>£3bn</td>
<td>4%</td>
<td>£2bn</td>
<td>2%</td>
<td>£4bn</td>
<td>3%</td>
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<tr>
<td>Branding</td>
<td>£5bn</td>
<td>9%</td>
<td>£7bn</td>
<td>10%</td>
<td>£12bn</td>
<td>13%</td>
<td>£15bn</td>
<td>11%</td>
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<tr>
<td>Training</td>
<td>£12bn</td>
<td>21%</td>
<td>£15bn</td>
<td>22%</td>
<td>£21bn</td>
<td>22%</td>
<td>£27bn</td>
<td>20%</td>
</tr>
<tr>
<td>Organisational Capital</td>
<td>£9bn</td>
<td>16%</td>
<td>£12bn</td>
<td>17%</td>
<td>£17bn</td>
<td>18%</td>
<td>£31bn</td>
<td>22%</td>
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<tr>
<td>All intangibles</td>
<td>£56bn</td>
<td></td>
<td>£69bn</td>
<td></td>
<td>£95bn</td>
<td></td>
<td>£138bn</td>
<td></td>
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<tr>
<td>All tangibles</td>
<td>£67bn</td>
<td></td>
<td>£62bn</td>
<td></td>
<td>£87bn</td>
<td></td>
<td>£104bn</td>
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Source: London Economics’ adaptation from Haskel et al. (2011) (Conlon et al. 2012)
Galindo-Rueda and Haskel (2005) combine the data from Annual Business Inquiry (ABI) and National Employer Skills Survey for England, and explore the effects of workplace skills on firm productivity. They show that one percentage point increase in high skilled employees leads to 0.30% increase in firm-level productivity in manufacturing. Riley and Robinson (2011) combine individual occupation and wage data from the Annual Survey of Hours and Earnings (ASHE) and the labour Force Survey with data from Business Structure Database (BSD) and Annual Business Inquiry (ABI). Following Corrado et al. (2005)’s categorisation of intangible investments, authors use employees’ occupations and earnings to estimate the impact of intangibles on labour productivity growth during 1998-2006. They find that organisational capital and investments in R&D contributed an equal share of 0.13% - 0.17% to productivity growth, while the contribution of the ICT capital was estimated between 0.08% - 0.13%.

Regarding the impact of patent activities, both Bloom and van Reenen (2002) and Hall et al. (2012) point to positive effects of patenting on firm performance. Equally, using trademarks as a form of formal intangible assets, Greenhalgh and Rogers (2007) show that stock market values are positively associated with firms’ trade mark activities, and that manufacturing firms with a trademark both at UK and European level has a performance premium of 16%. Similarly, holding a design registered in the UK in the late 1990s and early 2000s is found to be associated on average with a performance premium of 17%, although this positive effect has disappeared for the most recent years (Bascavusoglu-Moreau and Tether 2011).

At a cross-country level, recent evidence shows a correlation between total factor productivity growth and intangible investments (Ark et al. 2009; Corrado, Haskel, and Jona-Lasinio 2011). At the macro level, intangible investments are reported to be as important as tangible investments, or even more important in case of US and UK. Corrado et al. (2005) capitalise intangibles and expand the traditional growth model to include intangible input and output. Authors’ findings show that the exclusion of intangibles assets in national accounts entails underestimation of labour productivity growth by 10-20 % in the US (Corrado, Hulten, and Sichel 2009). With the same methodology, Marrano, Haskel and Wallis (2009) find that 15% of labour productivity growth is accounted for intangible capital deepening in 1979-2005 and 20% in 1995-2003.
Another concept that is very closely linked to intangible assets and tacit knowledge is the notion absorptive capacity (For an extensive review of intangible assets and absorptive capacity, see Harris & Moffat (2012)). Cohen & Levinthal (1990, 569–570) first coined the term ‘absorptive capacity’, defining it as: ‘the firm’s ability to identify, assimilate and exploit knowledge from the environment’. Subsequently they adopted a slightly wider view as: ‘… an ability to recognize the value of new information, assimilate it, and apply it to commercial ends’ (Cohen 1989, 128). Putting the two together provides a ‘classical’ view of absorptive capacity: the identification and recognition of new information, both internal and external, and its assimilation, application and exploitation for commercial ends.

The concept of absorptive capacity emphasises on the fact that the external knowledge is not automatically and effortlessly absorbed by the firm, and therefore, is not equally absorbed by all firms (Fabrizio 2009). Existing literature has considered various activities that can contribute and proxy firms’ absorptive capacity, such as investments in R&D (Wesley Cohen and Levin 1989), firms’ basic research (Rosenberg 1990; Dyer and Singh 1998), routines (Zahra and George 2002), technological overlap (Mowery, Oxley, and Silverman 1996) and collaborations with universities (Cockburn and Henderson 1998).

Although the theoretical definitions and discussions on the notion of absorptive capacity are numerous, the empirical estimation of the concept itself is very scarce. Most of the empirical studies proxy absorptive capacity with the in-house R&D investments or the share of the R&D personnel. These proxies fail to capture the realisation and accumulation of the absorptive capacity (Harris and Moffat 2012a). The most comprehensive set of empirical measure of absorptive capacity for the UK to our knowledge is estimated by Harris and Li (2009). Based on the 3 waves of the UK Innovation survey, the authors use factor analysis to group firms regarding the following capabilities: exploitation of external sources of knowledge, networking with external bodies at the national level, implementation of new organisational structures and acquisition/absorption of codified scientific knowledge. Firms that use greater external knowledge, cooperate with national partners, and that have a higher quality of corporate strategy and management techniques are found to be more likely to undertake R&D and to innovate (Harris and Moffat 2012b). Among the different aspects of absorptive capacity, acquiring external knowledge seems to be the most important, with a standard deviation increase in this variable increasing the likelihood of innovating by 17%, followed by national cooperation (6%) and corporate strategy and management techniques (5%) (Harris and Moffat 2012b).
Overall, this brief survey of firms’ internal knowledge assets suggests that there is still need to develop concept and measures to assess the various dimensions of intangible assets. Existing empirical research shows that intangible assets account for 0.1-0.2% of the labour productivity growth at the firm level (Riley and Robinson 2011). Firms with patents have growth rates that are on average 10 per cent (in level) above those without patents, although this correlation is not statistically significant (Hall et al. 2012), however; holding a trademark or a design right is associated with a performance premium of 16-17% (Greenhalgh and Rogers 2007; Bascavusoglu-Moreau and Tether 2011). At the national level, intangible capital accounted for 15-20% of labour productivity growth (Marrano, Haskel, and Wallis 2009). Different aspects of absorptive capacity are found to increase the likelihood of innovation at the firm level and innovation raised growth in output per person-hour in the UK by almost 2% p.a. in the 2000s, which is 73% of labour productivity growth (Haskel et al. 2009).

Although firms can develop and acquire knowledge internally, few possess all the inputs needed for successful and sustainable technological development, therefore firms need to use external sources to acquire and internalize knowledge (Almeida, Dokko, and Rosenkopf 2003; Harris 2011). The recent empirical studies also point to the importance of external knowledge sources and how internal and external knowledge is intertwined and crucial for firm performance. In the following section, we will overview the literature on these external sources of knowledge.

Summary of the findings:

• Intangible assets have been receiving increasing attention as the key input in firms’ performance.

• Within the formal intangible assets, the distributions of R&D spending, patents and trademarks are found to be highly skewed both at firm and the aggregate level.

• Non-R&D intangible spending is more widespread than R&D spending, highlighting the importance of informal intangible assets such as organisational, network or human capital.
The contribution of ICT capital on UK productivity growth is estimated to range between 0.08%-0.13%, and organisational capital and R&D have an equal share of 0.13%-0.17%

Holding a design right or a trademark has a performance premium of 16-17%. Although patenting firms seem to perform better than non-patenting firms, this positive effect is not statistically significant.

At the aggregate level, 20% (15%) of the UK’s labour productivity growth between 1995-2003 (1979-2005) is accounted for by the intangible capital deepening.

At the cross-country level, evidence shows a correlation between total factor productivity growth and intangible investments.

Absorptive capacity, i.e. firm’s ability to identify, assimilate and exploit knowledge from the environment is identified as a crucial factor.

Among the different aspects of absorptive capacity (other than in-house R&D and share of R&D personnel), acquiring external knowledge seems to be the most important factor to increase the likelihood of innovation.

3. External Knowledge Assets and Knowledge Spillovers

3.1 Formal Collaborations and Cooperations

In order to remain competitive, it is no longer enough to rely on internal knowledge assets, but being open to external sources, particularly for cooperation with different partners as well as for knowledge transfer from universities. There is extensive research evidence on sources of knowledge for business innovation and on the determinants and impacts of the collaboration on firm performance. In this section
we shall firstly review evidence on sources of knowledge, then the characteristics of UK firms’ cooperative behaviour, and finally the impact of engaging in collaborative agreements on firm performance.

Firms use multiple sources of knowledge for innovation, of which, by far the most frequently cited are customers, suppliers and competitors, alongside their own internal knowledge base. Universities are amongst the least frequently cited sources (Laursen and Salter 2006; Cosh, Hughes, and Lester 2006).

Turning now to the patterns of cooperation, Tether (2002) provides an analysis of R&D cooperation in relation with different types of innovation activities in the UK. R&D cooperation is shown to be more common among firms that introduce radical innovations, i.e. innovations that are new to the market. Engaging in in-house R&D activities as well as its intensity tends to increase the propensity to cooperate. More specifically, engaging in continuous R&D activities shows a significant impact on the probability to cooperate with customers, competitors and consultants, while the intensity of R&D activities increases R&D cooperations with suppliers and universities. Laursen and Salter (2004) corroborate the latter; UK firms which engage in R&D and use other external sources of knowledge also tend to use university research more intensively. On the other hand, in a comparison of the UK and US industry-university ecosystem, Cosh and Hughes (2009) report that more UK firms report direct use of the science base, compared to the US, however they attach less value to it.

In a cross-country (UK, France, Germany, Spain) study on the determinants of cooperation, Abramovsky et al. (2009) shows that the perceived importance of knowledge sources (also called incoming spillovers, see Cassiman and Veugelers (2009)) and appropriability explains co-operative R&D in the UK. Regarding to the objectives of engaging in cooperative agreements, Love and Roper (2004) report that increased speed to market as a key reason for UK plants for inter-plant collaboration. In a comparison with German plants, UK plants are found to be more likely to collaborate with other group companies than were their German counterparts (Love and Roper 2004).

Regarding to the effects of collaborations, engaging in cooperative agreements seems to have ambiguous impact on innovative performance, measured by the share of sales due to innovative products. Some empirical studies have found a
positive impact (such as Criscuolo and Haskel (2003) on the UK, Klomp and van Leeuwen (2001) and Belderbos et al. (2004) on the Netherlands, Loof and Heshmati (2002) on Sweden, among others) whereas others failed to find significant effect of cooperation on innovative performance (Janz, Lööf, & Peters, 2003 on Germany and Sweden). However, most of the studies have included a cooperation variable in empirical models explaining differences in firms’ innovation outputs (Janz, Lööf, and Peters 2003; Klomp and Van Leeuwen 2001; Lööf and Heshmati 2002; Criscuolo and Haskel 2003) without systematically evaluating the differences among cooperation partners. These include competitors, users and suppliers, universities and research institutes, among others.

Cooperation with competitors is often motivated by concerns regarding knowledge appropriability, knowledge exchange or cost sharing (Miotti and Sachwald 2003; Gallié and Roux 2010). Belberdos et al. (2004) find a positive impact of cooperation with competitors both on labour productivity and on innovative sales productivity in Dutch firms, however for Germany Janz et al.(2003) show a negative effect and Miotti and Sachwald (2003) fail to find any significant impact.

Collaborating with customers is an important way for a firm to improve its innovative capabilities and performance (Tether 2002; Belderbos, Carree, and Lokshin 2004). By learning about lead customers’ needs and expectations, firms are better able to identify market opportunities, new trends and solutions by learning about their customers’ needs and expectations (Hippel 1976). In the UK, firms are increasingly choosing to engage in collaborative agreements with their customers, over the other types of partners. Users, as both firms and individual customers, may also be actively involved in the innovation process, by creating and/or modifying products and services according to their own needs. It is estimated that UK consumers, as a group, spend more on consumer product development than commercial enterprises (Hippel, Ogawa, and Jong 2011). However, once again, the empirical studies show mixed results regarding the impact of cooperation with customers. In a cross-country study across four European countries, Freitas, Clausen, Fontana and Verspagen (2010) find a positive benefit to engaging with customers. Freel (2005) corroborates this positive impact on product innovation performance in small and medium sized firms in the northern Britain. However, Nieto and Santamaría (2007) find that the benefits of collaborating with customers only prevail for incremental innovations in Spain. Belderbos, et al. (2004) show that collaboration with clients has no impact on innovative sales, whereas Lööf and Heshmati (2002) find a negative relationship between customer collaboration and product innovation performance.
Universities and government research institutes are important contributors to the supply of new scientific and technological knowledge (Lundvall 1992). Belderbos et al. (2004) and Lööf and Heshmati (2002) report a positive impact of university cooperation on innovative sales.

For the UK, most of the studies are based on different waves of UKIS. Frenz and Ietto-Gillies (2009) do not find any impact of engaging in collaborative agreements on the either the likelihood of innovation nor the innovative sales. Iammarino et al. (2012) explore the impact of different types of cooperation on firm innovativeness, taking into account firms’ regional location. Vertical cooperation with customers and suppliers, horizontal cooperation with universities and horizontal cooperation within the business group are found to increase firms’ technological capabilities (Iammarino et al. 2012). However, authors highlight considerable differences between the regions.

Two studies combine UKIS with Annual Respondent Databases (ARD) to estimate the impact of collaboration on firm productivity. Harris et al. (2012) estimate that collaborating with higher education institutions increases the total factor productivity by around 16.3%. Crespi et al. (2008) show that the main sources of knowledge are competitors, suppliers and other plants that belong to the same business group, and that they account 50% of total factor productivity growth. They find that universities act as an important source of information for patenting activities (Crespi et al. 2008), but find no effect on productivity.

Based on a bespoke survey, De Propris (2002) shows that vertical collaborations are particularly important for innovation, compared to horizontal linkages, moreover the author empirically demonstrates that higher levels of vertical cooperations between firms over a range of activities induce higher levels of innovation.

Based on the UKIS, and using firms’ access to external sources of knowledge, Laursen and Salter (2006) explore how differences in search strategies among firms influence their ability to achieve different levels of novelty in their innovative activities. Although both using external sources of knowledge and the intensity of use are found to increase firms’ innovativeness, the benefits associated with openness are subject to decreasing returns.
Recently, it has been argued that these mixed results on the effects of collaborative agreements may be due to the omitted indirect effects of firms’ absorptive capacity (Escribano, Fosfuri and Tribo, 2009; Tsai & Hsieh, 2009; Tsai and Wang, 2009). The availability of external sources of knowledge does not itself imply that firms can easily use them; they need a certain level of absorptive capacity in order to identify, adopt and apply this external knowledge (Cohen and Levinthal, 1990). Although there is an extensive literature on the direct impact of firms’ absorptive capacity and the complementarities between firms’ own R&D and external R&D sources (Cassiman and Veugelers 2006; Cassiman and Veugelers 2009; Cassiman and Veugelers 1999), there are few studies that take into account the impact of interactions between firms’ absorptive capacity and external sources, which may explain the mixed empirical results.

Overall, the evidence reviewed suggests that UK firms benefit from external knowledge sources. The main sources of external knowledge are identified as suppliers and customers from the literature. Firms that are more engaged in collaborative agreements are more likely to innovate. The role of universities, however, is more ambiguous and there is less consensus regarding their impact on firm productivity. The review highlights the importance of absorptive capacity in benefiting from external knowledge assets.

3.2 Measuring Spillovers

There are two broad branches of literature concerning the measurement and impact of knowledge spillovers. The first one consists in introducing an external knowledge measure in a standard production function, alongside the traditional inputs such as capital and labour. This so-called “trade-growth” approach is based on works from Krugman (1979) and Grossman and Helpman (1991) which define knowledge and its externalities as the key determinants of growth and international trade. The analysis is conducted either at the firm level, or at the more aggregated sector or country level, and aims to assess the impact of the external knowledge on the total factor productivity of units considered, by emphasising the geographical aspect. Different results are obtained depending on the channel considered, i.e. international trade, foreign direct investment (FDI) or technology payments.

The second branch of literature is the knowledge production function (KPF)
framework, initiated by Griliches (1979; 1986). This approach focuses on knowledge spillovers in a technological space. From an empirical perspective, it assesses their impact on the production of knowledge, often measured by patents.

1. Knowledge Production Function

Several specifications of the knowledge production function have been investigated in the empirical literature (See among others, Blundell, Windmeijer, and Griffith, 1995; Hausman, Hall, and Griliches, 1986; Pakes and Griliches, 1984). The role of spillovers in knowledge production function framework is proxied by the amount of R&D conducted by other firms/sectors/countries weighted by some measure of technological and/or geographical proximity. The closer technical and geographic proximity the greater the intensity of potential knowledge flow spillovers between the source and the recipient (Mancusi 2008). The measurement of the weight varies between studies.

Jaffe (1986) is one of the first to estimate the impact of R&D expenditures and technological spillovers on patenting activity of US firms. He shows that firms’ own R&D investments as well as other firms’ R&D investments in the industry will have a positive impact on patenting activity, the effect of external R&D depending on the technological proximity between firms (Adam Jaffe 1986). This positive effects is corroborated by Cincera (1997) using the same methodology on patent counts. In the same line with Jaffe, Brendstetter (2006) assess the impact of firms’ own R&D, and domestic and foreign spillovers in American and Japanese firms and finds that firms benefit from their own R&D investments as well as national R&D however the evidence for international spillovers is limited. Los and Verspagen (2000) compare different weights (based on input/output tables, patent citations, and trade flows) and conclude for a positive impact of R&D spillovers, this result being robust to the different specifications.

Employing patent statistics as an output indicator of innovation allows patent citations to reflect the process of knowledge diffusion. Like scientific papers, patent documents contain references to earlier patent documents; we can then assume a knowledge flow from the cited patent to the citing one. Jaffe, Trajtenberg and Henderson (1993) and Jaffe and Trajtenberg (1996) have been the first to consider patent citations as a paper trail of knowledge flows. The patent citations indicator has been widely used to
measure the spatial distribution of the technological diffusion (Jaffe and Trajtenberg 1996; Maurseth and Verspagen 2002; Bottazzi and Peri 2003; Thompson and Fox-Kean 2005).

Using patent citations to trace knowledge flows, and patents to measure innovation activities, Malerba et al. (2007) find that alongside international spillovers, intra-sectoral spillovers are also a very important determinant of innovation in six large countries (France, Germany, Italy, Japan, UK and US) over the period 1981-1995.

The only study to our knowledge to estimate the impact of innovative activities on inter-industry total factor productivity for the UK is Sterlacchini (1989). Exploring the performance of British manufacturing industries in terms of productivity growth across various periods between 1954 and 1984, estimate the rate of return for firms’ own R&D activities to be around 12-20%, whereas external R&D ranges between 15-35% (Sterlacchini 1989).

Finally, the number of studies which combine patent citations with trade and investment flow is rather scarce. Sjöholm (1996) finds a correlation between Swedish patent citations and bilateral imports, suggesting that imports contribute to international knowledge spillovers. Globerman, Kokko and Sjöholm (2000) evaluate technology sourcing of Swedish multinational and small and medium sized enterprises (SME) and find that outward FDI increases citations. Brandstetter (2006) analyzes FDI and citation flows between USA and Japan, and shows a positive impact of FDI on knowledge spillovers. Using micro level data on French firms, MacGarvie (2005b) finds that both importers and exporters learn more from foreign technology then firms not involved in international trade. At a regional level, Peri (2005) compares knowledge and trade flows, and concludes that there is a lesser impact of distance on the former. We explore spillovers via trade and investments flows in more detail in the next section.

2. Trade Growth Approach

Endogenous growth theory predicts that growth rates of countries are related through international trade linkages and associated embodied and disembodied knowledge spillovers (Grossman and Helpman 1991). As mentioned earlier, knowledge is
inherently non-rival in its use, and hence its creation and diffusion are likely to lead to spillovers and increasing returns. It is this non-rival property of knowledge that is at the heart of the theoretical models that predict endogenous growth from research and development (R&D) investments (Aghion and Howitt 1998; Romer 1990; Grossman and Helpman 1991). In this context, the development of a country depends heavily on its knowledge capital, which in turn is determined by the rate of national innovation and international technology diffusion. Three mechanisms have been identified to assess the impact of trade openness on technology diffusion (Redding and Proudman 1998): the degree of international openness can affect the rate of domestic innovation, the quantity of transferred technology or the adoption rate of more advanced countries’ technologies.

At the firm level, the empirical literature has long focused on the role of exports, given the exporting firms’ high productivity growth (Aw and Hwang 1995; Clerides, Lach, and Tybout 1998; Bernard, Jensen, and Jensen 1999). There are two alternative, although not mutually exclusive explanations of exporters’ higher productivity rates (Wagner 2007). The first one points to self-selection which explains that the direction of causality is from productivity to exporting; firms that are more productive are more likely to export. The second explanation relates to learning; knowledge flows from international competitors and buyers and intense competition in international markets improve exporting firms’ performance. Firms become more productive because they export. Learning-by-exporting is conceptually very closely related to the notion of spillovers, as firms can benefit from the knowledge in international markets through other channels than their customers.

Before reviewing potential spillover effects of exporting, we first report studies on the characteristics of exporting firms. In the UK, exporting firms are found to pay higher wages, and to be larger and more productive (Greenaway 2004). Controlling for other characteristics that might affect these differences, Greenaway and Kneller report that exporting firms’ productivity are on average 8.3 and 11.4 % higher than non-exporting firms (measured by total factor productivity (TFP) or labour productivity, respectively). The difference of size ranges between 3.9 and 6.2, measured by output and employment. In aggregate, exporting firms contribute more to overall UK productivity growth than non-exporting firms (Harris and Li 2008).

While it is difficult to distinguish empirically the direction of causality between exporting and higher productivity, recent evidence on UK firms suggest the existence
of some learning effects. For example, Greenaway and Yu (2004) report positive learning effects, although only for younger exporters. On first year of exporting, firms experience a TFP growth rate about 1.6 % higher than non-exporting firms, and a 10 % increase in the export share in the period after entry leads to an additional 2.1 % TFP growth (Girma et al. 2004). Crespi et al. (2008) show that exporters draw information from their buyers when innovating. A recent survey found that around 63.5 % of the UK firms report a positive impact on profitability and 87 % on increased sales from exporting; and 65% report improved products, services, marketing and capacity utilisation, the latter suggesting the existence of learning effects (Kneller and Pisu 2010).

Beyond these spillover effects on exporting firms, exporting can also lead to other productivity externalities or demonstration effects on non-exporting firms (Alvarez and López 2008). So-called “productivity spillovers by exporting”, these externalities refer to the effects that exporting firms generate on other domestic and non-exporting firms’ performance (Silva, Afonso, and Africano 2012). They can either be positive when non-exporting firms benefit from exporting firms’ accumulated knowledge of technology and foreign markets (“demonstration effects”); or negative if there is a higher demand by exporting firms yielding to shortage of specialized inputs (“congestion effects”) (Karpaty and Kneller 2010). Greenaway and Kneller (2008) find evidence on productivity spillovers by exporting in the UK; having neighbour exporters and/or being located in high-export intensity regions increase the likelihood of exporting.

Another branch of empirical research, initiated by Coe and Helpman (1995), has analysed the knowledge capital incorporated in imported goods. The impact of these spillovers via imported goods on the host countries’ growth has been largely verified (Coe, Helpman, and Hoffmaister 1997; Keller 2000; Lichtenberg and van Pottelsberghe 1996).

From a theoretical perspective, endogenous growth theories provide the “missing link” between openness and growth via knowledge spillovers (Lejour and Nahuis 2001). In this context, knowledge originating in a particular country or region increasingly transcends national boundaries and contributes to the productivity growth of other geographic areas, or at least, reduces duplication of the research effort. International trade can be a source of spillovers through demonstration effects when domestic firms learn the innovative content of imported goods. Below we briefly
summarize the empirical results confirming that foreign R&D influences domestic productivity and that the more countries are open to international trade the more they benefit.

Coe and Helpman (1995), Coe et al. (1997) were among the first to estimate a positive and quantitatively large effect of import-weighted foreign research and development investments (R&D). In a sample of 22 developed countries, the authors have estimated that roughly a quarter of the benefits from R&D in G-7 countries (Canada, France, Germany, Italy, Japan, the UK and the US) were due to their trading partners. Coe and Helpman’s framework has been criticised (see Lichtenberg and van Pottelsbergh de la Potterie (1996) and Keller (1998)) and extended by including country characteristics (Keller 2000; Coe, Helpman, and Hoffmaister 2009), geographic characteristics such as distance and language (Keller 2002), by restricting trade to capital goods (Xu and Wang 1999), by using different estimation techniques (Kao and Chen 1999; Coe, Helpman, and Hoffmaister 2009) or by assessing indirect R&D spillovers (Lumenga-Neso, Olarreaga, and Schiff 2005). These different empirical studies, despite their different empirical specifications, suggest the existence of positive spillovers effects.

Previous studies have shown that technology diffusion via trade flows varies considerably between industries, high-technology intensive industries being more likely to receive R&D spillovers (Acharya and Keller 2009; Keller and Yeaple 2009). Furthermore, industry variations are estimated to be more important than country variations when analysing international R&D spillovers (Acharya and Keller 2009). The average effect across industries is mainly driven by aircraft, chemicals, communication equipment, computers and drug industries.

An empirical analysis on 14 manufacturing industries in the UK during 1970-1992 shows that R&D affects rates of UK productivity growth through innovation, while international trade facilitates the transfer of technology (Cameron, Proudman, and Redding 2005). Based on a very detailed analysis of international technology transfer through imports in Acharya and Keller (2009), at the average industry level, international R&D spillovers are found to be more important than the domestic technology spending in the UK (as in many industrialized countries). UK productivity is shown to be particularly affected by Japanese R&D compared to US and Germany. A 10% increase in domestic R&D translates on average into about 0.5% higher productivity, whereas the impact of international R&D spillovers ranges from 1.4 to
3.8% (Acharya and Keller 2009).

In the same context, multinational firms and foreign direct investment flows have also been considered as a channel of technology transfer to the host countries. Technology is transferred through FDI by three main mechanisms; demonstration effects, labour mobility and linkages between buyers and suppliers. There are extensive surveys of the literature on FDI spillovers; see surveys by Blomström and Kokko (1999), Cincera and van Pottelsberghe (2001), Saggi (2002), Gorg and Greenaway (2004), Smeets (2008), Keller (2009) and Harris (2009) among others. The empirical literature is however ambiguous. While there seems to be evidence of spillover effects of outward FDI (Hanel 1993; van Pottelsbergh, Lichtenberg, and Potterie 2001) as well as inward FDI (Findlay 1978; Blomstrom 1986; Borensztein, De Gregorio, and Lee 1998; Balasubramanyam, Salisu, and Sapsford 1996), there’s no consensus about its magnitude (See Haddad and Harrison (1993) and Aitken and Harrison (1999) for examples of the negative or null impact of FDI on home countries).

Before reviewing the evidence for the UK, we will first present different types of FDI spillovers and sum up briefly the extensive research on their determinants, by referring to two recent meta-analyses of FDI spillovers1.

The literature distinguishes between horizontal and vertical FDI spillovers. The effects of foreign investment on domestic firms in the same sector are called horizontal spillovers. On the other hand, vertical spillovers refer to the effect of FDI on domestic firms that are in suppliers and customer sectors. On average, horizontal spillovers are found to be negligible but their magnitude depends on a number of characteristics of source and host countries, domestic firms and type of investments; technology gap between foreign investors and domestic firms, the trade openness and the better protection of intellectual property rights decrease the impact of horizontal spillovers, whereas higher human capital and joint-ventures (rather than fully foreign-owned projects) are associated with larger spillovers (Iršová and Havránek 2012). Regarding to vertical spillovers, on average spillovers to suppliers (backward spillovers) are economically significant, whereas the spillovers to buyers (forward spillovers) are statistically significant but small; openness to international trade, smaller technological gap and geographic distance is found to increase the magnitude of vertical spillovers (Havranek and Irsova 2011).
Here, we will draw on recent work of Harris (2009), and Gorg and Greenaway (2004) and Haskel et al. (2002) who provide an extensive analysis of FDI spillovers in the UK. An overview of the previous empirical research on different types of FDI spillovers in the UK is presented in the Annex, Table A2.

Before discussing any potential spillovers effect from FDI, it has to be established that FDI plants operating in the UK are performing better than the domestic plants. Although the first study exploring the productivity levels in the motor vehicle industry did find significant differences between foreign-owned establishments and domestic firms (Griffith, 1999; 2001), it has been shown subsequently that this result may be due to sampling problems (i.e. data was biased towards larger establishments) (Harris 2002). Taking into account this bias, Harris showed that US and EU-owned plants were on average 21-26 % more productive than UK-owned plants. In a more extensive study on 20 4-digit manufacturing industries, Harris and Robinson (2003) also corroborate this result, although they did not find a clear productivity advantage for EU-owned plants. Using a different and more recent data, Harris and Li (2007) demonstrate that FDI plants are generally better than non-exporting domestic firms, although this is not the case for certain regions of the UK such as Northern Ireland. Distinguishing between US and British-owned plants, Criscuolo and Martin (2009) find that US-owned plants have a significant productivity advantage in the UK, compared to both British and other foreign-owned multinationals.

Having established a higher productivity rate for at least some of the foreign-owned plants does not necessarily imply positive spillover effects from FDI for UK firms. Haskel et al. (2002) report that at the industry level, a 10 percentage-point increase in the foreign presence boost domestic plants’ total factor productivity by about 0.5 percent. On the other hand, Harris and Robinson (2004) evaluate backward, forward, intra-industry and agglomeration spillovers over 20 manufacturing industries and do not find any clear pattern for benefiting from spillovers. These mixed results may be due to different methodologies, samples and/or periods analysed by different authors (Haskel et al. Considers the period between 1973-1992, whereas Harris and Robinson study 1990-1998), but also domestic firms’ technological abilities vis-a-vis foreign-owned firms.

The differences in terms of productivity, technological ability or absorptive capacity
between foreign-owned and domestic firms are considered as crucial in spillovers literature. It has been argued that the potential for catch-up depends positively on the difference level between leader and follower (Findlay 1978). This difference between two firms (or countries) is referred as the technology or the efficiency gap. However, the role of technology gap is rather unclear (Sjoholm 1999). According to some studies, for a given amount of foreign presence, the spillovers are larger, the larger the technology gap (Fagerberg 1994; Fagerberg 1995). On the other hand, the large technology gaps may constitute an obstacle for technology transfer (Lapan and Bardhan, 1958).

In the UK, empirical studies (Girma and Wakelin 2000; Görg and Greenaway 2004; Girma and Görg 2007; Haskel, Pereira, and Slaughter 2002) have pointed to absorptive capacity of domestic firms, and to technology (or efficiency) gap between foreign-owned firms and the domestic firms. Indeed, the concept of technology (or efficiency) gap is closely related to the concept of absorptive capacity. Girma (2005) finds that firms with a lower technology gap (i.e. difference between firms’ productivity level and the industry frontier productivity level) of 10 percent or less benefit from FDI spillovers. These effects seem to be closely related to industrial characteristics; firms located in high-technology sectors may gain from FDI even if they have a larger technology gap, whilst firms with low technology gaps in low-technology sectors may suffer from foreign presence (Girma, Greenaway, and Wakelin 2001). This finding suggests that in presence of high absorptive capacity, the level of technology gap does not matter much, however for firms with a low level of initial productivity; the foreign presence may be detrimental. Then again, Haskel et al. (2002) show that larger gaps lead to higher spillovers when measuring the gap relative to the distribution of three measures of performance (namely total employment, size and skill intensity). Girma and Gorg (2003) suggests a non-linear relationship between absorptive capacity and productivity spillovers from FDI, only firms with some level of absorptive capacity will benefit from foreign presence. Firms’ absorptive capacity relative to foreign-owned firms may also be proxied by their engagement in international markets. Exporting firms are supposed to have a higher absorptive capacity than non-exporting firms (see the section above). Domestic exporters are found to experience positive intra-industry spillovers, whereas non-exporters do not; a 1 percentage point increase in horizontal FDI increases 1.2% the productivity of an exporter with a median level of absorptive capacity (Girma, Görg, and Pisu 2008). However, these findings depend also on the type of FDI; while domestic-market oriented vertical FDI results on positive spillovers on both exporting and non-exporting domestic firms, export-oriented FDI has a negative effect (Girma, Görg,
and Pisu 2008). Export-oriented FDI can also increase the likelihood of domestic firms to engage in international markets as well as the export intensity of exporting firms (Kneller and Pisu 2007).

Another characteristic of foreign FDI that should also be taken into account is its orientation; whether foreign firms enter the domestic market to exploit their comparative advantage in the host country, or for locational advantages, to access technology that is generated by host country firms, known as “technology sourcing”. In case of technology sourcing FDI, the extent of productivity spillovers may be limited, or may even occur in the other direction, i.e. from domestic to foreign enterprises (Driffield and Love 2005). This type of FDI is more likely to take place in industrialised countries (van Pottelsberghe de la Potterie and Lichtenberg 2001). Driffield and Love (2005) show that foreign sector in UK manufacturing benefits from productivity spillovers in knowledge-intensive industries, both from UK-owned firms and other foreign-owned firms. Driffield and Love (2007) explore in detail the motivation for foreign FDI in the UK, and identify four types of FDI; technology sourcing/location advantages; technology sourcing, efficiency sourcing and ownership advantage. Ownership advantages refer to the classic case where a firm has some competitive advantages and will prefer to set up production facilities through FDI than exporting due to property rights protection (Dunning 1977; Dunning 1981; Cantwell 1989). Technology sourcing corresponds to the model of FDI in which the motivation is to access and transfer host country’s technological advantages (Fosfuri and Motta, 1999). Location advantages refer to FDI decisions motivated by country-specific phenomenon, generally factor costs differentials. In the case of the UK, domestic firms only gain from FDI motivated by ownership advantages; technology-sourcing inward FDI does not lead to productivity spillovers (Driffield and Love 2007). This perverse effect of technology sourcing FDI are also corroborated by the findings on engineering sector where UK has an advantage relative over FDI-source countries (Girma and Görg 2007; Girma and Görg 2003).

Overall, the surveyed evidence indicates positive spillovers via trade flows, however the evidence of positive effect of FDI spillovers on UK domestic firms is, at its best, mixed (See also Table A2 in the Annex). Attracting foreign direct investment does not lead to higher productivity in local firms. Positive effects depend on a number of characteristics of both local and foreign-owned firms. The absorptive capacity and the technology or efficiency gap between firms is crucial, but also the foreign firms’ orientation. Given that UK has a certain level of comparative advantages in number of sectors; it is very likely that foreign firms’ main objectives would be
technology outsourcing, exactly the type of FDI that is potentially more prone to negative spillovers. The negative spillovers may occur when domestic firms with low absorptive capacity are exposed to competition effects; an increase in their costs due to increased market share of foreign-owned firms. Less efficient firms risk being crowded-out because of FDI competition. On the other hand, as stressed in the first section, the access to external sources of knowledge is crucial for firm performance, hence there might be other mechanisms, generated by geographic proximity, via which the presence of foreign firms will be beneficial to the UK economy. The next section will focus on this geographic dimension.

Summary of the findings:

• In order to remain competitive, it is no longer enough to rely on internal knowledge assets, there is need to be open to external sources.

• The main sources of external knowledge in the UK are suppliers and customers, whereas universities are the least frequently cited sources.

• Firms that are engaged in collaborative agreements are more likely to innovate, however this positive impact does not always correspond to higher productivity.

• The review highlights the importance of absorptive capacity in benefiting from external knowledge assets.

• Firms can also benefit from external knowledge without engaging in collaborative agreements or economic transitions via the spillover effects.

• There are two broad branches of literature that measure the impact of spillovers; knowledge production function and trade-growth approach.

• Using the knowledge production function, the rate of return for firms’ own R&D activities has been estimated to be around 12-20%, whereas external knowledge ranges between 15-35%.
• Trade-growth approach focuses on the role of international trade in transmitting knowledge spillovers.

• In the UK, 63.5% of the firms report a positive impact on profitability and 87% on increased sales from exporting, and 65% report improved products, services, marketing and capacity utilisations.

• While R&D affects rates of UK productivity through innovation, international trade is found to facilitate the transfer of technology, and international R&D spillovers are found to be more important than the domestic technology spending.

• Empirical evidence on positive FDI spillovers is, however, mixed. Positive effects depend on the characteristics of both local and foreign-owned firms.

4. The Spatial Dimension and Mechanisms of Spillovers

The idea of positive externalities of spatial proximity, or agglomeration economies is not new; Marshall (1890) in his “industrial district” argument asserts that the spatial concentration of production reduces the production costs of the individual firms in the cluster. The literature distinguishes between two different types of agglomeration economies; location externalities and urbanization externalities. The location externalities are also called MAR-spillovers, named after Marshall (1890), Arrow (1962) and Romer (1986), and are defined as spillovers occurring between agents within an industry (Glaeser et al. 1992). An example of MAR-spillovers is the concentration of suppliers of semiconductors and related technologies in Silicon Valley (Audretsch and Feldman 1994). The urbanization externalities, on the other hand, take into account the diversity in an agglomeration. Also called Jacobian-spillovers, this type of spillovers occur between different industries (Jacobs 1969; Jacobs 1984). We can say that while MAR-spillovers exploit regional economies of scale, Jacobian-spillovers exploit the regional economies of scope (Beaudry and Schiffauerova, 2009).
In the UK, recent studies find positive localization and urbanization externalities at the firm level using FAME Data (Graham 2009; Graham et al. 2010). On the other hand, using ARD Database, Overman et al. (2009) show positive urbanization externalities on total factor productivity growth, but negative localisation externalities. Exploring the effects of being located in cities, both Overman et al. (2009) and Harris and Moffat (2012c) find that firms in the Southeast of England and London tend to have higher productivity than firms located elsewhere. Plants located in “core” cities are found to perform better than plants in the same region outside of these cities, but overall there is no strong evidence that being located in British cities is encouraging growth (Harris and Moffat 2012c). The city-region with the highest productivity outside of London is Bristol (Overman, Gibbons, and Tucci 2009; Harris and Moffat 2012c).

In a study that explores the determinants of FDI location in UK regions using UK Trade and Investment (UKTI) dataset between 1997-2003, Dimitropoulou et al. (2013) show that London is qualitatively different to the other UK regions as it attracts new investment projects. The authors also find that localization is far more important in attracting inward FDI projects than urbanization externalities at the regional level (Dimitropoulou et al., 2013). Using the same dataset between 1985-2000, Wren and Jones (2012) highlight the importance of agglomeration economies in determining FDI location at the regional level. The authors conclude that regional policy can alter this location pattern, however this effect is not self-sustaining; FDI reverts to its earlier pattern once the policy is related (Wren and Jones 2012, p:282).

More recently, a growing literature has been focusing on various concepts related to the spatial dimension of technical change (for an extensive survey of regional growth models, see Harris (2011)). Whether it is called clusters (Porter 2003), learning regions (Florida 1995), local innovative milieu (Maillat 1998; Camagni 2005), local innovation systems (Cooke, Gomez Uranga, and Etxebarria 1997), or local buzz (Storper and Venables 2004; Bathelt, Malmberg, and Maskell 2004), the main idea posits that regions possessing certain tangible and intangible assets experience superior performance. Due to the fundamental role that geographical proximity among agents plays in mediating the processes of knowledge creation, transmission and appropriation certain regions accumulate intangible assets and tacit knowledge (Breschi 1998). These intangible assets are hard to grasp for non-local firms outside the regional innovation system. In order to reap fully the benefits of local buzz, co-location rather than occasional interludes of face-to-face contact is required (Kramer and Diez 2012; Boschma and Frenken 2009). Buzz itself is a complex concept but has been defined as consisting of specific information flows, intended and
unanticipated learning processes, mutual understanding of new knowledge, shared cultural traditions and habits; and one can benefit from and contribute to the buzz by just “being there” (Storper and Venables 2004; Bathelt, Malmberg, and Maskell 2004; Gertler 2003; Florida 2002).

The literature has identified three mechanisms that may produce a skewed spatial distribution of innovation activities. These are agglomeration economies, knowledge spillovers and technological diversity. In this review we are mainly interested in local knowledge spillovers, considered as the mechanism that facilitates the transmission and the acquisition of tacit and complex knowledge. The main argument is that local firms competing in the same industry or collaborating across related industries will generate processes promoting learning and innovation. This is because spatial proximity carries with it, among other things, the potential for intensified face to face interaction, short cognitive distance, common language, trustful relations between various actors, easy observation and immediate comparison of actions and outcomes (Malmberg and Maskell 2002).

However, the concept of local knowledge spillovers has been criticised as being no more than a “black box” (Breschi and Lissoni 2001a; Doring and Schnellenbach 2006). Some studies question how much of the clustering is due to local knowledge spillovers. Empirical evidence on the exact mechanism via which the knowledge is transmitted is still lacking (for a critical survey, see Breschi and Lissoni (2001a; 2001b)). The main arguments identified against the view that tacit knowledge requires spatial proximity are summarised as follows by Breschi and Lissoni:

- Knowledge sharing is less likely in industries with a rapid pace of technological change (Zucker, Darby, and Armstrong 1998).

- Knowledge sharing amongst previous colleagues is more likely to concern small ideas, and not strategic knowledge given the risk of a competitive backlash for the disclosing companies (Appleyard 1996).

- Inter-personal channels of communication are relatively more important for sharing knowledge with customers than for sharing knowledge with competitors. Furthermore, friendship does not increase the transfer of specific information (Schrader 1991).
• Inter-personal knowledge sharing does not necessarily require physical proximity (Lakhani and Hippel 2003).

• Tacit knowledge can, moreover, be transferred by formal means of communications such as mails, scientific articles or public conferences (Breschi and Lissoni 2001b, 262). Malmberg and Power (2005) argue that there is limited evidence on inter-firm transactions and collaboration in local clusters. Successful and innovative firms use a mixture of local and extra-local collaborations and connections, and that one cannot fully function without the other (Simmie 2004; Malmberg and Power 2005). The channels used for extra-local interactions are referred as “pipelines”, in the literature (Owen-Smith and Powell 2004). Knowledge flows through pipelines are not automatic; their establishment and maintenance require actions by firms to predesign and plan in advance (Bathelt, Malmberg, and Maskell 2004).

• It is important to note that, physical proximity does not imply social proximity, which has more dimensions than the spatial one. This argument is also picked up in Boschma (2005), who claims that spatial proximity on its own is neither necessary, nor sufficient for learning. However, it may facilitate learning by strengthening the other dimensions of proximity, namely cognitive, organizational, social and institutional proximities (Boschma 2005). Boschma also argues that there is a non-linear relationship between learning, innovation and proximity. This is termed proximity paradox, too much and too little proximity are detrimental to learning and innovation (Boschma 2005; Boschma and Martin 2010; Broekel and Boschma 2011). Based on Nooteboom’s work on optimal cognitive distance (Nooteboom 2000), it has been argued that an “optimal” proximity or combination of proximities may exist between agents (Boschma and Martin 2010; Broekel and Boschma 2011).

We can now focus on the empirical evidence for the UK. First, we establish whether there are positive cluster effects in the UK. Evidence of positive cluster effects implies that spillovers may exist. We can then focus on studies that explore mechanisms of knowledge diffusion which induce spillovers.

Baptista and Swann (1998) evaluate the innovative behaviour of UK manufacturing firms and find that firms located in industrial clusters or regions are more likely to innovate than firms outside these regions. In a comparative study of UK and US
computer industries, the authors also find that firm growth is fostered by the strong presence of firms in the same sector, suggesting intra-industry knowledge spillovers (Baptista and Swann 1999). These positive clustering effects have been confirmed for other sectors such as biotechnology (Swann and Prevezer 1996), broadcasting (Cook, Pandit, and Swann 2001), and aerospace (Beaudry 2001). Beaudry and Swann (2001) studied 137,816 UK firms in 57 industries and found that firms grew faster in clusters, especially in the finance, computer, motor, aerospace, and communications manufacturing industries.

Although they indicate a positive effect of geographical clusters, these studies do not shed light on the particular mechanisms through which knowledge flows. There are, however, a small number of mainly qualitative studies that explore particular clusters in the UK that we can draw upon. Henry and Pinch (2000; 1999) study the Motor Sport Valley, home of the British motor sport industry, and identify rapid and continual transfer of personnel, high rates of firm turnover, transactions with suppliers, as well as gossip, rumours and spying as channels of knowledge diffusion. They report that the leakage of knowledge is endemic throughout the industry, but it is seen as part of the high rate of diffusion of innovation across the firms in the sector. As a result, the churning of personnel and sharing suppliers raise the knowledge base of the industry as a whole within the region (Henry and Pinch 2000, 9). In the motor sport industry, it seems that it is the desire to be close to the community of knowledge, than the need to be close to specialist suppliers which generates knowledge.

May et al. (2001) focus on the clustering of the high-fidelity industry in South East England and find also that the main mechanisms of knowledge flows are the transfer of key personnel, a dense network of personal contacts and informal links. However, the authors stress that the innovation process is more closed than in the motor sport industry. Although a lack of horizontal collaboration between firms is noted, innovation in the high-fidelity industry is found to be supported by an increasing degree of mutual learning. There is a large amount of vertical collaboration between firms and their specialist suppliers, but only one third are local.

These local collaborations seem to be preferred by smaller firms, as confirmed by Freel (2003), in a study of 597 UK manufacturing firms. Larger SMEs and firms that are engaged in radical innovation tend to get involved in more distant networks (Freel 2003). Bennett et al. (2001) explore the influence of location on use of external advice and collaboration. They show that location has a very small impact once
the firm and sectoral-level characteristics have been taken into account. Regarding the use of private-sector advisers such as accountants or consultants and vertical collaborations, the intensity of use does not vary significantly with location in most cases. Only the input of business friends and relatives is strongly constrained by location. On the other hand, based on interviews with software and IT developers and electronics SMEs in Oxfordshire and Berkshire, Romijn and Albu (2002) highlight the importance of interactions with suppliers, private sector providers, training institutes and local support organisations in fostering innovation. Geographic proximity is found to be of particular importance for radical innovations. The authors also draw attention to the regional science base; firms with strong interactions with research laboratories and universities are more likely to have more original and/or complex innovations (Romijn and Albu 2002).

The role of universities and industry-university relationships has been extensively studied, especially with regards to Cambridge and Oxford high-tech clusters. Although there is evidence of networked economies in both regions, the universities are found to have played different roles; in the Cambridge model the University plays an instrumental role, while in the Oxford model there is a vertical division of labour (Lawton Smith et al. 2001). High-technology SMEs in Cambridge show a greater propensity to form close inter-firm relations than do high-technology SMEs in Oxford, but the latter attach a greater importance to the local links (Lawton Smith et al. 2001). Lawton-Smith (2003), in a study on the set-up of Oxford high-tech agglomeration, shows how the local networks were crucial in providing the right local governance structures, that helped to launch the development of the cluster. Rather than technological learning or innovation, the collaboration between actors laid the foundations for sectoral development. However, in the early stages of Cambridge high-tech agglomeration, it has been suggested that dynamic local interaction was at best embryonic and that many Cambridge firms had to rely on overseas markets without benefiting from significant domestic advantages, except in biotechnology (Garnsey and Cannon-Brookes 1993, 200). Yet, later studies highlight the importance of local interaction and knowledge flows between firms. The critical mass of high-tech activities led the emergence of an informal investor community and the spontaneous emergence of an institutional support system (Keeble et al. 1999). The success of Cambridge high-tech agglomeration include clustering stimulated by serial spin-outs from originator firms, the rise of local suppliers, the emergence of specialist labour markets and the attraction of venture capital; all facilitated by social networks diffusing knowledge (Elizabeth Garnsey and Heffernan 2005). A recent study investigating R&D workers’ experience in the Cambridge IT Cluster also shows that
the main advantage of the cluster is the labour market advantages and the global brand of Cambridge (Huber 2011). However, nearly two third of the R&D workers “do not see a real knowledge benefit” for their work to be located in Cambridge (Huber 2011, 121). Personal networks seem instead to be a factor linked to the business knowledge of senior managers.

Labour market advantages are confirmed by Faggian and McCann (2006), who explore the effect of British university graduates on regional innovation. The authors find little or no evidence in favour of direct spillovers between university research and regional innovation, suggesting that research conducted at the universities does not constitute a source of knowledge for local firms. However, they show that the primary role of universities appears to be as a conduit for bringing potential high quality undergraduate human capital into a region (Faggian and McCann 2006).

Looking into a traditional industry, rather than high-tech agglomeration, Watts et al. (2003) focus on the Sheffield metal-working cluster. They find that commodity exchanges between owner-managers and their suppliers are accompanied by embodied transactions, although rather infrequently. Moreover these exchanges are no more extensive or significant than those with suppliers located beyond the cluster. The extent and frequency of the exchanges are driven rather by a business logic than personal affinities (Watts, Wood, and Wardle 2003).

Other studies have focused on creative industries. Drake (2003) analyses how perceived attributes of a location provide inspiration in creative processes. Based on interviews with workers in the craft metalwork and digital design sectors in the UK, locality-based intensive social and cultural activity, referred also as the “buzz”, unpredictability or excitement of a locality, is found to be a key source of creativity. An examination of co-location patterns between creative sectors and other innovative industries such as High-Tech Manufacturing and Knowledge Intensive Business Services (KIBS) shows that advertising and software firms are very often found near both High-Tech Manufacturing businesses and KIBS (Chapain et al. 2010). These co-location patterns may be due to value-chain linkages, knowledge spillovers and/or urban buzz. However, in-depth case studies of clusters of software firms in Wycombe and Slough, film, post-production and visual effects in London (Soho), media production in Cardiff and advertising in Manchester, do not always confirm the existence of knowledge spillovers and local buzz. In the case of Wycombe and Slough, few firms were aware of the existence of a cluster, subsequently there is
a very low level of formal and informal interactions, and the internet are found to be the main source of contacts (Chapain et al. 2010). On the other hand, firms in Manchester and Soho are shown to collaborate locally as part of their innovation activities, and to engage in higher levels of informal networking (Chapain et al. 2010). Then again, other studies on the Soho cluster have found that the most important role of the local interaction was the provision of services and labour (Nachum and Keeble 2003b; Nachum and Keeble 2003a). When accessing the local labour market, firms rely on informal personal networks, based on loyalty and friendship, and are made entirely informally, through personal recommendations, referrals by colleagues, and word-of-mouth (Nachum and Keeble 2003b). Labour mobility through freelancers plays a significant role for knowledge diffusion in both Manchester and Soho clusters. This is not the case in Cardiff, because of the non-disclosure agreements (NDAs) that constrain the diffusion of knowledge between TV companies (Chapain et al. 2010). By contrast, the Digital Media firms that supply these TV companies with digital platforms and technology services are found to be more open to collaboration, networking and the use of external sources of innovation, thus also facilitating the knowledge flows across TV production firms (Chapain et al. 2010).

The studies we have reviewed present a mixed picture of local knowledge spillovers. There is some evidence for the importance of labour market dynamics and social interaction at the level of the individual in firms’ and clusters’ knowledge creation processes. However, the positive impact of knowledge spillovers seems to be closely dependent on sectoral and institutional characteristics. There are a number of conclusions we can draw upon reviewed studies. The main mechanism of knowledge diffusion is through the labour mobility. Clusters act as a hub for the attraction for global talents. High-technology clusters are found to be more likely to generate knowledge spillovers. However, the nature of the technology is closely related to the issues of intellectual property. Non-disclosure agreements act as a barrier to the knowledge diffusion through human mobility. The regional science-base and university-industry interactions are also important factors. Geographic proximity seems to facilitate personal interactions, however knowledge flows are not confined to proximate locations; successful firms access knowledge regardless of its geographical location. Local and global networks should not be seen as conflicting, they both have important but different, sometimes complementary roles to play (Christopherson, Kitson, and Michie 2008). A combination of local buzz and global pipelines appears to be the best for the long-term evolution of clusters (Bathelt et al., 2004; Balland et al., 2010). Successful clusters should enable local firms to be embedded simultaneously in knowledge exchanges at different geographic scales.
Summary of the findings:

• The transmission of knowledge can be encouraged by spatial proximity or agglomeration economies as defined by Marshall (1980).

• The literature distinguishes between two types of agglomeration economies; location externalities and urbanization externalities.

• Empirical evidence shows positive urbanization externalities in the UK, but the impact of location externalities is mixed.

• There is no strong evidence that being located in British cities is encouraging growth.

• However empirical evidence points to a positive effect of clustering on UK firms' growth

• But the positive impact of knowledge spillovers seems to be closely dependent on sectoral and institutional characteristics.

• The main mechanism of knowledge diffusion is through the labour mobility as clusters act as a hub for the attraction for global talents.

• High-technology clusters are found to be more likely to generate knowledge spillovers.

• The regional science-base and university-industry interactions are also important factors.

• Geographic proximity seems to facilitate personal interactions, however knowledge flows are not confined to proximate locations; successful firms access knowledge regardless of its geographical location.

The main data source employed in the empirical analysis draws on recent waves of the UK Innovation Survey (henceforth UKIS). This survey was sent to a nationally representative sample of firms in the UK that employed more than 10 employees, every two years from 2005 (prior to this time it was less frequent). We use the recent 4 waves of the UKIS data covering a nine-year period from 2002-2010, viz. UKIS 2005 (for the 2002-2004 period), UKIS 2007 (for the 2004-2006 period), UKIS 2009 (for the 2006-2008 period), and lastly UKIS 2011 (for the 2008-2010 period).

There were 16,445 firms providing valid responses to the UKIS 2005 survey, 14,872 responses to the UKIS 2007 and 14,281 to the UKIS 2009, achieving a response rate of 58%, 53% and 49% respectively. In the case of UKIS 2011, although 14,342 responses were received, only 9,111 firms provided valid information and thus the real response rate was much lower in this most recent wave. On average, around 30% of all firms in the UKIS survey from 2005-2009 are in the manufacturing sector, including 4,863 firms in UKIS 2005, 4,604 in UKIS 2007 and 3,699 in UKIS 2009. This figure reduces to 2,849 (just under 20%) in UKIS 2011. However, with weighting in place, the proportion of manufacturing firms across all 4 waves becomes more consistent (around 20%).

In particular, we consider the potential sample attrition issue relating to the UKIS 2011 data. The UKIS 2011 questionnaire was sent to some 28,000 enterprises in the UK and responses were received from 14,342 enterprises. However, more than 5,300 respondents failed to provide information on the majority of questions and thus deemed unusable, due to a series of changes in both the sampling (e.g. a larger proportion of respondents new to the survey) and collection procedures (e.g. around half of survey responses collected by telephone interview). Therefore, there are only 9,111 valid cases with information on innovation-related activities (with an attrition rate of 36.5%).

In this instance, appropriate tests need to be undertaken to ascertain that sample attrition bias – a form of selection bias - does not arise as a result of such loss of valid responses. That is, the attrition is random and the final usable sample (of 9,111
enterprises) is unbiased in retaining the characteristics of the original UKIS 2011 sample (of 14,342 enterprises), especially in terms of the core variables of interest in this study.

It follows that an attrition probit model has been estimated to ascertain if the final usable sample of 9,111 firms is representative of the original UKIS 2011 sample. This involved estimating a probit model using the full UKIS 2011 sample where the dependent variable is an attrition dummy taking the value of one if the record is included in the final sample (i.e. that contains a valid response) and zero otherwise. The estimation results are presented in Table A3 in the Annex.

Ideally the explanatory variables should include those that are expected to affect attrition rate and any variables that might characterize the survey/interview process; nevertheless, given that most of these variables such as those relating to innovation behaviour contain a large number of missing values, our set of explanatory variables are limited to those covering general firm-level characteristics such as employment, weights, industry and regional dummies. Results reported in Table A3 indicate that 13 variables (i.e. mostly industry and regional dummies) are statistically significant in determining attrition. A likelihood-ratio test was subsequently conducted to test the joint statistical significance of these 13 variables and a chi-square of 106.86 led to the rejection of the null hypothesis of no effect on attrition indicating these variables are statistically significant predictors of attrition and thus attrition is non-random. Therefore, in order to correct for attrition bias, new population weights have been created for the 2011 sample for use throughout the analysis, based on similar stratification criteria to those used by the ONS (i.e. by industry division, region and employment size band).

Most of the descriptive analyses in this report are based on all 4 waves of UKIS data pooled together, i.e. 54,709 observations in total with 15,166 in the manufacturing sector. The UKIS data have also been merged with relevant data from the Annual Respondents Database (ARD) using the Inter Departmental Business Register (IDBR) numbers, in order to incorporate additional information on firm-level specific characteristics such as age, output, foreign ownership, geography, enterprise structure.

Summary of main findings:
The empirical analysis presented in this report utilises a linked UKIS-ARD dataset. Most importantly, the recent four waves of the UK Innovation Survey (UKIS) data constitute the main data source covering a nine-year period from 2002-2010.

There were 16,445 firms providing valid responses to the UKIS 2005 survey, 14,872 responses to the UKIS 2007, 14,281 responses to the UKIS 2009, and only 9,111 responses to the UKIS 2011.

The potential sample attrition issue relating to the UKIS 2011 data was considered and an attrition probit model was estimated to ascertain if the final usable sample of 9,111 firms is representative of the original sample. The explanatory variables used cover general firm-level characteristics such as employment, weights, industry and regional dummies.

Results from the attrition probit model indicate that attrition is non-random (i.e. there is evidence of attrition bias) and thus new population weights have been created for the 2011 sample in order to correct for attrition bias.

6. The Use of Knowledge Sources in Innovation by UK Manufacturing Firms

Firms have been asked to identify 10 sources of information/knowledge in their innovation related activities and rate their relative importance, covering the following aspects -

- Market: suppliers of equipment, materials, services or software; clients or customers; competitors or other businesses in the industry; consultants, commercial labs or private R&D institutes;

- Institutional: universities or other HEIs; government or public research institutes;
• Others: conferences, trade fairs, exhibitions; professional and industry associations; technical, industry or service standards; scientific journals and trade/technical publications

Figure 2: Proportion of firms utilising knowledge sources, all sectors, 2002-2010

![Bar chart showing proportion of firms utilising knowledge sources](image)

Data Source: weighted UKIS 2005-2011

Across all sectors\(^5\), Figure 2 shows that clients constituted the most important source of knowledge for innovation activities, with suppliers and competitors also being of great importance. Alongside these market-based sources, a large proportion of firms were also taking advantage of other information sources such as professional and industry associations and technical/industry standards, whereas public institutions (such as government and HEIs) were reported to be least commonly associated with firms' knowledge sourcing for innovation. For instance, engagement with government appeared to be relatively weak, with only Agriculture and Utilities, Mining and Quarrying, Knowledge-Intensive Services (KIS) and Manufacturing sectors showing more than 5 per cent of firms with knowledge links to the government. The story was similar for HEIs with just over 5 per cent of firms (economy wide) stating that they used any information or knowledge from HEIs.

In terms of inter-sectoral differences, manufacturing firms appeared to represent the largest users of knowledge from most sources except consultants, HEIs, government, industry associations and scientific journals or trade publications. Also notably
KIS firms seemed to dominate in the use of knowledge from industry associations and scientific journals. Perhaps more surprisingly, consultants were utilised more prevalently within the Agriculture and Utilities, Mining and Quarrying and KIS sectors (vis-à-vis Manufacturing), which may however represent the rather specialised use of experts in many of these sectors.

Table 2: Proportion of firms utilising knowledge sources and ranking, manufacturing industries, 2002-2010

<table>
<thead>
<tr>
<th>Industry</th>
<th>Suppliers</th>
<th>Clients</th>
<th>Competitors</th>
<th>Consultants</th>
<th>HEIs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical etc. instruments</td>
<td>53</td>
<td>1</td>
<td>66</td>
<td>1</td>
<td>45</td>
</tr>
<tr>
<td>Rubber, Plastic</td>
<td>51</td>
<td>2</td>
<td>54</td>
<td>5</td>
<td>34</td>
</tr>
<tr>
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<td>3</td>
<td>63</td>
<td>2</td>
<td>42</td>
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<tr>
<td>Chemicals</td>
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<td>4</td>
<td>61</td>
<td>3</td>
<td>41</td>
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<tr>
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<td>5</td>
<td>57</td>
<td>4</td>
<td>39</td>
</tr>
<tr>
<td>Non-metallic minerals</td>
<td>48</td>
<td>6</td>
<td>51</td>
<td>8</td>
<td>37</td>
</tr>
<tr>
<td>Motor &amp; Transport eqpt</td>
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<td>7</td>
<td>53</td>
<td>6</td>
<td>36</td>
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<tr>
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<td>8</td>
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<td>45</td>
<td>11</td>
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<tr>
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<tr>
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<td>43</td>
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<td>26</td>
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<td>43</td>
<td>15</td>
<td>30</td>
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<tr>
<td>Basic metals</td>
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<tr>
<td>Mean</td>
<td>45</td>
<td>51</td>
<td>34</td>
<td>13</td>
<td>8</td>
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</table>

Source: weighted UKIS 2005-2011; figures in italics are rankings
<table>
<thead>
<tr>
<th>Industry</th>
<th>Government</th>
<th>Conferences</th>
<th>Ind assoc</th>
<th>Tech standards</th>
<th>Sci journals</th>
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<tr>
<td>Motor &amp; Transport eqpt</td>
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<tr>
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<td>Mean</td>
<td>6</td>
<td>23</td>
<td>28</td>
<td>32</td>
<td>17</td>
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</tbody>
</table>

Source: weighted UKIS 2005-2011; figures in italics are rankings

Table 2 above provides a closer look at industries within the manufacturing sector. Suppliers and clients represented main sources of knowledge to around half of manufacturers in Medical etc. Instruments, Electrical Machinery, Chemicals, Rubber and Plastic, Machinery and Equipment, Non-metallic Minerals and lastly Motor and Transport Equipment. Outside these frequently utilised market-based channels, manufacturers in Medical etc; Instruments, Electrical Machinery and Chemicals were also the leading users of knowledge from all other sources (e.g. conferences,
industry associations, technical/industry standards and scientific journals). It’s worth noting that firms in Medical etc Instruments in particular were most inclined to link their knowledge source to the public sector (i.e. 20 per cent with knowledge ties with HEIs and 13 per cent with government).

Figure 3 follows OECD’s industrial classification\(^6\) to divide manufactures into low tech, medium-low tech, medium-high tech and high tech industries to take a microscopic view of the sector. As might be expected, higher tech manufacturers leveraged knowledge across a wider spectrum of sources at a higher rate than lower tech ones. Also there is an especially notable difference in the percentage of high tech respondents (vis-à-vis low or medium-low tech firms) stating that they utilised knowledge transfer from HEIs, scientific journals and conferences. Overall, there is a clear association between technology intensity and the strength in the utilisation of externally-sourced knowledge amongst manufacturing firms, corroborating the empirical strength of the OECD’s classification of industries\(^7\).

**Figure 3: Proportion of manufacturing firms utilising knowledge sources by technology intensity, 2002-2010**

![Figure 3: Proportion of manufacturing firms utilising knowledge sources by technology intensity, 2002-2010](source: weighted UKIS 2005-2011)
Special attention has also been paid to the advanced manufacturing industries that have been identified by the Government to be of particular importance to the UK’s industrial strategy, especially aerospace, automotive and life sciences (c.f. BIS Economics Paper No. 18 (2012)). Figure 4 shows an unequivocal advantage enjoyed by the advanced manufacturers in their knowledge utilisation: compared with their non-advanced counterparts, a higher proportion of them were able to leverage knowledge across all channels, especially the institutional sources such as government and HEIs.
In terms of the evolution of firms’ knowledge sourcing behaviour over time, Figure 5 illustrates that there was a general downward trend in the utilisation of knowledge within most categories across the economy, from the 2005 UKIS wave (2002-2004 period) to the 2009 wave (2006-2008 period). The decline seemed most substantial during the 2006-2008 period of economic recession (as evident in the 2009 survey) before an incremental upswing was seen in the most recent 2011 wave (2008-2010 period). The only exception was the case of obtaining knowledge from HEIs and government sources, which remained relatively constant over time. Other than manufacturing firms having a higher utilisation rate of knowledge from all sources vis-à-vis the rest of the economy, the patterns of change over time were broadly comparable.

Table 3 provides evidence on the knowledge sources used by UK manufacturers across government office regions (GORs). Again, suppliers, clients and competitors were very important sources for respondents across all UK regions. Knowledge linkage with HEIs was utilised by more than 10 per cent of firms based in Wales and Northern Ireland. And knowledge transfer from government was most prevalent amongst respondents from Northern Ireland (9.2 per cent), Wales (8.5 per cent) and Scotland (7.3 per cent).

Table 3: Proportion of manufacturing firms utilising knowledge sources and ranking, by UK government office region, 2002-2010
<table>
<thead>
<tr>
<th>GOR regions</th>
<th>Suppliers</th>
<th>Clients</th>
<th>Competitors</th>
<th>Consultants</th>
<th>HEIs</th>
</tr>
</thead>
<tbody>
<tr>
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<td>54</td>
<td>3</td>
<td>40</td>
</tr>
<tr>
<td>Wales</td>
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<td>2</td>
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<td>Mean</td>
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Source: weighted UKIS 2005-2011; figures in italics are rankings
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<th>Region</th>
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<th>50-199</th>
<th>200+</th>
<th>Mean</th>
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<td>19</td>
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<tr>
<td>North West</td>
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<td>London</td>
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<td>32</td>
<td>17</td>
<td></td>
</tr>
</tbody>
</table>

Source: weighted UKIS 2005-2011; figures in italics are rankings

**Figure 6: Proportion of manufacturing firms utilising knowledge sources by size band, 2002-2010**

Data Source: weighted UKIS 2005-2011

**Figure 7: Proportion of manufacturing firms utilising knowledge sources by age band, 2002-2010**
Furthermore, Figure 6 suggests that there was a very strong correlation between the size of a manufacturing firm (as measured in employment band) and its orientation of knowledge linkage with external sources. For instance, in most categories, the proportion of firms in the largest size band (i.e. 200+ employees) leveraging from external knowledge sources was twice that of those in the smallest band (i.e. less than 10 employees). In contrast, the relationship between firm age and knowledge sourcing may not be a distinct one. As shown in Figure 7, the utilisation of knowledge seemed to differ little between firms of different age.

Turning next to the effect of foreign ownership, Figure 8 shows that foreign subsidiaries in the UK manufacturing routinely outperformed their indigenous counterparts in leveraging external knowledge across all sources. In particular, US owned firms were especially adept at exploiting knowledge from most channels, whereas subsidiaries owned by firms from countries other than the EU or US demonstrated an advantage in utilising knowledge from consultants, government and industry associations.

Figure 9 provides evidence that a firm’s export orientation was also an important element in understanding how it makes use of sources of knowledge in UK
manufacturing. Exporting firms in the high tech industries consistently outperformed not only medium and lower tech exporters in leveraging knowledge but also those high tech firms that were not internationalised. Clients were the most important source of knowledge for exporting firms, followed by suppliers, technical/industry standards and competitors. Overall, the difference between non-exporters and exporters on these scores is a stark one: exporters were often twice as likely to make use of various knowledge sources in innovation; and even exporters in the low tech industries systematically utilised various knowledge sources at a higher rate compared with their non-exporting high tech counterparts. This may in part be explained by some stylised facts of exporters being larger, more productive and paying higher wages (and thus better positioned to acquiring many types of knowledge to gain a competitive edge). More importantly and in the context of innovation activities, the interrelatedness in the decisions to export and to innovate has also been widely documented in the literature, i.e. export-market entry facilitated by product innovation/differentiation, and innovation fostered by the need to gain competitive advantages at the international stage (Lachenmaier 2006; Harris and Li 2009).

Figure 8: Proportion of manufacturing firms utilising knowledge sources by foreign ownership, 2002-2010
Figure 9: Proportion of manufacturing firms utilising knowledge sources by technology intensity and exporting status, 2002-2010

Source: weighted UKIS 2005-2011
Summary of main findings:

- Clients constitute the most important source of knowledge for innovation activities, with suppliers and competitors also being of great importance.

- Alongside market-based sources, a large proportion of firms were also taking advantage of other information sources such as professional and industry associations and technical/industry standards, whereas public institutions (such as government and HEIs) were reported to be least commonly associated with firms’ knowledge sourcing for innovation.

- In terms of inter-sectoral differences, manufacturing firms appeared to represent the largest users of knowledge from most sources except consultants, HEIs, government, industry associations and scientific journals or trade publications.

- Suppliers and clients represented main sources of knowledge to around half
of manufacturers in Medical etc. Instruments, Electrical Machinery, Chemicals, Rubber and Plastic, Machinery and Equipment, Non-metallic Minerals and lastly Motor and Transport Equipment.

• Outside these frequently utilised market-based channels, manufacturers in Medical etc. Instruments, Electrical Machinery and Chemicals were also the leading users of knowledge from all other sources (e.g. conferences, industry associations, technical/industry standards and scientific journals).

• As might be expected, higher tech manufacturers leveraged knowledge across a wider spectrum of sources at a higher rate than their lower tech counterparts.

• There is evidence that there was a very strong correlation between the size of a manufacturing firm (as measured in employment band) and its orientation of knowledge linkage with external sources.

• The effect of foreign ownership in the UK manufacturing was also evident in that foreign subsidiaries routinely outperformed their indigenous counterparts in leveraging external knowledge across all sources.

• Additionally the difference between non-exporters and exporters is also a stark one: exporters were often twice as likely to make use of various knowledge sources in innovation; and even exporters in the low tech industries systematically utilised knowledge sources at a higher rate compared with non-exporting firms in the high tech industries.

7. Cooperation on Innovation Activities in UK Manufacturing Firms

The UKIS questionnaire also compiles information on business cooperation on innovation activities (at both national and international levels), covering the following elements:

-
• Market: suppliers of equipment, materials, services or software; clients or customers; competitors or other businesses in the industry; consultants, commercial labs or private R&D industries;

• Institutional: universities or other HEIs; government or public research institutes

### 7.1 Cooperation in Innovation at the National Level

As illustrated in Figure 10, across the economy, as with the knowledge sourcing behaviour, firms engaged in cooperation for innovation activities in the UK most frequently with market-based partners (namely suppliers and clients but unsurprisingly not competitors), and less so with institutional partners such as HEIs or government. The strength of these partnerships was highest in the Manufacturing, Agriculture and Utilities, and KIS sectors.

**Figure 10: Proportion of firms cooperating nationally in innovation, all sectors, 2002-2010**

![Proportion of firms cooperating nationally in innovation, all sectors, 2002-2010](source: weighted UKIS 2005-2011)

Within the manufacturing sector, as Table 4 shows, almost every industry placed great importance on the cooperation with suppliers and clients (notable exceptions are the Clothing and Leather, and Wood Products industries which had relatively low cooperation rates). Across all categories of collaboration (including the public sector), Medical etc, Instruments, Chemicals, Electrical Machinery and Motor and Transport
Equipment were most active in building formal partnerships in their innovation activities.

Table 4: Proportion of firms cooperating nationally in innovation and ranking, manufacturing industries, 2002-2010

<table>
<thead>
<tr>
<th>Industry</th>
<th>Suppliers</th>
<th>Clients</th>
<th>Competitors</th>
<th>Consultants</th>
<th>HEIs</th>
<th>Government</th>
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</thead>
<tbody>
<tr>
<td>Medical etc. instruments</td>
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<td>1</td>
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</tr>
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<td>19</td>
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<td>6</td>
<td>12</td>
</tr>
<tr>
<td>Motor &amp; Transport eqpt</td>
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<td>3</td>
<td>18</td>
<td>5</td>
<td>6</td>
<td>9</td>
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<tr>
<td>Machinery, Equip</td>
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<td>5</td>
<td>17</td>
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</tr>
<tr>
<td>Rubber, Plastic</td>
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<tr>
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<td>17</td>
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<td>8</td>
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<td>8</td>
<td>2</td>
</tr>
<tr>
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<td>11</td>
<td>14</td>
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</tr>
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<td>Furniture</td>
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<tr>
<td>Wood products</td>
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<td>9</td>
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<td>4</td>
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<td>Clothing, Leather</td>
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<td>10</td>
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<td>5</td>
<td>10</td>
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<tr>
<td>Mean</td>
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<td>15</td>
<td>5</td>
<td>7</td>
<td>6</td>
<td>4</td>
</tr>
</tbody>
</table>

Source: weighted UKIS 2005-2011; figures in italics are rankings

High tech manufacturers cooperated most fully across each type of partner (Figure 11). For example, relative to their low tech counterparts, nearly 4 times high tech
firms were cooperating with government, 4 times as many with HEIs and 3 times as many with consultants and around twice as many with competitors or clients. Also compared with average manufactures, advanced manufacturers had an advantage in collaboration with all types of partners and especially with government and HEIs.

Figure 11: Proportion of manufacturing firms cooperating nationally in innovation by technology intensity and advanced manufacturing, 2002-2010

Figure 12: Proportion of firms cooperating internationally in innovation, all sectors, 2002-2010

Source: weighted UKIS 2005-2011

7.2 Cooperation in Innovation at the International Level

On a global scale, cooperation for innovation was also strongest with suppliers and clients across all sectors, with particularly strong collaboration within the Manufacturing and KIS sectors (Figure 12). Furthermore, KIS firms were especially strong in forming partnerships with government, HEIs and consultants.

Figure 12: Proportion of firms cooperating internationally in innovation, all sectors, 2002-2010
Figure 13: Proportion of manufacturing firms cooperating internationally in innovation by technology intensity and advanced manufacturing, 2002-2010

As Figure 13 illustrates, within manufacturing suppliers and clients were by far the most important means of international cooperation across all sectors and many sectors appeared to have especially low values for cooperation with HEIs and government at the global level. Detailed breakdown by manufacturing industries is not available due to small numbers of firms engaging in international cooperation in the UKIS data resulting in statistical disclosure issues. However, at a more
aggregated level, industrial classification by technology intensity shows a fairly linear pattern: low tech and medium-low tech firms had lower levels of international cooperation than medium-tech or (especially) high tech manufacturers. Advanced manufacturers were around twice as likely to cooperate internationally with all partners relative to average manufactures.

Summary of main findings:

• Firms engaged in cooperation for innovation activities in the UK most frequently with market-based partners (namely suppliers and clients), and less so with institutional partners such as HEIs or government. The strength of these partnerships was highest in the Manufacturing, Agriculture and Utilities, and KIS sectors.

• Within the manufacturing sector, Medical etc. Instruments, Chemicals, Electrical Machinery and Motor and Transport Equipment were most active in building formal partnerships in their innovation activities at the national level.

• Within the UK, high tech manufacturers cooperated most fully across each type of partner. And compared with average manufactures, advanced manufacturers had an advantage in collaboration with all types of partners and especially with government and HEIs.

• In terms of international cooperation in innovation activities, such collaborative partnership was also strongest with suppliers and clients across all sectors, with particularly strong collaboration within the Manufacturing and KIS sectors.

• Furthermore, KIS firms were especially noticeable in forming partnerships with overseas government, HEIs and consultants.

• Within the manufacturing sector, suppliers and clients were by far the most important means of international collaboration. Low tech and medium-low tech manufactures had lower levels of international cooperation than medium-tech or (especially) high tech manufacturers. Advanced manufacturers also had a notable
8. Absorptive Capacity in UK Manufacturing Firms

Following the approach developed in Harris and Li (2009), we constructed an empirical multi-index of absorptive capacity to measure a firm’s ability to internalise and appropriate external knowledge for innovation activities. Despite the lack of direct information on the concept of absorptive capacity, the UKIS compiles information outlining an extensive picture of a firm’s behaviour in ‘external’ knowledge-sourcing, collaborative partnership and ‘internal’ implementation of business strategies and practices, which can be expected to relate to the level of absorptive capacity.

Here the first sets of variables that were employed to create the absorptive capacity measure consist of those used to study external knowledge sources and national/international innovative activities as discussed in Sections 6 and 7 earlier. Additionally, we also included measures for firms’ ability to implement changes in cooperate strategy and practices covering the following areas:

- new or significantly changed corporate strategies;

- new management techniques within firms (e.g. just-in-time, 6 Sigma, Investors in People);

- major changes to organisational structures (e.g. introduction of cross-functional teams, outsourcing of major business functions);

- changes to marketing concepts or strategies

These 26 elements\textsuperscript{12} of knowledge-sourcing, cooperation and corporate strategies exhibit a high degree of internal statistical consistency with a Cronbach’s Alpha score of 0.89 (scale reliability coefficient). In order to reduce the number of
variables under investigation and exact crucial information on the firm’s capability of absorbing information and appropriating knowledge, we undertook a factor analysis (in conjunction with weighting and oblique oblimin rotation) using these 26 input variables outlined above.

Five principal components have been retained with eigenvalues above one, accounting for 58% of the total variance in the data. This procedure yielded 5 factors capturing 5 distinct aspects of a firm’s absorptive capacity. Table 5 illustrates the structure of the factor loadings associated with each factor and input variable. Each factor was interpreted to principally capture the variables for which it had the highest factor loadings, representing the firm’s absorptive capacity for general external knowledge (Factor 1), national cooperation (Factor 2), international cooperation (Factor 3), implementation of new business strategy and practice (Factor 4) and lastly, more specialist knowledge from HEIs, government or public research institutes, consultants and commercial labs (Factor 5). These 5 indices were then normalised to distribute between zero and one.

<table>
<thead>
<tr>
<th>Input Variables</th>
<th>Factor 1 General external knowledge</th>
<th>Factor 2 National co-operation</th>
<th>Factor 3 International co-operation</th>
<th>Factor 4 Business strategy and practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sources of knowledge/info for innovation</td>
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<tr>
<td>Suppliers/materials/services</td>
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<td>0.047</td>
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<td>Clients/customers</td>
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<td>0.064</td>
<td>0.015</td>
<td>0.118</td>
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<td>Competitors</td>
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<td>0.020</td>
<td>0.072</td>
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<td>0.022</td>
<td>0.109</td>
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<tr>
<td>Universities/other HEIs</td>
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<td>0.064</td>
<td>0.042</td>
<td>0.078</td>
</tr>
<tr>
<td>Government/public research institutes</td>
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<td>0.049</td>
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<td>Conferences/trade fairs/exhibitions</td>
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<td>-0.013</td>
<td>-0.046</td>
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<tr>
<td>Scientific journals &amp; trade publications</td>
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<td>-0.052</td>
<td>0.024</td>
<td>-0.067</td>
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</table>
### Table 6 (continued): Structure matrix of factor loadings: correlations between variables and rotated common factors

<table>
<thead>
<tr>
<th>Input Variables</th>
<th>Factor 1 General external knowledge</th>
<th>Factor 2 National co-operation</th>
<th>Factor 3 International co-operation</th>
<th>Factor 4 Business strategy and practice</th>
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</thead>
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<tr>
<td>Co-operation partners on innovation activities (National)</td>
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<tr>
<td>Suppliers/materials/services</td>
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<td>-0.011</td>
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<td>Innovation in business strategy and practices</td>
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<td>Corporate strategies/practices</td>
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<td>-0.031</td>
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</table>
### 8.1 Absorptive Capacity – Sectoral Disparity

Average scores across sectors of each absorptive capacity index are presented in Table A6 in the Annex. Overall manufacturing firms appeared to have the highest absorptive capacity for general external knowledge (the first principal component) and also a noticeable advantage in its absorptive capacity for national and international cooperation, and business strategy and practice. Another sector that stood out is the Knowledge-Intensive Services (KIS) which dominated in its absorptive capacity for business strategy and practice, national and international cooperation and was only second to manufacturing in its principal absorptive capacity for general external knowledge. Sectors such as construction, Less Knowledge-Intensive Services (LKIS) and wholesale and retail performed fairly poorly in terms of overall ranking in this table.

To control for the influence of outliers (which can sometimes drive means values as presented in Table A6) and provide a more comprehensive account of sectoral heterogeneity at all levels of absorptive capacity, Figure 14 plots the empirical cumulative distribution functions (ECDFs) of 5 absorptive capacity indices for all sectors. The cumulative distribution function (CDF) denotes, at each possible score of absorptive capacity index (i.e. $x$ on the horizontal axis), the probability of receiving that score or a lower one (i.e. $P(x)$ on the vertical axis). Hence $P(x)$ is the non-decreasing probability of the absorptive capacity score less than a given score $x$; $P(x)$ goes to zero as $x$ decreases $\lim_{x \to -\infty} P(x) = 0$ and conversely, it goes to unity as $x$ reaches its maximum score $\lim_{x \to \infty} P(x) = 1$. Here we employ the empirical cumulative distribution function (ECDF) of absorptive capacity as a non-parametric estimator of the distribution function based on our empirical data. The absorptive capacity scores are normalised and bounded between 0 and 1 (x-axis), and by definition, the ECDF...
$P(x)$ contains probability/proportion values ranging from 0 to 1 (y-axis). For a given set of scores of absorptive capacity, the value of the ECDF $P(x)$ at an absorptive capacity score $x$ is the proportion of scores in the set that are no greater than $x$.

A common application of ECDFs is to determine the differences in distributions of sub-groups or a relation of stochastic dominance (for instance the income inequality between different population subgroups, or productivity gaps amongst firms of differing characteristics). For example, let us consider the distributions of absorptive capacity of sectors A and B, represented by $P_A(x)$ and $P_B(x)$ respectively. Then distribution A stochastically dominates distribution B if the plotted ECDF of distribution A lies to the right of the distribution B, i.e. for any score of $x$, $P_A(x) \leq P_B(x)$. More specifically, if $x$ denotes a given score of absorptive capacity, then the inequality in the two distributions (of sectors A and B) indicates that the proportion of firms in sector A with absorptive capacity scores no greater than $x$ is no greater than the proportion of such firms in B. In other words, whatever absorptive capacity levels we consider, there is always a larger proportion of firms with higher scores of absorptive capacity in sector A than in sector B, and therefore A is the dominating and B the dominated distribution.

As shown in Figure 14, there seems to be considerable variation in the empirical distributions of absorptive capacity indices across all sector groups, except at extremely low or high scores of absorptive capacity where the inter-sectoral differences become indistinguishable. Thus it is worth noting that the relationships of stochastic dominance referred to here are mostly restricted (and sometime weak) dominance, as the inequality holds over some restricted range of the argument $x$ rather than for all possible values (as is often the case in empirical distributions). Overall the patterns revealed by these graphs are broadly similar to those based on the mean statistics in Table A6.

In the case of absorptive capacity for general external knowledge, the distribution of Manufacturing dominated those of other sectors mostly throughout all values of the index (i.e. its empirical distribution lies to the right of other sectors). The Knowledge-Intensive Services (KIS) also had a leading position and was only dominated by Manufacturing. Notably the Less Knowledge-Intensive Services (LKIS) sector appeared to have the lowest capacity with its distribution statistically dominated by all other sectors nearly at all levels.
The distributions of the absorptive capacity for national and especially international cooperation appeared to be most skewed (especially given the small fraction of firms engaging in the latter cooperation activities), with the top quartile (75% percentile) scores of 0.15 and 0.01 for national and international cooperation respectively. In terms of the absorptive capacity for national cooperation, Manufacturing, KIS and Agriculture and Utilities seemed the strongest performers with the LKIS and Construction sectors being mostly dominated at medium-range of the index but such differences remained largely insignificant at other levels of the index. As to the absorptive capacity for international cooperation, Manufacturing was seen to weakly dominate other sectors at a rather small range of the index and thus there was little evidence of sectoral heterogeneity in this respect.

Considering next the absorptive capacity for business strategy and practice, as might be expected KIS sector had stochastic dominance over all other sectors (i.e. weak dominance over Manufacturing and Agriculture and Utilities but strong dominance over Mining and Quarrying, LKIS, Construction and Wholesale, Retail and Motor Repairs) across the absorptive capacity index. Meanwhile, Manufacturing and Agriculture and Utilities sectors also performed strongly although the differences start to dissipate at the top end of the absorptive capacity index.

Lastly, the absorptive capacity index for specialist knowledge seemed to be distributed more similarly regardless of the sector firms originated in. The distribution of Manufacturing was weakly dominated by others at low levels of absorptive capacity and the distributions of sectors such as Agriculture and Utilities, Mining and Quarrying and KIS showed some weak dominance at higher levels of absorptive capacity, although most of this inequality remained indiscernible.

What’s more, the distributions of absorptive capacity indices for industries (by technology intensity) within manufacturing are reported in Figure A1 in the Annex. Overall, there appears to be substantial inequality amongst different types of manufacturers in their scores of absorptive capacity although (as with the case presented in Figure 14) such variations are usually indistinguishable at extremely low values of absorptive capacity and the distributions tend to converge at extremely high levels.

As these diagrams in Figure A1 illustrate, the distribution of high tech manufactures clearly dominated other types of manufacturers in all five aspects of absorptive
capacity, i.e. the distribution of the high tech industries nearly always lie to the right of other distributions. Although being dominated by the distribution of high tech manufacturing, the distribution of medium-high tech manufacturing firms also had a strong stochastic dominance over those of medium-low and low tech firms. Perhaps more surprisingly, the distribution of the medium-low tech firms seemed to be dominated by that of their low tech counterparts in the absorptive capacity for general external knowledge (except at very low or high levels), which again indicates the boundaries as per the OECD’s classification within these two groupings may overlap.

**Figure 14: Empirical cumulative distribution of absorptive capacity indices, all sectors, 2002-2010**

![Diagram of Absorptive Capacity by Sector](image-url)
Absorptive Capacity by Sector

AC for general ext. knowledge

Data source: weighted UKIS 2005-2011

Absorptive Capacity by Sector

AC for national cooperation

Data source: weighted UKIS 2005-2011
8.2 The Spatial Distribution of Absorptive Capacity in UK Manufacturing

A number of ‘heat maps’ showing performance of absorptive capacity for UK local authorities are provided in Figure 15 and at a more aggregated level the mean scores of each index are also reported in Table A7 in the Annex for each GO region.

In terms of the absorptive capacity for general external knowledge, Wales and Scotland appeared to be associated with higher levels overall - it seems that the areas with strong manufacturing component tended to have higher capacity. The essentially ‘clustered’ nature of absorptive capacity was revealed, especially in the North East and East of England. A surprise was the low rank of London and also the West Midlands, suggesting that the nature of absorptive capacity in these regions may be more ‘industry specific’ (e.g. dominance towards services away from manufacturing in London may be an important factor). Our findings here echo those highlighted in a recent study of spatial spillovers and ‘place’ effects in the UK by Harris and Moffat (2012c); that is productivity spillovers are distributed across the
country and not just confined to the Capital or other major cities. Finally, these results should also be considered bearing in mind that there are differences in the underlying industrial structure of UK regions.

The picture of absorptive capacity for national cooperation is more ‘bitty’ than that for other types of absorptive capacity. The areas with higher level of capacity were seen around the UK periphery (Scotland, Wales and parts of Northern England) but there were also stronger areas embedded within the Midlands, South East and South West. As to the capacity for cooperation at the international level, the strongest areas were similar to those found at the national level - there were clusters of relative strength in Wales and Scotland, the North East and a band in the Midlands.

Given the ‘hub’ effect of London and the South East (hosting leading global businesses), these regions performed more strongly on their absorptive capacity for business strategies and practices, which may be a result of the greater number of head office functions which occurred in these regions. What’s more, there is a strong association between being in the more heavily urbanised areas of the country and a strong performance against this variable. Lastly, in terms of the regional absorptive capacity for specialist knowledge from HEIs and government, Scotland was a strong performer visually against this variable, as were the North East and North West and the South of Wales. Again in the rest of the UK there were identifiable clusters (the Midlands, Home Counties) but there was no overall consistent pattern which can be defined across each and every region.

Figure 15: Spatial distribution of absorptive capacity indices in UK manufacturing firms, 2002-2010
Absorptive Capacity in UK Manufacturing
AC for national cooperation

Data source: weighted UKIS 2005-2011
Absorptive Capacity in UK Manufacturing
AC for international cooperation

Data source: weighted UKIS 2005-2011
Absorptive Capacity in UK Manufacturing
AC for business strategy and practice

Data source: weighted UKIS 2005-2011
Absorptive Capacity in UK Manufacturing
AC for specialist knowledge

Data source: weighted UKIS 2005-2011
Summary of main findings:

• Following the approach developed in Harris and Li (2009), we constructed an empirical multi-index of absorptive capacity to measure a firm’s ability to internalise and appropriate external knowledge for innovation activities.

• Our empirical indices of absorptive capacity consist of the following 5 elements - the absorptive capacity for general external knowledge (Factor 1), for national cooperation (Factor 2), for international cooperation (Factor 3), for implementation of new business strategy and practice (Factor 4) and lastly, for more specialist knowledge from HEIs, government or public research institutes, consultants and commercial labs (Factor 5).

• Based on the average scores of absorptive capacity indices, manufacturing firms appeared to have the highest absorptive capacity for general external knowledge and also a noticeable advantage in its absorptive capacity for national and international cooperation, and business strategy and practice.

• Our analyses of the empirical cumulative distribution functions (ECDFs) of 5 absorptive capacity indices shed further light on the relation of stochastic dominance between different sectors.

• In the case of absorptive capacity for general external knowledge, the distribution of Manufacturing dominated those of other sectors mostly throughout all values of the index. KIS sector also had a leading position and was only dominated by the Manufacturing.

• In terms of the absorptive capacity for national cooperation, Manufacturing, KIS and Agriculture and Utilities seemed the strongest performers; as to the absorptive capacity for international cooperation, there was little evidence of sectoral heterogeneity.

• In the case of the absorptive capacity for business strategy and practice, KIS sector had stochastic dominance over all other sectors.
• The absorptive capacity index for specialist knowledge seemed to be distributed more similarly regardless of the sector firms originated in.

• Within the manufacturing sector, there appears to be substantial inequality amongst different types of manufacturers: the distribution of high tech manufactures clearly dominated other types of manufacturers in all five aspects of absorptive capacity; and the distribution of medium-high tech manufacturing firms also had a strong stochastic dominance over those of medium-low and low tech firms.

• Major spatial variations in the regional absorptive capacity have been documented in a number of ‘heat maps’. In terms of the absorptive capacity for general external knowledge, Wales and Scotland appeared to be associated with higher levels overall - it seems that the areas with strong manufacturing component tended to have higher capacity.

• The essentially ‘clustered’ nature of absorptive capacity was revealed, especially in the North East and East of England.

• The picture of absorptive capacity for national and/or international cooperation is more ‘bitty’: the areas with higher level of capacity were seen around the UK periphery (Scotland, Wales, and parts of Northern England) and a band in the Midlands.

• Given the ‘hub’ effect of London and the South East (hosting leading global businesses), these regions performed more strongly on their absorptive capacity for business strategies and practices.

• Lastly, in terms of the regional absorptive capacity for specialist knowledge from HEIs and government, Scotland was a strong performer as were the North East, North West and the South of Wales.

9. The Nexus between Knowledge
Sources, Innovation Input and Output

It is beyond the scope of this report to formally investigate the relationship between innovation input and output in the value chain in a multivariate framework of econometric modelling. Therefore, this section provides some initial descriptive analysis to shed light on the pathway of innovation in UK manufacturing. We consider the nexus between knowledge sources, cooperation partners used in innovation activities, formal R&D strategies, innovation output, and lastly IP protection strategies. In particular, in terms of R&D strategy, we measure three forms of R&D spending, viz. intramural R&D (‘make’), extramural R&D (‘buy’) and collaborative R&D (‘cooperate’), a combination of which yields seven R&D strategies – 1) make only, 2) buy only, 3) cooperate only, 4) make and buy, make and cooperate, 5) buy and cooperate, 6) make, buy and cooperate, and lastly 7) none of the above (i.e. no R&D). With respect to the innovation output, we measure process and/or product innovation, as well as a more radically form of blue sky innovation, i.e. product new to the market/industry. Finally, as to the strategies for capturing value of innovation, we focus on patent or any industrial design registered.

A multiple correspondence analysis (MCA) was employed to study the associations between aforementioned innovation-related variables with the results plotted in a geometric (or Euclidean) space in Figures 16 and 17. As a special case of principal components analysis and an extension of the simple correspondence analysis, the MCA method provides a multivariate descriptive technique for understanding patterns of relationship between a number of variables by combining them into visual ‘maps’ and presenting the interrelatedness by clustering of variables. It is worth noting that although interpretation of association is based on proximities between points in the ‘maps’, the magnitude of distance between points in geometric space usually does not have a straightforward interpretation.

The MCA diagram plots individual values of each variable on a two-dimensional ‘map’: in the case of a binary variable this is split into two points suffixed with numbers 0 and 1 (e.g. in Figure 16, ‘gov1’ denotes ‘government used as knowledge source’ and ‘gov0’ denotes otherwise); and in the case of an ordinal variable this is split into various categories consisting of its numeric scores (e.g. in Figure 16, ‘rd_strategy’ is split into 7 categories as discussed above, such as ‘makeonly’, ‘buyonly’, ‘make&buy’, ‘make&buy&coop’).
Figure 16 illustrates the results of a MCA of knowledge sources, R&D strategies and innovation output, plotting 20 variables/points in a geometric space (two dimensions represented on the horizontal and vertical axes respectively). Here the two dimensions retained jointly explain nearly 94% of total inertia in the data and thus have considerable explanatory power.

Figure 16: The nexus between sources of knowledge, R&D strategies and innovation output in UK manufacturing firms, 2002-2010

Categories that are associated are placed close together in the ‘map’. Given that the first dimension explains over 92% of inertia (compared with under 2% as explained by the second dimension) the horizontal axis is obviously the most important dimension and able to differentiate most clearly along the categories of variables under consideration; in other words, horizontal proximity presents far stronger association vis-à-vis vertical proximity on the ‘map’. More specifically, in Figure 16, the bottom-left quadrant suggests that product innovators were also likely to be process innovators (and vice versa), and the more radical innovators (with blue sky innovations) turned to combine ‘make’/intramural and ‘cooperation’ in their R&D investment. Relating knowledge sources to R&D strategies, the clustering of categories near origin seems to suggest that UK manufacturers tended
to use a number of market-based knowledge sources at the same time such as suppliers, clients, competitors, technical standards, industry associations, which is also associated with combining various forms of R&D strategies such as ‘make’ only, ‘make’ and ‘buy’, ‘buy’ and ‘cooperate’, and ‘make’, ‘buy’ and ‘cooperate’.

Interestingly, the firms that used public institutions such as HEIs and government as their knowledge sources (top left corner) seemed to have more distinct patterns of innovation behaviour and less related to other categories. Also notably in the top-right quadrant, categories for no utilisation of various knowledge sources tended to cluster with those for no R&D expenditure and/or for no innovation output (which also indicates the agreement in measuring scales in the underlying data), which is intuitively appealing.

Figure 17: The nexus between cooperation, innovation output and protection in UK manufacturing firms, 2002-2010

Finally, linking patterns in the UK manufacturers’ cooperation partners (both national, prefixed with ‘coop_n’ and international prefixed with ‘coop_i’) to their innovation output (e.g. process/product/blue sky innovation) and value capturing of such output
(e.g. patent, registered design), Figure 17 shows the nexus between these relevant categories. Again the two extracted dimensions explain as high as 89% of total inertia in the data and the principal dimension (1) alone explains 85% of inertia and thus is the most important dimension to observe. The top-left quadrant suggests a clear and close association between blue sky innovation and exploiting value from such path-breaking innovation by registering patents and industrial designs. Again similar to Figure 16, there is often not a clear-cut distinction between being a product and a process innovator (i.e. investment in one type of innovation is associated with that in another type). Notably, the bottom-left quadrant shows a major clustering of cooperation in innovation activities with all 6 types of domestic partners (namely suppliers, clients, competitors, consultants, HEIs and government); that is, the firms engaged in cooperation with one national partner were also likely to report cooperation with other types of partners at national level. At the same time, those firms that participated in cooperation with overseas partners in one form were also more likely to engage in international cooperation in another form (more specifically, there was a noticeable clustering in the international cooperation with HEIs, government, consultants and competitors). Again as with Figure 16, the clustering of variables around the origin in the right quadrant shows that firms that did not engage in cooperation activities were more likely to also report that they were not active in innovation and hence protection of innovation output.

Summary of main findings:

• Product innovators were also likely to be process innovators (and vice versa), and the more radical innovators (with blue sky innovations) turned to combine ‘make’/intramural and ‘cooperation’ in their R&D investment.

• Relating knowledge sources to R&D strategies, UK manufacturers tended to use a number of market-based knowledge sources at the same time such as suppliers, clients, competitors, technical standards, industry associations. This knowledge-sourcing pattern was also associated with combining various forms of R&D strategies such as ‘make’ only, ‘make’ and ‘buy’, ‘buy’ and ‘cooperate’, and ‘make’, ‘buy’ and ‘cooperate’.

• Manufacturing firms engaged in cooperation with one national partner were also likely to report cooperation with other types of partners at national level.
Meanwhile, those firms that participated in cooperation with overseas partners in one form were also more likely to engage in international cooperation in another form (more specifically, there was a noticeable clustering in the international cooperation with HEIs, government, consultants and competitors).

10. Concluding Remarks

The literature generally points to the importance of intangible investments in firms’ internal knowledge assets. Investments in in-house R&D and the share of R&D personnel have been traditionally considered as the main component of the internal knowledge assets; however recent evidence highlights the importance of other types of intangible investments. Although it is difficult to identify and measure the different types of intangible investments, a number of recent studies have attempted to develop measures using new data sets or new survey data (Borgo et al. 2012; Riley and Robinson 2011; J Haskel et al. 2011), and further research should be undertaken to estimate the extent and importance of the soft side of innovation. A concept that is very closely linked to intangible assets is the notion of absorptive capacity, and our survey of the literature suggests that more direct measures of absorptive capacity would improve understanding of this area.

Accessing external knowledge is very important in determining productivity and competitiveness. Evidence suggests that UK firms are increasingly engaging in formal collaboration with different types of partners. The reviewed studies indicate that vertical linkages, through customers and suppliers are considered as the main sources of knowledge for innovation in UK firms. Firms that are more open to external collaboration are more likely to innovate and innovate better.

Firms can also benefit from knowledge developed by other firms and/or institutions without engaging in collaborative agreements or economic transactions. These are spillover effects, because the user who benefits does not pay the full economic cost of producing them. The review of the literature suggests that spillovers may vary in importance and occur through different routines. Trade appears to be an important channel of spillovers. There is some evidence on R&D spillovers via imports, and exporting is found to be associated with learning effects and higher productivity. Regarding FDI-spillovers, although foreign-owned firms are found to be more
productive than their domestic counterparts, the empirical evidence reviewed is mixed. The positive impact of FDI-spillovers is closely linked to the domestic firms’ absorptive capacity and the type of FDI.

Focusing on the spatial dimension of knowledge flows, the literature surveyed indicates a positive effect of being located in a cluster; however, studies reviewed present a mixed picture of local knowledge spillovers. There is some evidence on the importance of labour market dynamics and social interaction at the level of the individual in firms’ and clusters’ knowledge creation processes. However, the positive impact of knowledge spillovers seems to be closely dependent on sectoral and institutional characteristics.

The main mechanism of knowledge diffusion is through labour mobility. This finding highlights the importance of the tacit knowledge embedded in people. In this sense, clusters act as a hub for the attraction of global talents. High-technology clusters are found to be more likely to generate knowledge spillovers. However, the nature of the technology is closely related to the issues of intellectual property. Excessive non-disclosure agreements act as a barrier to knowledge diffusion. The regional science-base and university-industry interactions also arise as an important factor. Geographic proximity appears to facilitate personal interactions, however knowledge flows are not confined to geographical spaces; successful firms access knowledge regardless of its geographical location, through digital communication technologies. However, local and global networks should not be seen as conflicting, they both have important but different, sometimes complementary roles to play (Christopherson, Kitson, and Michie 2008). Successful clusters enable local firms to be embedded simultaneously in knowledge exchanges at different geographic scales.

Using data from four successive waves of the UKIS datasets spanning the 2002-2010 period, our empirical analysis shows that suppliers and clients represent the most important source of knowledge for innovation activities, with both manufacturing and other sectors making greater use of these than of institutional sources such as government and HEIs. Within the manufacturing sector those identified as being ‘high tech’ or ‘advanced manufacturing’ including Electrical Machinery, Medical etc. Instruments and Chemicals were the most inclined to use all sources of knowledge, including institutional sources. Comparing these knowledge linkages across regions, notably, the North West and the North East, Wales and Scotland seemed to suggest the strongest ties with government and HEIs.
In terms of measuring the sectoral variations in absorptive capacity, our results suggest that manufacturing, especially high-tech manufacturing, had the highest overall absorptive capacity (i.e. general external knowledge as the principal capacity). As to the absorptive capacity for national cooperation, Manufacturing and KIS sectors along with Agriculture and Utilities dominated the distribution of the absorptive capacity scores at the medium-range scores of the index although the difference was insignificant at other levels of the index. And there was little evidence of sectoral heterogeneity in the case of international cooperation. Within the manufacturing sector, our overall results suggest that high tech manufacturers had the strongest capacity for internalising and exploiting general external knowledge, followed by their medium-high tech counterpart; whereas the difference between the medium-low and low tech groups was often not very distinguishable.

Policy decisions made by government need to identify attributes which connect the most innovative firms. Within the manufacturing sector, our results from the multiple correspondence analysis indicate that product innovators are also likely to be process innovators, with more radical ('blue sky') innovators combining several streams and strategies together in their R&D investment.

Harris and Moffat (2012a) argue that for firms to perform better they need to mobilise their absorptive capacity to survive in difficult times. Therefore, understanding this process is also central to government when devising policy aiming to help firms survive and grow. They state:

“Having high levels of absorptive capacity (simply defined as the ability to exploit knowledge – obtained both internally and especially externally – that is embodied in intangible assets) is the way firms exploit their intangible assets, which largely define the dynamic capabilities that determine the firm’s competitive advantage. Through a combination of organisational routines and processes, firms must apprehend, acquire, share, assimilate, transform and exploit new knowledge in order to compete and grow in markets”.

The trend for greater cooperation in a globalised world is surely one that will increase and that the most dynamic and cooperative firms will reap rewards from it. There is evidence that manufacturers respond to external market conditions in their utilisation of knowledge sources. For example, the impact of the recent economic recession can be seen within the data sources in a decline in use of various knowledge sources
in the 2006-2008 period before a graduated resurgence in the 2008-2010 period, suggesting that firms were making greater use of knowledge sources in times of uncertainty. HEIs and government sources remained relatively constant over time which suggests that firms with knowledge ties to these public institutions continued to do so independent of prevailing economic conditions. The challenge for industry will be to continue to make the best use of all sources of knowledge as economic conditions in the UK and abroad improve, across all parts of the UK.

Notes

1. In statistics, a meta-analysis refers to methods focused on contrasting and combining results from different studies, in the hope of identifying patterns among study results, sources of disagreement among those results, or other interesting relationships that may come to light in the context of multiple studies.

2. According to Outes-Leon and Dercon (2008), the pseudo R-squared from the estimated attrition probit model can be interpreted as the proportion of attrition that is non-random. In this instance, only some less than 2% of attrition is non-random and thus there is little evidence of substantial bias.

3. Data linking will be undertaken at the ‘establishment’ or ‘reporting-unit’ level to ensure comparability between the ARD and UKIS data.

4. For each element, respondents were asked to rank from 0 ‘not used’, 1 ‘Low’, 2 ‘Medium’ to 3’High’ importance. For the purpose of this report, these responses have been recoded to have two categories only, viz. used and not-used (i.e. we do not make distinctions in the level of importance).

5. Refer to Tables A4 and A5 in the Annex for a detailed classification of sectors.

6. Refer to Table A5 in the Annex for detailed definition of each grouping by their technology intensity.

7. Admittedly, there seems to be some overlap between low and medium-low
industries as evident in Figure 3 here and in subsequent analysis using this classification.

8. The UK has a strong aerospace sector with an international reputation. If the industry can maintain these strengths it is well placed to take advantage of the increased demand for air travel and rising demand for new aircraft as a result from rising per capita income across the world. International competition is marked by strong brands and Airbus, BAE Systems, Bombardier and Rolls Royce are key players in the global market with strong UK operations.

9. The UK automotive sector is strongly export driven, with over 50% of total sales being exports. The future industry will be driven not only by economic factors but also by environmental drivers, which will force innovative changes in vehicles in terms of reducing emissions from combustion engines and hybrids and other non–fossil fuel alternatives. In common with aerospace, studies show that the automotive industry generates significant pull through for new goods and services from other areas within the economy.

10. Life sciences are a broad sector encompassing pharmaceuticals, medical technology and medical biotechnology. The sector is likely to be the beneficiary of high demand due to the simultaneously ageing population and increased incomes.

11. Respondents to the UKIS survey were asked to state whether the cooperation was UK regional, UK national, Other Europe, Other country. We have derived two broader categories pooling the UK national and the international options.

12. Refer to Table 5 for the variable names of these 26 elements.

13. Kaiser-Meyer-Olkin measure of sampling adequacy is employed to assess the value of input variables. Historically, the following labels are given to different ranges of KMO values: 0.9-1 Marvellous, 0.8-0.89 Meritorious, 0.7-0.79 Middling, 0.6-0.69 Mediocre, 0.5-0.59 Miserable, 0-0.49 Unacceptable.
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**Annex**

1. Overview of the studies on the rate of return of R&D – UK Evidence

<table>
<thead>
<tr>
<th>Study</th>
<th>Sample</th>
<th>Period</th>
<th>Type of estimation</th>
<th>R&amp;D rate of return</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bond, Harhoff, &amp; Reenen, 2003</td>
<td>239 firms</td>
<td>1988-1996</td>
<td>GMM-SYS (pooled)</td>
<td>38%</td>
</tr>
<tr>
<td>Bond et al. 2003</td>
<td>239 firms</td>
<td>1988-1996</td>
<td>Sectoral level</td>
<td>20%</td>
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<td>R Griffith et al. 2006</td>
<td>188 mfg firms</td>
<td>1990-2000</td>
<td>GMM -SYS</td>
<td>11%*</td>
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<tr>
<td>R Griffith et al. 2006</td>
<td>188 mfg firms</td>
<td>1990-2000</td>
<td>VA Production function (pooled)</td>
<td>14%*</td>
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Table A.2. Overview of the studies on FDI spillovers – The UK Evidence

<table>
<thead>
<tr>
<th>Study</th>
<th>Spillovers Effects</th>
<th>Period</th>
<th>Data</th>
<th>Aggregation level</th>
<th>Result</th>
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<tbody>
<tr>
<td>Girma, Greenaway, &amp; Wakelin, 2001</td>
<td>Productivity</td>
<td>1991-1996</td>
<td>panel</td>
<td>Firm</td>
<td>?</td>
</tr>
<tr>
<td>Girma et al., 2001</td>
<td>Productivity</td>
<td>1980-1992</td>
<td>panel</td>
<td>Firm</td>
<td>?</td>
</tr>
<tr>
<td>Harris &amp; Robinson, 2004</td>
<td>Productivity</td>
<td>1974-1995</td>
<td>panel</td>
<td>Firm</td>
<td>?</td>
</tr>
<tr>
<td>Girma &amp; Wakelin, 2000</td>
<td>Productivity</td>
<td>1988-1996</td>
<td>panel</td>
<td>Firm</td>
<td>?</td>
</tr>
<tr>
<td>Haskel, Pereira, &amp; Slaughter, 2002</td>
<td>Productivity</td>
<td>1973-1992</td>
<td>panel</td>
<td>Firm</td>
<td>+/-</td>
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<tr>
<td>Girma, 2005</td>
<td>Productivity</td>
<td>1989-1999</td>
<td>panel</td>
<td>Firm</td>
<td>?</td>
</tr>
<tr>
<td>De Propris &amp; Driffield, 2005</td>
<td>Productivity</td>
<td>1993-1998</td>
<td>panel</td>
<td>Firm</td>
<td>-</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Backward: ?</td>
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<td></td>
<td></td>
<td>Forward: +</td>
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<td>Harris &amp; Robinson, 2003</td>
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<td>panel</td>
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<td>Forward: ?</td>
</tr>
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<td>Girma et al., 2001</td>
<td>Wage</td>
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<td>panel</td>
<td>Firm</td>
<td>?</td>
</tr>
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<td>Authors</td>
<td>Sample Year</td>
<td>Panel Type</td>
<td>Industry</td>
<td>$\hat{b}$</td>
<td>SE</td>
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<tr>
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<td>-------------</td>
<td>------------</td>
<td>------------------------------------</td>
<td>----------</td>
<td>------</td>
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<tr>
<td>Driffield &amp; Girma, 2003</td>
<td>Wage</td>
<td>1980-1992</td>
<td>panel</td>
<td>?</td>
<td></td>
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</table>

**Table A3: Attrition probit model to determine attrition bias in UKIS 2011**

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<th>$\hat{b}$</th>
<th>SE</th>
</tr>
</thead>
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<tr>
<td>Employment</td>
<td>-0.000**</td>
<td>(0.000)</td>
</tr>
<tr>
<td>Weight</td>
<td>-0.006***</td>
<td>(0.001)</td>
</tr>
<tr>
<td>Food, drink, tobacco</td>
<td>-0.055</td>
<td>(0.104)</td>
</tr>
<tr>
<td>Textiles</td>
<td>-0.028</td>
<td>(0.151)</td>
</tr>
<tr>
<td>Clothing, leather &amp; footwear</td>
<td>-0.206</td>
<td>(0.192)</td>
</tr>
<tr>
<td>Wood products</td>
<td>-0.054</td>
<td>(0.153)</td>
</tr>
<tr>
<td>Paper</td>
<td>0.251</td>
<td>(0.171)</td>
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<td>Publishing &amp; printing</td>
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<td>(0.110)</td>
</tr>
<tr>
<td>Chemicals</td>
<td>0.047</td>
<td>(0.129)</td>
</tr>
<tr>
<td>Rubber &amp; plastics</td>
<td>0.138</td>
<td>(0.117)</td>
</tr>
<tr>
<td>Non-metallic minerals</td>
<td>-0.156</td>
<td>(0.142)</td>
</tr>
<tr>
<td>Basic metals</td>
<td>0.399**</td>
<td>(0.202)</td>
</tr>
<tr>
<td>Fabricated metals</td>
<td>0.044</td>
<td>(0.097)</td>
</tr>
<tr>
<td>Machinery &amp; equipment nes</td>
<td>0.162</td>
<td>(0.107)</td>
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<tr>
<td>Electrical machinery</td>
<td>-0.062</td>
<td>(0.117)</td>
</tr>
<tr>
<td>Medical etc instruments</td>
<td>0.187</td>
<td>(0.142)</td>
</tr>
<tr>
<td>Motor &amp; transport</td>
<td>-0.057</td>
<td>(0.110)</td>
</tr>
<tr>
<td>Furniture &amp; manuf nes</td>
<td>-0.192</td>
<td>(0.118)</td>
</tr>
<tr>
<td>Construction</td>
<td>-0.095</td>
<td>(0.082)</td>
</tr>
<tr>
<td>Sale/repair motors</td>
<td>0.042</td>
<td>(0.094)</td>
</tr>
<tr>
<td>Wholesale trade</td>
<td>0.085</td>
<td>(0.082)</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Dependent variable: non attrition (valid in usable sample)</th>
<th>$\hat{b}$</th>
<th>SE</th>
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</thead>
<tbody>
<tr>
<td>Retail</td>
<td>-0.142*</td>
<td>(0.085)</td>
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<tr>
<td>Hotels and restaurants</td>
<td>-0.217***</td>
<td>(0.082)</td>
</tr>
<tr>
<td>Transport</td>
<td>-0.370***</td>
<td>(0.094)</td>
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<tr>
<td>Transport support</td>
<td>0.002</td>
<td>(0.116)</td>
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<tr>
<td>Post &amp; telecom</td>
<td>0.109</td>
<td>(0.124)</td>
</tr>
<tr>
<td>Financial</td>
<td>-0.315***</td>
<td>(0.095)</td>
</tr>
<tr>
<td>Real estate</td>
<td>-0.170*</td>
<td>(0.092)</td>
</tr>
<tr>
<td>Category</td>
<td>Coefficient</td>
<td>Standard Error</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Machine rentals</td>
<td>-0.342***</td>
<td>(0.121)</td>
</tr>
<tr>
<td>Computing</td>
<td>-0.057</td>
<td>(0.100)</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>-0.073</td>
<td>(0.105)</td>
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<tr>
<td>Other business</td>
<td>-0.101</td>
<td>(0.077)</td>
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<tr>
<td>Film etc services</td>
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<td>(0.139)</td>
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<tr>
<td>Eastern England</td>
<td>0.055</td>
<td>(0.056)</td>
</tr>
<tr>
<td>London</td>
<td>-0.295***</td>
<td>(0.050)</td>
</tr>
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<td>North East England</td>
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<td>(0.072)</td>
</tr>
<tr>
<td>North West England</td>
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<td>(0.052)</td>
</tr>
<tr>
<td>Northern Ireland</td>
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<td>(0.068)</td>
</tr>
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<td>Scotland</td>
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<td>(0.057)</td>
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<td>South East England</td>
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<td>(0.051)</td>
</tr>
<tr>
<td>South West England</td>
<td>-0.028</td>
<td>(0.057)</td>
</tr>
<tr>
<td>Wales</td>
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<td>(0.069)</td>
</tr>
<tr>
<td>West Midlands</td>
<td>0.004</td>
<td>(0.057)</td>
</tr>
<tr>
<td>Yorks &amp; the Humber</td>
<td>-0.021</td>
<td>(0.057)</td>
</tr>
<tr>
<td>Constant</td>
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<td>(0.084)</td>
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<table>
<thead>
<tr>
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<th>Value</th>
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</thead>
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<tr>
<td>No. of observations</td>
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<tr>
<td>Log likelihood</td>
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</tr>
<tr>
<td>Likelihood-ratio test</td>
<td>106.86***</td>
</tr>
</tbody>
</table>

Data source: UKIS 2011

Notes: *** significant at better than 1% level, ** significant at better than 5% level, * significant at better than 1% level
### Table A4: Sectoral structure used in the analysis

<table>
<thead>
<tr>
<th>Sectors</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture, forestry and fishing (Sections A, B, E), recycling</td>
<td></td>
</tr>
<tr>
<td>Mining and quarrying (Section C)</td>
<td></td>
</tr>
<tr>
<td>Manufacturing (Section D)</td>
<td></td>
</tr>
<tr>
<td>Food, drink, tobacco</td>
<td></td>
</tr>
<tr>
<td>Textiles</td>
<td></td>
</tr>
<tr>
<td>Clothing, leather &amp; footwear</td>
<td></td>
</tr>
<tr>
<td>Wood products</td>
<td></td>
</tr>
<tr>
<td>Paper</td>
<td></td>
</tr>
<tr>
<td>Publishing &amp; printing</td>
<td></td>
</tr>
<tr>
<td>Chemicals</td>
<td></td>
</tr>
<tr>
<td>Rubber &amp; plastics</td>
<td></td>
</tr>
<tr>
<td>Non-metallic minerals</td>
<td></td>
</tr>
<tr>
<td>Basic metals</td>
<td></td>
</tr>
<tr>
<td>Fabricated metals</td>
<td></td>
</tr>
<tr>
<td>Machinery &amp; equipment nes</td>
<td></td>
</tr>
<tr>
<td>Electrical machinery</td>
<td></td>
</tr>
<tr>
<td>Medical etc instruments</td>
<td></td>
</tr>
<tr>
<td>Motor &amp; transport</td>
<td></td>
</tr>
<tr>
<td>Furniture &amp; manuf nes</td>
<td></td>
</tr>
<tr>
<td>Construction (Section F)</td>
<td></td>
</tr>
<tr>
<td>Wholesale and retail trade; repair of motor vehicles, motorcycles and</td>
<td></td>
</tr>
<tr>
<td>personal and household goods (Section G)</td>
<td></td>
</tr>
<tr>
<td>Services (Sections H, I, J, K, L, M, N, O, P)</td>
<td></td>
</tr>
<tr>
<td>Knowledge-intensive services (KIS)</td>
<td></td>
</tr>
<tr>
<td>Water transport, Air transport</td>
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</tr>
<tr>
<td>Financial intermediation (Section J)</td>
<td></td>
</tr>
<tr>
<td>Less Knowledge-intensive Services (LKIS)</td>
<td></td>
</tr>
<tr>
<td>Hotels and restaurants (Section H)</td>
<td></td>
</tr>
<tr>
<td>Telecommunications</td>
<td></td>
</tr>
<tr>
<td>Land transport; transport via pipelines</td>
<td></td>
</tr>
<tr>
<td>Supporting/auxiliary transport; travel agencies</td>
<td></td>
</tr>
<tr>
<td>Computer and related activities</td>
<td>Post and courier activities</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>Research and development</td>
<td>Real estate activities</td>
</tr>
<tr>
<td>Legal, accounting, book-keeping and auditing activities; tax consultancy; market research and public opinion polling; business and management consultancy holdings</td>
<td>Renting of machinery and equipment without operator and of personal and household goods</td>
</tr>
<tr>
<td>Architectural and engineering activities and related technical consultancy</td>
<td>Industrial cleaning</td>
</tr>
<tr>
<td>Technical testing and analysis</td>
<td>Miscellaneous business activities n.e.c.</td>
</tr>
<tr>
<td>Advertising</td>
<td>Activities of membership organisations n.e.c.</td>
</tr>
<tr>
<td>Labour recruitment and provision of personnel</td>
<td>Other service activities</td>
</tr>
<tr>
<td>Investigation and security activities</td>
<td>Private households with employed persons (Section P)</td>
</tr>
<tr>
<td>Public administration and defence; compulsory social security (Section L)</td>
<td>Extra-territorial organisations and bodies (Section Q)</td>
</tr>
<tr>
<td>Education (Section M)</td>
<td></td>
</tr>
<tr>
<td>Health and social work (Section N)</td>
<td></td>
</tr>
<tr>
<td>Recreational, cultural and sporting activities</td>
<td></td>
</tr>
<tr>
<td>Water transport, Air transport</td>
<td></td>
</tr>
</tbody>
</table>
Table A5: OECD classification of industries by technology intensity *

<table>
<thead>
<tr>
<th>High tech manufacturing</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pharmaceuticals</td>
<td></td>
</tr>
<tr>
<td>Computers and Office Machinery</td>
<td></td>
</tr>
<tr>
<td>Electronics and Communications</td>
<td></td>
</tr>
<tr>
<td>Medical, precision and Optical Instruments</td>
<td></td>
</tr>
<tr>
<td>Aerospace</td>
<td></td>
</tr>
<tr>
<td>Medium-high tech manufacturing</td>
<td></td>
</tr>
<tr>
<td>Chemicals</td>
<td></td>
</tr>
<tr>
<td>Non Electrical machinery</td>
<td></td>
</tr>
<tr>
<td>Electrical Machinery</td>
<td></td>
</tr>
<tr>
<td>Motor Vehicles</td>
<td></td>
</tr>
<tr>
<td>Other transport equipment</td>
<td></td>
</tr>
<tr>
<td>Medium -low tech manufacturing</td>
<td></td>
</tr>
<tr>
<td>Petroleum Refining</td>
<td></td>
</tr>
<tr>
<td>Rubber and Plastic Products</td>
<td></td>
</tr>
<tr>
<td>Non Metallic Mineral Products</td>
<td></td>
</tr>
<tr>
<td>Non ferrous Metals</td>
<td></td>
</tr>
<tr>
<td>Fabricated Metal Goods</td>
<td></td>
</tr>
<tr>
<td>Shipbuilding</td>
<td></td>
</tr>
<tr>
<td>Low tech manufacturing</td>
<td></td>
</tr>
<tr>
<td>Food Products and Tobacco</td>
<td></td>
</tr>
<tr>
<td>Wood , Textiles and Furniture</td>
<td></td>
</tr>
<tr>
<td>Paper and Printing, recorded media</td>
<td></td>
</tr>
<tr>
<td>Wood, Textiles and Furniture</td>
<td></td>
</tr>
</tbody>
</table>

*Refer to Annex1 in the OECD publication on Science, Technology and Industry Scoreboard (2003) for more details

Table A6: Average absorptive capacity indices, all sectors, 2002-2010

<table>
<thead>
<tr>
<th>Sector</th>
<th>General external knowledge</th>
<th>National co-operation</th>
<th>International co-operation</th>
<th>Business strategy and practice</th>
<th>Specialist knowledge from HEIs/ government</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture, Utilities</td>
<td>0.404</td>
<td>0.202</td>
<td>0.023</td>
<td>0.257</td>
<td>0.319</td>
</tr>
<tr>
<td>Mining, Quarrying</td>
<td>0.388</td>
<td>0.183</td>
<td>0.038</td>
<td>0.207</td>
<td>0.318</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>0.433</td>
<td>0.201</td>
<td>0.035</td>
<td>0.250</td>
<td>0.298</td>
</tr>
<tr>
<td>Construction</td>
<td>0.362</td>
<td>0.175</td>
<td>0.016</td>
<td>0.185</td>
<td>0.300</td>
</tr>
<tr>
<td>Wholesale, Retail</td>
<td>0.382</td>
<td>0.184</td>
<td>0.026</td>
<td>0.202</td>
<td>0.291</td>
</tr>
<tr>
<td>Services-LKIS</td>
<td>0.351</td>
<td>0.176</td>
<td>0.023</td>
<td>0.192</td>
<td>0.294</td>
</tr>
<tr>
<td>Services-KIS</td>
<td>0.419</td>
<td>0.201</td>
<td>0.037</td>
<td>0.272</td>
<td>0.311</td>
</tr>
<tr>
<td>Mean</td>
<td>0.390</td>
<td>0.188</td>
<td>0.028</td>
<td>0.222</td>
<td>0.298</td>
</tr>
</tbody>
</table>

Source: weighted UKIS 2005-2011

**Figure A1**: Empirical cumulative distribution of absorptive capacity indices in manufacturing firms by technology intensity, 2002-2010

Data source: weighted UKIS 2005-2011
Absorptive Capacity in Manufacturing
AC for general ext. knowledge

Data source: weighted UKIS 2005-2011
Absorptive Capacity in Manufacturing

AC for business strategy and practice

Data source: weighted UKIS 2005-2011

Absorptive Capacity in Manufacturing

AC for international cooperation

Data source: weighted UKIS 2005-2011
Table A7: Average absorptive capacity indices in manufacturing firms by UK government office region, 2002-2010

<table>
<thead>
<tr>
<th>GOR regions</th>
<th>General external knowledge</th>
<th>National co-operation</th>
<th>International co-operation</th>
<th>Business strategy and practice</th>
<th>Specialist knowledge from HEIs/government</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Midlands</td>
<td>0.430</td>
<td>0.198</td>
<td>0.029</td>
<td>0.249</td>
<td>0.295</td>
</tr>
<tr>
<td>Eastern England</td>
<td>0.449</td>
<td>0.199</td>
<td>0.038</td>
<td>0.254</td>
<td>0.299</td>
</tr>
<tr>
<td>London</td>
<td>0.421</td>
<td>0.192</td>
<td>0.030</td>
<td>0.253</td>
<td>0.296</td>
</tr>
<tr>
<td>North East</td>
<td>0.429</td>
<td>0.204</td>
<td>0.036</td>
<td>0.273</td>
<td>0.302</td>
</tr>
<tr>
<td>North West</td>
<td>0.427</td>
<td>0.208</td>
<td>0.037</td>
<td>0.243</td>
<td>0.301</td>
</tr>
<tr>
<td>Northern Ireland</td>
<td>0.441</td>
<td>0.192</td>
<td>0.034</td>
<td>0.241</td>
<td>0.315</td>
</tr>
<tr>
<td>Scotland</td>
<td>0.448</td>
<td>0.195</td>
<td>0.033</td>
<td>0.256</td>
<td>0.301</td>
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<tr>
<td>South East</td>
<td>0.441</td>
<td>0.203</td>
<td>0.044</td>
<td>0.258</td>
<td>0.295</td>
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</table>

Data source: weighted UKIS 2005-2011
<table>
<thead>
<tr>
<th>Region</th>
<th>0.439</th>
<th>0.201</th>
<th>0.036</th>
<th>0.247</th>
<th>0.292</th>
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</thead>
<tbody>
<tr>
<td>South West</td>
<td>0.439</td>
<td>0.201</td>
<td>0.036</td>
<td>0.247</td>
<td>0.292</td>
</tr>
<tr>
<td>Wales</td>
<td>0.452</td>
<td>0.209</td>
<td>0.039</td>
<td>0.260</td>
<td>0.308</td>
</tr>
<tr>
<td>West Midlands</td>
<td>0.417</td>
<td>0.205</td>
<td>0.030</td>
<td>0.244</td>
<td>0.297</td>
</tr>
<tr>
<td>York’s &amp; Humber</td>
<td>0.428</td>
<td>0.200</td>
<td>0.033</td>
<td>0.242</td>
<td>0.294</td>
</tr>
<tr>
<td>Mean</td>
<td>0.434</td>
<td>0.201</td>
<td>0.035</td>
<td>0.250</td>
<td>0.298</td>
</tr>
</tbody>
</table>

Source: weighted UKIS 2005-2011
INTERNATIONAL INDUSTRIAL POLICY EXPERIENCES AND THE LESSONS FOR THE UK

BY
PROFESSOR HA-JOON CHANG
DR ANTONIO ANDREONI
MING LEONG KUAN
International Industrial Policy
Experiences and the Lessons for the
UK

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December 2013

***
International Industrial Policy Experiences and the Lessons for the UK

Executive Summary

1. Introduction

2. Theoretical Issues

3. Country Case Studies

4. Lessons for the UK

5. Looking Ahead

References

Appendix
Executive Summary

The present study reviews a diverse set of countries with the most successful industrial policy experiences since the Second World War – namely, the US, Germany, Japan, Italy, Finland, (South) Korea, Singapore, China, and Brazil – with a view to deriving lessons for the UK.

In section 1, we start by reviewing the current state of the manufacturing sector in the UK, especially, although not exclusively, comparing it with the nine countries whose industrial policy we review in this state. The picture that emerges is an alarming one, in which the UK’s industrial performance distinguishes itself for being poor and is still declining further.

In section 2, we discuss some of the key theoretical issues in the debate on industrial policy. We discuss: (a) different definitions of industrial policy, especially focusing on the relationship between and the relative merits of ‘horizontal’ (or ‘general’) and ‘vertical’ (or ‘selective’) industrial policies; (b) the special role of the manufacturing sector in the overall economy, especially as the source of productivity growth, innovation, learning, and resilience; (c) main theoretical justifications for certain notable industrial policy tools and institutions used in the countries reviewed.

In Section 3, we review the industrial policy experiences of the nine comparator countries. While historical material dating back from the 18th century is covered when appropriate, the focus is more on the recent period, since the 1980s or the 1990s, depending on the country.

In Section 4, we draw lessons for the UK’s industrial policy from the nine country experiences that we review in Section 3, filtered through the theoretical discussions provided in Section 2. We draw the lessons along several dimensions: (a) the role of ‘vision’; (b) institutional settings (e.g., coordination within the government, the role of surrounding institutional networks); (c) finance and corporate governance; (d) promotion of innovation; (e) management of transnational corporations (TNCs); (f) support for SMEs; (g) skills and training.

In Section 5, we look ahead for the future of the UK’s manufacturing sector, taking
into account our theoretical discussions, country case reviews, and the lessons we have drawn from those discussions.

1. Introduction

Since the 2008 global financial crisis, there has been a widespread acceptance – even among many of the traditional proponents of finance-led service economy – that the UK needs to ‘rebalance the economy’ and generate a ‘manufacturing revival’ through what George Osborne, the Chancellor of the Exchequer, called ‘the march of the makers’ (BIS, 2012, and TSB, 2012 are the recent examples). However, few people realise the scale of challenge that the UK faces in engineering a manufacturing renaissance.

The UK was the epicentre of the Industrial Revolution, which has given birth to the modern world. And until the late 19th century, its industrial dominance was absolute. In 1860, it produced 20% of world manufacturing output, despite having only about 2.5% of the then world population (28 million out of 1.2 billion). Today, China produces only about 15% of world manufacturing value-added (MVA) (see Table A.1 in the appendix), despite having 19% of world population (1.3 billion out of 6.9 billion). In 1870, the UK accounted for 46% of world trade in manufactured goods. The current Chinese share in world exports is only around 14% (Table A.1 in the appendix).

Today, the UK’s manufacturing sector is a pale shadow of its former self. People often have taken comfort in the fact that the country is still the 8th largest manufacturing nation in the world, but in per capita terms (MVA per capita), it is only the 24th in the world (see Table 1), behind even Iceland (ranked the 16th) and Luxembourg (ranked the 19th), not to speak of the Japans and the Finlands of this world. By 2012, it had also fallen behind its traditional rival, France (ranked the 22nd, with $3,810 against the UK’s $3,731) (Table A.2 in the appendix provides more indicators for the top 60 manufacturing nations).

And it is not just the shrinking size of the manufacturing sector that is the cause for concern. The fact that the UK has failed to generate a manufacturing export boom despite a 30-35% devaluation of its currency since the 2008 global financial crisis is a
powerful testimony to the underlying weakness of its manufacturing sector.

Table 1. Ranking of countries by per capita MVA in 2012 (in 2000 dollars)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Per capita MVA</th>
<th>Rank</th>
<th>Country</th>
<th>Per capita MVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ireland</td>
<td>11,772</td>
<td>33</td>
<td>Kuwait</td>
<td>2,391</td>
</tr>
<tr>
<td>2</td>
<td>Switzerland</td>
<td>10,191</td>
<td>34</td>
<td>Hungary</td>
<td>2,347</td>
</tr>
<tr>
<td>3</td>
<td>Singapore</td>
<td>8,800</td>
<td>35</td>
<td>Poland</td>
<td>2,336</td>
</tr>
<tr>
<td>4</td>
<td>Finland</td>
<td>7,997</td>
<td>36</td>
<td>Turkmenistan</td>
<td>1,962</td>
</tr>
<tr>
<td>5</td>
<td>Japan</td>
<td>7,693</td>
<td>37</td>
<td>Portugal</td>
<td>1,945</td>
</tr>
<tr>
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The UK's de-industrialisation, which started in the 1970s, has progressed at a continuous and alarming pace. As we see from Figure 1, no country among the 10 countries that we have chosen to study in this report for comparison with the UK (in alphabetical order, Brazil, China, Finland, Germany, Italy, Japan, Singapore, South Korea, and the United States) has experienced de-industrialisation in the relentless way in which the UK has experienced it.

Table 2 shows the comparative manufacturing performance of the 10 countries during the 20-year period between 1990 and 2010 across a diverse range of indicators compiled by UNIDO (2013). The table shows that the UK performed the worst (or joint-worst) in 7 out of 8 indicators across our 10 countries. Three aspects are worth highlighting here.

Table 2.

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Note: Countries whose names are in italics are the ones included in this report. Data source: UNIDO (2013)
Table 2. Manufacturing indicators in selected countries, per annum rate of change (%), 1990-2010

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<tr>
<th>Country</th>
<th>MVA per capita</th>
<th>MVA as % of GDP</th>
<th>MHT MVA as % of total MVA</th>
<th>MVA as % of World MVA</th>
<th>MX per capita</th>
<th>MX as % of total exports</th>
<th>MHT MX as % of total MX</th>
<th>MX as % of WMT</th>
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</table>

Source: Authors’ calculations based on UNIDO (2013)

Notes: Manufacturing Value Added (MVA) and GDP are in constant 2000 US dollars. MHT, MX and WMT refer to medium and high-technology, manufacturing exports and world manufacturing trade respectively. Due to data gaps, China’s compounded annual growth rates (CAGRs) were calculated for the period 1992-2010 while Germany’s CAGRs were for the period 1991-2010.

First, the UK de-industrialised at the fastest pace among the 10 countries during this period (2.4% p.a. decline in the share of MVA as a percentage of GDP), resulting in the lowest manufacturing share in GDP (11.4%) in 2010 among the 10 countries, as shown in Figure 1.
Second, the UK’s industrial competitiveness has been eroded at a faster pace than the other countries. Both the shares of the country’s MVA in World MVA and its share of manufacturing exports (MX) in world manufacturing trade (WMT) fell faster in the UK (-2.9% p.a. and -3.8% p.a. respectively) than in the other countries between 1990 and 2010.

Third, the UK has not successfully upgraded the quality of its manufacturing sector. Among the developed economies in the sample, it was the only country that saw declines in both the share of medium and high-technology (MHT) MVA in total MVA (-0.3% p.a.) and the share of MHT MX in total MX (-0.2% p.a.) between 1990 and 2010.

The typical, albeit increasingly less frequent, response to the kind of information that we have provided so far is that the UK’s industrial decline is the result of market forces and therefore that there is nothing to be done about it. However, those apparently ‘natural’ market outcomes are in the end the results of deliberate decisions by economic agents – productive enterprises, financial investors, and trade unions. And shaping all these decisions is the government, which sets the boundaries of the market, decides on the types of permissible behavior, and (explicitly and implicitly) manipulates incentives through interest rates, taxes, subsidies, regulations, procurement decisions, and many other means. Particularly important in relation to the manufacturing sector is industrial policy, which is policy specifically targeted at industries, rather than more general policies (e.g., monetary policy, fiscal policy) or policies targeted at other things (e.g., social policy, education policy) – we will provide a more rigorous definition in the next section.

In this report, we discuss how the UK government may improve the country’s manufacturing sector performance through industrial policy by looking at the industrial policy experiences of nine other countries, all with important achievements and strengths at least in some respects. We have deliberately chosen a range of countries in terms of size (from huge China, the US, and Brazil to tiny Singapore and Finland), level of overall economic development (from the richest US and Finland to the poorest Brazil and China), and areas of strengths in terms of industries (from electronics in Japan and Korea to aircraft in the US and Brazil), firm size (from huge firms in the US and Korea to medium-sized firms in Germany and Japan and small firms in Italy), and technological intensity (from high-tech Japan, Finland, and Korea to medium-tech Germany and Italy to low-tech China).
Before we look at individual country experiences, however, we need to look at some general issues related to industrial policy, including its definition, theoretical justifications, and evaluation, in order to provide a framework for our case discussions.

2. Theoretical Issues

2.1. Definitional issues

The controversial nature of industrial policy is testified to by the fact that there is actually no universally agreed definition of the term (see Warwick, 2013, pp. 14-18).

The most literal interpretation of industrial policy would be to define it to include any policy that affects industry (usually interpreted as the manufacturing industry), in the same way in which we would define fiscal policy as policy that affects government revenue and spending, and monetary policy as policy that affects monetary variables. Indeed, some commentators who adopt this definition would include even infrastructure policy, education policy and tax policy as parts of industrial policy (see Chang, 1994a, pp. 58-61, for some examples).

The majority of the commentators on industrial policy, however, define industrial policy to mean ‘selective’ industrial policy, ‘sectoral industrial policy’ or ‘targeting’ – namely, a policy that deliberately favours particular industries/sectors (or even firms) over others, against market signals, usually (but not necessarily) to enhance efficiency and promote productivity growth, for the whole economy as well as for the targeted industries themselves.1

Industrial policy thus defined has been even more controversial than more generally defined industrial policy.2 Many people believe that industrial policy should be of general (or functional or horizontal) kind, rather than of selective (or sectoral or vertical) kind. In this view, industrial policy should focus on ‘public goods’ that benefit all industries equally but are likely to be under-provided by the market – e.g., education, research and development (R&D), and infrastructure – and not involve
'picking winners'.

The fundamental problem with this view is that the distinction between selective and general industrial policies cannot take us very far. In a world with scarce resources, every policy choice you make, however general the policy involved may look, has discriminatory effects that amount to implicit targeting.

For example, many people believe that education is one of those general industrial policies, but beyond the basic level (say, the first 9 years), education becomes specialised. So, for example, when we produce engineers, it does not produce some generic engineers but engineers specialised in certain areas. Therefore, a government providing more funding to electronics engineering departments than to chemical engineering departments is implicitly favouring the electronics industry. Likewise, there is no such thing as generic physical infrastructure. Physical infrastructure is always location-specific, so it affects different industries differently. Moreover, different modes of transportation have different impacts on different industries – bulky goods (e.g., iron ore, wheat) will be helped more by developments of seaports and railways, while lighter goods, especially when they are perishable (e.g., flowers, fresh fish), will be helped more by developments of airports. Finally, if a government is giving out R&D subsidies, it is implicitly favouring the more R&D-intensive higher-tech sectors.

Thus seen, selectivity (targeting) is inevitable. Except in the case of the provision of basic education, calling which an 'industrial policy' is really stretching the term beyond credulity, there is really no policy that does not involve some degree of targeting.3

Now, it may be said that, while targeting may be unavoidable, the less targeted a policy is, the better it is. However, this is a one-sided view. While less targeted policies may open themselves less to the possibilities of lobbying and 'regulatory capture', thus making it easier to maintain the necessary myth that the government is impartial, they are more costly to implement. Being less precise and thus more difficult to monitor, they have more 'leakages' than more targeted policies. Indeed, many mainstream economists have long argued – and many politicians, including the members of the current British government – that the welfare state should be more precisely targeted because there are simply too many leakages in the system of universal welfare (on targeting in social policy, see Mkandawire, 2005). It is curious
that this point is almost entirely ignored in relation to industrial policy.

Given all this, we have to admit that we cannot ‘not target’ and should try to attain the best possible degree of targeting, which may differ across industries and countries. We cannot assume that there is a linear relationship, positive or negative, between the degree of targeting and policy success. Some degree of targeting is inevitable, while some more of it may be desirable, but too much of it may not be good, although how much is too much is debatable (and one’s position on it will depend on one’s economic theories and political values). The best way to think about it is ‘targeting within universalism’, as some people propose in relation to social policy (Skocpol, 1991, as cited in Mkandawire, 2005, p. 23), rather than ‘targeting vs. universalism’.

### 2.2. The Special Role of the Manufacturing Sector

Industrial policy, according to our definition, does not involve only manufacturing industries. It could target service industries, as the UK, Ireland, Iceland, and Dubai did with the financial industry in the last two, three decades – albeit all unfortunately with highly negative consequences. Or it could involve promotion of certain industries in the primary sector – prominent examples include the dairy industry in Denmark in the late 19th and the early 20th century (Chang, 2009a and 2009b), and more recently, the salmon and the forestry industries in Chile (Meissner, 1988; Clapp, 1995; UNCTAD, 2006) and the soybean industry in Brazil (Hosono & Hongo, 2012; Andreoni, 2013a).

However, those who are interested in selective industrial policy tend to put great emphasis on the need to promote the manufacturing sector. The reasons to promote the manufacturing industries are many and diverse.

First, it is widely recognised that the manufacturing sector is the main source of technology-driven productivity growth in modern economies. It is not much of an exaggeration to say that manufacturing is what has made the modern world. Thanks to the fact that the manufacturing activities lend themselves much more easily to mechanisation and chemical processing than do other types of economic activities, the manufacturing sector has been the main source of productivity growth throughout history. Productivity increase in agriculture is highly constrained by nature in terms
of time, space, soil, and climate. By their very nature, many service activities are inherently impervious to productivity increases. In some cases, the very increase in productivity will destroy the product itself. If a string quartet trots through a 27-minute piece in nine minutes, we won’t say that its productivity has trebled. For some other services, the apparently higher productivity may be due to the de-basement of the product. A lot of the increases in retail service productivity in countries like the US and the UK have been bought by lowering the quality of the retail service itself – fewer shop assistants, longer drives to the supermarket, lengthier waits for deliveries, etc. The 2008 global financial crisis has also revealed that much of the recent productivity growth in finance had been achieved through the de-basement of the products – that is, the creation of overly complex, riskier, and even fraudulent products.

Second, many economic historians and economists argue that the manufacturing sector, especially the capital goods sector, has been the ‘learning centre’ of capitalism in technological terms (Rosenberg, 1963 and 1982; Kaldor, 1981; Cohen & Zysman, 1987; Rowthorn & Wells, 1987; Park & Chan, 1989; Mokyr, 1990 and 2002; Mowery & Rosenberg, 1999; Guerrieri & Meliciani, 2005). Because of its ability to produce productive inputs (e.g., machines, chemicals), what happens in the manufacturing sector has been extremely important in the productivity growth of other sectors. The increases in agricultural productivity that we have seen in the last century and half would not have been remotely possible without the developments of manufacturing industries producing agricultural machinery, chemical fertilizers, pesticides, and increasingly genetic engineering. The rapid increases in the productivity of services like logistics and retail in the last couple of decades were also made possible by manufacturing industries producing more efficient transport equipment, computers, and mechanised warehouses.

Third, the manufacturing sector has also been the source of organisational innovation. Productivity growth in the last two centuries has been driven not just by technological changes but also organizational changes, most of which originated in the manufacturing sector. For example, these days many fast food restaurants use ‘factory’ techniques, turning cooking into an assembly job and sometimes even delivering food on conveyor belts (Yo! Sushi being the most familiar example for the UK citizens). For another example, large retail chains – be they supermarkets, clothes shop chains, or on-line retailers – apply modern inventory management techniques, developed in the manufacturing sector. Even in the agricultural sector, productivity has been raised in some countries through the application of manufacturing-style organisational knowledge, like computer-controlled feeding (the
Dutch agriculture is the prime example here).

Fourth, the manufacturing sector has been the main source of demand for high-productivity activities in other industries. For example, most of the service activities that have high productivity and have seen high productivity growths – sometimes even faster than those of some sub-sectors of manufacturing – recently (e.g., finance, transport, and business services) are ‘producer’ services, whose main customers are manufacturing firms. Of course, countries can specialise in those services, but in the case of many producer services (e.g., engineering, design, management consulting), their ability to export cannot be maintained in the long run without a strong manufacturing sector. In those services, insights gained from the production process and the continuous interaction between the provider and the clients are crucial. Given this, a weakening manufacturing base will eventually lead to a decline in the quality, and exportability, of those services (Tassey, 2010; Fuchs & Kirchain, 2010; Pisano & Shih, 2012).

Fifth, the manufacturing sector, producing physical and non-perishable products, has higher tradability than agriculture and, especially, services. At the root of the low tradability of services lies the fact that many services require their providers and consumers to be in the same location. No one has yet invented ways to provide haircut or house cleaning long-distance. Of course, this problem will be solved if the service provider (the hairdresser or the cleaner in the above examples) can move to the customer’s country, but that in most cases means immigration, which most countries severely restrict. Given this, a rising share of services in the economy means that the country, other things being equal, will have lower export earnings. This, in turn, means that, unless the exports of manufactured goods rise disproportionately, the country won’t be able to pay for the same amount of imports as before. Also, the high tradability of manufacturing imparts a crucial resilience to an economy with a strong manufacturing sector, as it can better protect itself from external shocks – as we have seen this with the resilience of the German economy, following the 2008 financial crisis.

2.3. Theories of Industrial Policy

Unless we live in the fantasy world of perfect markets, industrial policy does not lack theoretical justifications (for reviews, see Dosi et al., 1989; Chang, 1994a and 2011;
Stiglitz, 1996; Lall, 2004; Rodrik, 2004 and 2008; Aiginger & Sieber, 2006; Bianchi & Labory, 2006; Cimoli et al., 2009; Spence, 2008; Aghion et al., 2012). This is not a place to review these theories in any detail, so let us just provide an overview of the key types of arguments.

2.3.1. Interdependences

There are various arguments that justify industrial policy, especially of selective type, on the basis of the existence of interdependence between different activities.

The best-known of this type of argument are those based on demand complementarities and increasing returns (to scale) in manufacturing industries, which were prominent in Classical Economics and in early Development Economics (Toner, 1999, provides an excellent review; also see Andreoni & Scazzieri, 2013). The first variety of these is the so-called Big Push argument – or the balanced growth model – of Paul Rosenstein-Rodan (1943) and Ragnar Nurkse (1952), which argues that there needs to be a coordination of investment between interdependent activities, as their returns depend on there being all the complementary investments. Using a similar insight, the so-called linkages argument of Albert Hirschman (1958) advocates industrial policy that first promotes industries with particularly strong interdependences with other sectors, whether as suppliers of inputs into other industries (forward linkages) or as purchasers of outputs of other industries (backward linkages), thus setting off chain reactions in different directions. This argument is also known as the unbalanced growth model, in the sense that the government initially focuses on the leading industries, rather than trying to promote all industries together.

Second, there are less well-known justifications for industrial policy based on interdependences between competing – rather than complementary – activities. In oligopolistic industries with lumpy investments, simultaneous investments by competing firms may result in excess capacity, which may push some firms into bankruptcy, which in turn means that the resources invested in them will have been wasted – unless the machines and skills involved are of very general nature and can be redeployed elsewhere easily, which rarely is the case in modern industries. In order to prevent such ‘wasteful competition’, countries, especially Japan and Korea, have used entry restrictions and government-approved investment cartels so that
investments are staggered at suitable intervals (see Chang, 1994a, pp. 66-7; Amsden & Singh, 1994).

Coordination problems among competing investments may be related not only to investment but also to situations of temporary disinvestment or structural change in the industrial sector. Recession cartels and mechanisms of negotiated exit have been widely used to face periods of economic crisis or accompany structural transformation (Dore, 1986, is the classic study). In these situations industrial policies introduce “a ‘protective’ element – that is ‘helping losers’ by temporarily shielding them from the full forces of the market” (Chang, 2003, p. 262). More generally, support for declining sectors may be seen as an attempt to socialise risk to encourage and sustain the process of structural change and productivity growth, from which economic development derives.

Third, there is the externality argument (Scitovsky, 1954), in which industrial policy is deployed to compensate for under-investment in (and thus under-production of) certain activities due to the fact that their providers do not reap the full benefits from their efforts. Supports for basic R&D or worker training are classic cases. More recently, some commentators have developed an argument for industrial policy based on ‘information externality’. The argument is that investments are not made in industries because the potential ‘pioneer’ firm is afraid of providing ‘free experiment’ to competitors, who may then imitate it and deprive it of what Schumpeter would have called ‘entrepreneurial profit’ (Hausmann & Rodrik, 2003; Rodrik, 2004 and 2008; Lin, 2012). Lin’s (2012) new structural economics proposes the ‘growth identification and facilitation framework’, while Hidalgo and Hausmann (2009) develop the so-called ‘atlas of economic complexity’, whose aim is to reveal the existence of linkages and different countries’ capability endowments.

2.3.2. Capabilities

Another important set of arguments for industrial policy is based on the time-consuming and costly nature of the process of accumulating productive capabilities (Lall, 1992 and 2001; Chang, 1994a; Lall & Teubal, 1998; Loasby, 1999; Andreoni, 2013b). Productive capabilities are personal and collective skills, productive knowledge and experience that are embedded in physical agents and organisations (Andreoni, 2011).4
The most famous argument along this line is the infant industry argument. This is based on the understanding that productive capabilities can be accumulated only over time and in an unpredictable way. Given this, new producers need a period of protection – through tariffs, subsidies (related to equipment investments, R&D, and worker training), regulation on foreign direct investment (FDI), and other measures – from competitive forces coming from abroad, in the same way in which children need protection before they can go out and compete in the labour market unassisted. This argument applies to the catching-up economies particularly strongly, but can hold for all countries, insofar as their producers in certain sectors are trying to catch up with superior producers abroad. The ultimate example of the latter case is the development of Airbus by the European governments against what looked like an insurmountable US dominance in the civilian aircraft market.

Another capabilities-related justification for industrial policy is based on policies providing support for small producers – such as small and medium-sized enterprises (SMEs) in the manufacturing sector and small farms. The problem is that capability accumulation needs some indivisible inputs (thus high fixed costs) that small producers cannot provide on their own – whether in R&D, machinery, or worker training. There are many industrial policy measures intended to solve this problem. The government can directly provide these inputs into the capability building process through public R&D, training of workers in public universities and training institutes, and the provision of ‘extension service’ for small firms and small farmers. It may subsidise those inputs through the provision of R&D subsidies, credit guarantees (which will promote physical investments, among other things), or training subsidies. Not all of the above-mentioned measures are specifically targeted at small producers, but they may be of disproportionate help to such producers insofar as they are disproportionately disadvantaged in providing such inputs through market-based arrangements. On top of all these, the government may provide legal and other backings for voluntary cooperative arrangements among small producers – such as tax advantages for cooperatives among small producers or subsidies for particular joint activities (e.g., R&D, processing, export marketing).

The third capability-based justification for industrial policy rationale is known as the ‘industrial commons’ argument. The argument is rooted in the fact that productive capabilities have a fundamental collective nature, that is, their development and application is very much the result of interdependent processes of learning and production, each of which involves a variety of actors (Richardson, 1972 and Abramovitz, 1986 are the classic references). Given these interdependencies, the
effective coordination of actors endowed with different capabilities becomes a key determinant of the competitiveness of any sectoral innovation system (Metcalfe, 1995, Malerba, 2002: for a review, see Laranja et al., 2008). Such coordination has become increasingly important in modern manufacturing systems. As eloquently documented in Tassey (2010): “Most modern technologies are systems, which means interdependencies exist among a set of industries that contribute advanced materials, various components, subsystems, manufacturing systems and eventually service systems based on sets of manufactured hardware and software” (p. 6). The modern global economy is therefore constructed around supply chains, whose tiers (industries) interact in complex ways”. A representative study in this line of argument is Pisano and Shih (2009). Using information from the semiconductor, electronics, pharmaceutical and biotech industries, the study shows how the production and innovation capacities of a given economic system depend on the presence of multiple resources, such as R&D know-how, engineering skills, technological capabilities, and specific manufacturing and prototyping competences. The study points out that many of these resources are scattered across a large number of manufacturing and services companies as well as other organisations (such as universities and vocational schools), so all those actors need to be located close to each other, if they are to utilise those ‘common pool’ resources effectively.

The industrial commons literature stresses that even the development of high-tech cutting-edge products often depends (amongst other factors) on the commons of a mature manufacturing industry. The maintenance of industrial commons necessitates not only the maintenance of a manufacturing base of a certain size and diversity but also various forms of what we call in this report ‘intermediate institutions’ – industry associations, trade unions, research institutes, and educational institutions. These institutions maintain and nurture the industrial commons by developing research and innovation activities in new industrial processes and products, both within and across sectors (O’Sullivan, 2011; Best, 2011; Andreoni 2012a).

Fourth, there are measures to do with the establishment of local technological capabilities in cases of ‘direct’ technology imports. The problem being addressed here is that, when technologies are imported in a ‘direct’ way through technology licensing or FDI, there is less incentive, on the part of both the importer and the provider, to create technological capabilities in the importing country than when compared to cases of ‘indirect’ technology imports through machines. On the one hand, the buyer of technology would find it easier not to develop its own capabilities to adapt and improve the imported technologies, which means that they either
import obsolete, ‘easier’ technologies or become dependent on the provider in technological terms. On the other hand, the provider would be reluctant to transfer core technologies, for fear of losing future customs and creating another competitor. In order to overcome this problem, the government can impose conditions on these direct forms of technology imports. Some countries (e.g., Japan, Korea) require approval for technology imports, to ensure that overly obsolete technologies are not imported while the licensing fees for up-to-date technologies are not excessive. In relation to FDI, many countries we have reviewed – Japan, Korea, Finland, and even FDI-friendly China and Singapore – have used ‘carrots’ and ‘sticks’ to ensure that core technologies are transferred and, more importantly, that the relevant local technological capabilities are created. The ‘carrots’ include the customised provision of necessary skills and subsidies for the establishment of R&D facilities. The ‘sticks’ include requirements for TNCs for technology transfer, local sourcing, hiring of local workers in higher capabilities, and exports (as export markets typically have higher quality requirements).

2.3.3. Risk and Uncertainty

There are a lot of justifications for industrial policy that are based on the recognition that there are inherent discrepancies in the ability to deal with risk and uncertainty between individual producers (whether they are corporations or individual workers) and the society as a whole – often expressed somewhat misleadingly as ‘capital market failure’ (implying, implausibly, that a ‘perfect’ capital market will finance any project that is viable).

One classic argument of this kind is based on the observation that the government often has the ‘deepest pocket’ in the country and thus the strongest ability to deal with risk. This is why many ambitious, high-risk projects have had to be subsidised by the government – as in the case of Airbus – especially when the country’s capital market is of ‘impatient’ variety, like in the UK. When it comes to backward economies entering technologically most demanding industries, the risk is incalculable and thus turns into uncertainty. In such cases, establishing state-owned enterprises (SOEs) may be the only solution. Korea’s steel-maker (POSCO), established in the late 1960s when the country’s income was only 4% of the US income, and Brazil’s aircraft manufacturer (EMBRAER), established in the late 1950s when the country’s income was only 8% of the US income, are the supreme examples of this kind.
Second, governments have often deployed industrial policy to restructure companies in trouble on the recognition that a major corporate restructuring – or even restructuring of an entire industry (like the shipbuilding industry in Japan in the 1980s or the automobile industry in the US after 2008) – requires risk of scales that private sector investors are simply not interested in taking. Policies involved include government taking of an equity stake (which often results in majority control), state-mediated mergers, coordinated capacity scrapping, provision of loan guarantees, public subsidisation of severance payments, and transitional subsidies.

Third, some governments, especially those in Scandinavia, have taken cognisance of the fact that, in a fast-changing world, individual workers are exposed to levels of risk that they cannot simply bear on an individual basis. On this recognition, these governments have provided a comprehensive welfare state – especially strong unemployment insurance, job search services, subsidised retraining, and even subsidies for re-location (e.g., government providing bridging loans to workers who have to sell their house to move to their new jobs) (Landesmann, 1992; Chang, 1994b). These are not ‘industrial policies’ in the sense we have defined in this report, but they help industrial developments by promoting smoother structural change.

2.4. Implementation Issues

All the above justifications of industrial policy, of course, do not mean that industrial policy measures are bound to succeed. From the disasters of China’s Great Leap Forward to the white elephant of Concorde, there have been many cases of industrial policy that have failed because the goals were set wrongly. Moreover, industrial policy measures that are theoretically sound can also fail because of various types of ‘government failure’, owning to lack of political commitment, ‘capture’ by interest groups, lack of bureaucratic capabilities, and other reasons. Therefore, we need to understand why some attempts succeed and others fail and think of ways to maximise the chance of success and minimise the chance of failure. The industrial policy literature since the 1980s has always highlighted the implementation issues, but these issues have been getting renewed attention and more refined discussions in the more recent literature (Chang, 2011; OECD, 2013; Andreoni, 2013c).

First, the success of industrial policy depends critically on the country’s political economy. If there is no political base for industrial policy, it will fail in the face of
policies that undermine it. It is well known that countries with a strong landlord class or a strong financial capitalist class have always found it difficult to implement good industrial policy, as those classes want policies that may be detrimental to manufacturing. One such prominent example is the US landlords in the South up till the Civil War constantly putting pressure for free trade despite the fact that it would have deterred the development of the country’s manufacturing sector. In the more recent period, we have seen the strong financial capitalist classes of the UK and Brazil wanting policies that lead to overvalued exchange rates, thereby destroying large swathes of their export-oriented manufacturing industries.

However, all of this does not mean that a country is bound by its history. New political coalitions can be built and policies changed. For example, in the late 19th century, Bismarck managed to make the landlord class (the Junkers) accept high tariff protection and other industrial policy measures for the emerging heavy and chemical industries by providing it with its own protection too – in the so-called ‘marriage of iron and rye’. For another example, in 1860, the Northern manufacturing states of the US established their national hegemony by establishing the Republican Party, which brought on board the Western states, traditionally in favour of free trade, by offering them free distribution of public land (embodied in the Homestead Act of 1862) – and eventually winning the Civil War. For a more recent example, the recent counter-offensive by the industrial capitalists in Brazil following the 2008 global financial crisis has led to the fall of real interest rates and a diminution of currency overvaluation, which had beleaguered the country’s manufacturing sector since 1996.

Second, the relationship between the government and the industrial capitalist class matters. Experiences show the importance of continuous dialogue and exchange of information between the two, if the policies are going to be well informed and relevant. However, it is also important that the government does not get beholden to particular industrial interests and thus avoid the danger of ‘capture’. Peter Evans (1995), the eminent American sociologist, has captured this point beautifully in his notion of ‘embedded autonomy’, which means that the government needs to have roots in the society (‘embeddedness’) but also has to have its own will and power (‘autonomy’) in order to be effective in its intervention. Autonomy without embeddedness can create a state that imposes an ‘inorganic’ vision on the society through force, while embeddedness without autonomy means that the state is turned into Marx’s executive committee of the bourgeoisie. Evans used the case of Japan, Korea, and Taiwan to illustrate this point, but the other countries that we have examined in this report – most notably Singapore, Germany, Italy (local
governments), and Finland – fit this case.

Third, the nature of a country’s prevailing ideology matters. If the ideology is too rigid – like the free-market ideology in the UK from the 1980s until the 2008 financial crisis, or the autarchic variety of communism practised in Mao’s China – a country will use industrial policy of wrong type in wrong quantity. All the countries we have reviewed in this report showed a considerable degree of flexibility in ideological terms during most of the periods reviewed (except for the obsession with inflation control in Brazil between 1996 and 2008). And their industrial policy was compromised when ideologies became hardened, as in the case of the free-market ideology in Korea, especially between the 1997 financial crisis until the last government (2007-12). Singapore is the ultimate example of industrial policy success based on pragmatism, mixing some of the most ‘free market’ measures (free trade) with some of the most ‘communist’ ones (public ownership of land, huge role for SOEs).

Fourth, the capabilities of the organisations implementing industrial policy matter. Not only the relevant government ministries and public agencies but also the private sector agencies needed in actually implementing some of the policy measures (e.g., employers’ association, industry associations, trade unions) need to have adequate policy capabilities. This requires staffing these organisations with individuals with appropriate skills and experiences. One important thing to note is that capabilities here do not imply training in standard economics, as testified to by the fact that the industrial policy-makers of the East Asian ‘miracle’ economies were mainly non-economists – lawyers in Japan and, to a lesser extent, Korea and scientists and engineers in Taiwan and China (see Chang, 2011). Moreover, capabilities are not just those possessed by the individuals working in those organisations. Organisations themselves possess capabilities in the forms of particular command structure, institutional routines, and organisational ‘memories’ (e.g., past records). Of course, the difficulty is that it takes time and investments to build up these capabilities and coherences, although they are not as difficult to build up as many critics of industrial policy would like us to believe (see Chang, 2011).

Fifth, not only the capabilities of but also the interactions between the organisations implementing industrial policy are important. The relevant bodies (public and private) need to have good working relationships with each other. They also need some mechanisms to coordinate their actions, whether through some intellectual exercises (e.g., indicative planning, foresight exercise) or through organisational structures that
make coordination easier (e.g., some coordinating super-ministry, such as France’s Planning Commission or Korea’s Economic Planning Board [EPB]).

Last but not least, how sensible the policies are obviously matters, although what is ‘sensible’ would be different across different commentators. Two aspects – policy realism and policy adaptation – need consideration. First, as for ‘policy realism’, policy targets need to be commensurate with the capabilities of the producers (and, secondarily, those of the policy-makers themselves). This is true for all countries but particularly relevant for countries at early stages of development, whose inadequate productive capabilities make industrial upgrading risky. Given the risk, these countries should not try to leap too far from where they are. However, the nature of the game is such that, without some risk-taking, industrial policy will achieve little (Chang in the Lin-Chang debate emphasises this point; see Lin & Chang, 2009). Striking the balance between realism and the need for risk-taking is, of course, not easy, but it can be – and has been – done. As for ‘policy adaptation’, policy targets need to be adjusted according to changes in conditions, especially the country’s technological capabilities (which take long and cumulative processes to build and efforts to maintain, as we emphasised above) and the world market conditions (e.g., overall demand conditions, what the existing and potential competitors are doing). It is widely recognised that, as the country moves up the technological ladder, the focus of industrial policy needs to shift to innovation policy. It is less widely recognised that countries at higher stages of economic development need timely but orderly phasing-out of ‘geriatric’ (as opposed to ‘infant’) industries (see Chang, 1994, ch. 3, for further discussions).

2.5. Evaluating Industrial Policy

There have been various attempts to ascertain the effectiveness of selective industrial policy by looking at the relative performances of the targeted industries against those of non-targeted industries. Apart from various methodological and factual problems with individual studies (two prominent studies – World Bank, 1993 and Lee, 1996 – are reviewed in Chang, 2011), there is a problem with this general approach.7

First, there are serious problems with the way in which these studies identify targeted sectors. Some studies define targeted industries in terms of some general
characteristics without actually ascertaining that the industries were in practice favoured by government policies. For example, the famous East Asian Miracle report of the World Bank argues that industrial policy in the East Asian ‘miracle’ economies (except for some periods in Japan) was a failure on the grounds that the targeted sectors did not perform better (World Bank, 1993). However, the study assumed that the higher it’s value-added component and the higher its capital intensity, the more favoured an industry was. However, industrial targeting was never practiced in this kind of simplistic way in those countries. For example, during the 1970s and the 1980s, the textile industry was promoted heavily as a ‘strategic’ industry in Korea, as it was the most important export industry (see Chang, 1995, for further details).

Other studies do look at the actual (as opposed to theoretical) degree of state support to define targeted sectors. For example, Lee (1996), in analysing Korean industrial policy for the 1962-83 period looks at tariffs, non-tariff barriers, tax incentives, and subsidised loans for each sector and finds no correlation with a number of performance indicators (e.g., labour productivity, total factor productivity or TFP, and capital intensity), thus concluding industrial policy to have been ineffective. However, many important industrial policy measures cannot by definition be captured through quantifiable indicators. Such measures include: (i) coordination of complementary investments (the Big Push); (ii) coordination of competing investments; (iii) policies to ensure scale economies (e.g., licensing conditional upon production scale, emphasis on the infant industries starting to export from early on, state-mediated mergers and acquisitions); (iv) regulation on technology imports; (v) regulation on foreign direct investment.

More recent studies (see the special issue edited by Lenihan et al., 2007) have overcome the problems of identifying the promoted sectors and the supports they get by looking at very specific programmes, such as R&D tax credits (Cappelen et al., 2012), government sponsored R&D consortia (Lechevalier et al., 2010) or programmes for supporting manufacturing jobs (Criscuolo et al., 2012), using micro data and industrial surveys. They then try to identify the effects of those policies by comparing the ‘treated firms’ with ‘non-treated firms’, using the randomisation technique or the ‘differences in difference’ technique.8

However, even these studies do not give us reliable results.

First of all, there are inherent difficulties in clearly linking the observed changes in the
targeted sector (or firms) with the implemented policy. This is because it is not easy to understand how policies implemented in different sectors, geographical locations, and timing interact with each other (Lenihan, 1999; Wren, 2007).

Moreover, our definition and discussions above emphasised that, while industrial policy may target certain industries (or even firms), this is done ultimately for the benefit of the overall economy – a lot of selective industrial policy is about externalities, linkages, coordination, and shifts across industries, with the aim of upgrading the structure of the entire economy. If this is the case, it will be wrong to evaluate industrial policy only in terms of its direct outcomes in the targeted industries. We also need to look at its indirect impacts on the rest of the economy by adopting system-level evaluation techniques. For example, when we assess the industrial policy of a particular country, we need to look at things like its ability to generate new technologies, make structural shifts, and compete in the world market, and not just what is going on in the targeted industries. All of these will be ultimately reflected in the country’s growth rate, but it is a rather catch-all indicator, so we may have to supplement it with more specific indicators regarding things like the (overall and sectoral) balance of payments, changes in the share of manufacturing in total output, or the changes in the world market share overall and, in particular, ‘leading’ industries with technological dynamism and demand expansion (see, for example, UNIDO, 2002 and 2013).

The problem of evaluating industrial policies does not end with the difficulties related to addressing systemic effects (such as displacement effects or linkage effects) of the policy. An added layer of problem is that the evaluation framework has to account for the existence of long-run effects arising from cumulative dynamics (Wren, 2007). Even if we recognize the existence of ‘time lags’ – and thus of qualitative transformations, discontinuities, truncations, and reversals – we still have to explicitly take into account the question of time scale – that is, the amount of time that firms require to build productive capabilities (as a result of, say, an infant industry policy) and move from low- to medium- and high-tech industries (Andreoni, 2011).

These time issues become increasingly complex when we attempt an evaluation of a full package of industrial policies but are also extremely relevant even in the more narrow evaluation of specific policies, such as the increasingly widely-adopted randomised control trials. This technique implicitly assumes that the effect of a certain treatment (i.e., policy) unfolds in a ‘proper’ way, that is, in a monotonically
increasing and linear manner. However, this is not often the case, and therefore we can come out with completely different evaluation results, depending on the moment we compare the observed (e.g. treated firms) and the counterfactual (non-treated firms). As Woolcock (2009) highlighted, “[w]e know we need ‘baseline’ (at time t0) and follow-up data (at time t1), but the content and shape of the proverbial ‘black box’ connecting these data points remains wholly a mystery, to the development industry’s peril” (p. 3).

This section has reviewed various issues related to the evaluation of industrial policy. Problems related to actually identifying the targeted sectors and the benefits they received were discussed. We also pointed out the problem arising from the systemic nature of industrial policy – linkages, displacements, and other interactions between industries make it difficult to evaluate a sectoral policy purely in terms of its impacts on the targeted sector. Time factors – problems associated with time lags and time scales – also need to be considered. All of these issues, of course, do not mean that we should not, or cannot, evaluate industrial policy. Good evaluation is necessary to improve policy. However, they mean that we need to use a plurality of both quantitative and qualitative evaluation tools and be cautious about any evaluation result.

3. Country Case Studies

3.1. Japan: The quintessential example

Japan is not the only country that has successfully used industrial policy. However, it occupies a special place in the modern debate on industrial policy in the sense that it is the rise of Japan as an industrial powerhouse between the 1960s and the 1980s that prompted such debate (the early debate is summarised in Chang, 1994a, ch. 3).

Japan’s industrial policy remained lopsided and unsystematic until the Second World War, being constrained by external forces (the country could not use tariff protection until 1911, when the so-called unequal treaties, signed upon the forced opening of 1853, expired) and driven by unrealistic imperialist ambitions, which over-developed the heavy and chemical industries (on pre-WWII Japanese industrial policy, see
Allen, 1981; Johnson, 1982; Macpherson, 1987). Until the Second World War, Japan was actually on the whole not the economic superstar that it later became. Between 1900 and 1950, Japan's per capita income growth rate was only 1% p.a., which was below the average for the 16 largest now-OECD economies, which was 1.3% p.a. (Maddison, 1989).

Japan went through an extremely difficult patch following the end of WWII, in which output collapsed by almost half (from the peak of $2,897 in 1941 to $1,555 in 1946, GDP per capita in 1990 dollar; Maddison, 2001, p. 206, table A-j) and enterprises were in such a state that even Toyota had to be bailed out with public money (in 1949). It started to recover rapidly from 1950, partly thanks to the export boom due to the Korean War (1950-3), but until the late-1950s, the country was still not very developed – its biggest export item was still silk and silk-related products and its export products were bywords for shoddy products.

However, from the 1950s, the Japanese government used strong industrial policy to develop higher value-added industries, such as steel, automobile, electronics, and machinery (further details can be found in Magaziner & Hout, 1980; Johnson, 1982; Hall, 1986; Dore, 1986; Okimoto, 1989).

The Japanese government did not give much outright subsidies (thus making some people who equate industrial policy with subsidies believe that it did not have much industrial policy), but provided long-term finances through the Japanese Development Bank (JDB) and other public financial institutions, such as the Long-Term Credit Bank of Japan and the Industrial Bank of Japan. Protectionist measures (tariffs and quantitative restrictions) were actively used, while the country had arguably the world’s toughest regulations on FDI (Chang, 2004) and on technology imports (to make sure that imported technologies were not overly outdated and the royalties paid were reasonable). The targeted industries were often also provided with subsidies for export, investment, R&D, and utility bills, while also being given preferential tax breaks (Goto & Wakasugi, 1988). The Japanese government also used indicative planning and foreign exchange rationing. Laws were introduced in the 1950s to prevent large firms from abusing their monopsony or oligopsony positions to squeeze their suppliers, which prompted the large firms to invest in enhancing the capabilities of their suppliers (e.g., some equity participation, secondment of technicians), rather than constantly squeezing them and thus depriving them of the resources to invest in capability enhancement.
The Japanese performance after the 1950s, especially during the “Golden Age of Capitalism” (1950-73), was simply spectacular. During this period, per capita income in Japan grew at the amazing rate of 8.05%, which is more than double the average of the 12 European countries (3.93%). It was over 3% points higher than the second-best performer, West Germany (5.02%), and over 3 times higher than that of the USA (2.45%). By the 1970s, Japan started breaking into markets that had until then been considered the exclusive domains of only Europe and North America – automobile, steel, shipbuilding, electronics, and so on. By the 1990s, Japanese products, represented by Toyota’s luxury car, Lexus, had become synonymous with quality, innovative design, and reliability.

Behind the success of these industrial policies were the corporate governance and financing structures that made long-term-oriented investments possible. Between the mid-1960s and the late 1990s, Japanese companies insulated themselves from short-termist pressures through cross-shareholding among friendly enterprises, which accounted for 35-50% of all Japanese shares during this period (it is still 20% today, after two decades of battering by economic recession). Banks were closely involved with enterprises and provided not only ‘patient capital’ but also de facto management consultancy for smaller firms, which could not afford them in the open market. The ‘core’ workers – roughly, 2/3 of the workers in large firms and 1/3 of them in the smaller ones – were integrated into the enterprise governance structure through the granting of lifetime employment and opportunities for consultation. With more cooperative workforces, firms found it easier to restructure themselves and thus minimised the need for hostile takeover.

As we mentioned earlier, in today’s industrial policy debate, Japan plays the role of the benchmark. However, many of the industrial policy measures used by the Japanese government until 1990 were not very different from the ones used by other governments. And we are not talking about countries like Korea, Taiwan, and China, which emulated Japanese industrial policy to one degree or another, but we are also talking about most of other developed countries today, including Britain (between the mid-18th to the mid-19th century), the US (between the mid-19th and the mid-20th century), Germany (in the late 19th and the early 20th century), and post-WWII France (see Chang, 2002, for further details).

However, this is not to say that Japan was only repeating what other countries had done before. Japan’s postwar industrial policy involved some important policy
'innovations'. Two things are notable here.

One notable Japanese innovation is the establishment of deliberation councils for policy-making in key industries, comprising the government officials, industry representatives, and more ‘objective’ observers (e.g., journalists, academics). These councils are said to have made industrial policy more effective by improving information flows between the government and the private sector, on the one hand, and between the private sector firms themselves, on the other hand.

Another Japanese innovation, or rather improvement over past practices of its own and in other countries, is the improved technique of managing cartels. Rather than regarding all cartels as negative, as has the US done, the Japanese government recognised that cartels can help industrial development by reducing ‘wasteful competition’ that destroys profit and undermines the capacities to invest and innovate in the long run. Of course, the problem, as Japan itself (and many European countries) had seen in the pre-war period, is that cartels can also become conservative forces that prevent progress. Therefore, in the postwar period, the Japanese government tried to minimise this problem by allowing cartels only under clear conditions in terms of their aims (e.g., avoiding duplicative investments, upgrading technology, avoiding price wars in the export market, orderly phasing-out of declining industries) and life spans.

The stock market crash of 1990, followed by the so-called ‘lost decade’, triggered profound changes in the government approach to industrial policies (OECD, 1998; Nezu, 2007). Overall, industrial policy became less targeted at the sectoral level and more decentralised to the regional level. For example, between 1989 and 1993, SME development, R&D investments and export credit insurance programmes accounted for almost 90% of total expenditure. Policy interventions for SMEs programmes alone were half of the total budget and were managed and financed by regional governments. Funds for sectoral policies targeting, focused on the energy, computer and shipbuilding industries, accounted for less than 10%.

During the mid-1990s, the industrial policy agenda became increasingly dominated by the deregulation agenda, further weakening the traditional industrial policy framework. In 2000, this change in the industrial policy approach culminated in the institutional transformation of the MITI (Ministry of International Trade and Industry) into the METI (Ministry of Economy, Trade and Industry) and, later, with an
amendment to the Japanese Corporate Law that allowed mergers and acquisitions (M&A) by foreign companies of Japanese enterprises through swapping of stocks. Despite these changes, considerable amount of industrial policy has continued in the two new key areas of SME promotion and innovation.

SMEs have always played a key role in the Japanese economy as suppliers of components and intermediate inputs to internationally successful large firms, especially in the automotive, electronics and other assembly industries. However, in the stagnation of the 1990s and the early years of the 2000s, they were particularly stressed by the slow growth of internal demand and the increasingly competitive international environment. During this period, Japanese SMEs were indirectly helped by the injection of public funds into the banking sector, which enabled them to have access to low interest-rate borrowing. On top of that, the Japanese government deployed a comprehensive package of industrial and innovation policies under the coordination of the METI’s council for SMEs, in order to promote start-ups and boost the innovation capacities of existing SMEs. Various forms of subsidies (such as favourable tax treatment for R&D investment) and regulatory reforms (such as the removal of the minimum capital requirement for start-ups) were mixed with measures aiming at nurturing the science and technological infrastructure.

From 2001 to 2010, the Science & Technology Plan had a budget of almost 50 trillion yen (very roughly £400 billion), which were invested in four major priority areas: life science, ICT, environment, and nanotech/materials. Also, a number of industries were identified as key for satisfying future social needs. They are: robots, fuel cells, digital content, and digital consumer electronics. METI’s policy targets and selection of key technologies were underpinned by a strategic technology roadmap. Among the policy measures, particular emphasis was given to the establishment of ‘regional consortium clusters’ (defined as networks of regional industries, on the one hand, co-located universities and research centres, on the other), linked by both cooperative and competitive relationships (Weiss, 2005; Goto & Kodama, 2006). Finally, in 2006, the new policy initiative for competitiveness and productivity encapsulated in the idea of an ‘Innovation Super High-Way’ for Japan stressed the importance of strengthening the linkages between science, technology and industry.
3.2. Germany: The teacher?

Especially given its influence on Japanese industrial policy, Germany is often considered to be the ‘teacher’ for Japan. This was true, however, only in the old days. After WWII, Germany’s industrial policy was considerably different from that of Japan or of other European countries such as France, Italy and the UK, as we shall see below.

During the first two decades after the WWII, Germany’s recovery was driven by those industries in which the country had a long-standing competitive advantage and it was sustained by the high demand of investment goods from the rest of Europe. Between 1950 and 1970, investments remained high at 22-24% of national income, while exports rose from 9% to 19% of national income.

After the war, the giant chemical company, I.G. Farben, was broken up into Bayer, Hoechst (now part of Aventis), Agfa, and BASF. These companies allowed Germany to regain a world leading position in the modern science-based chemical industry. In electrical engineering Siemens quickly became a European leader in power engineering, telecommunications and other electronics. The non-electrical machinery and, more broadly, machine tools industries developed thanks to a dense network of highly productive small and medium sized firms, the so-called Mittelstand, supported by a whole array of public and quasi-public institutions (see below).

The German model (Modell Deutschland), as Helmut Schmidt called it in the 1970s, was developed during the first two decades after the WWII thanks to an articulated package of industrial policies operating both at the national and regional (Lander and municipalities) levels. The German industrial policy mainly focused on four axes: regulation of the labour market, the development of an integrated vocational training system, creation of a basic science and industrial research infrastructure, and public support for industrial finance.

In the early 1950s, the Works Constitution Act and the Collective Bargaining Law introduced a set of legally binding sectoral collective bargaining agreements between employers’ associations and unions. These agreements introduced a ‘labour constraint’ for employers with respect to the remuneration, mandated or state-provided social security benefits, working condition, dismissal of workers, and rights
of work councils (Muller-Jentsch, 1995; Vitols, 1997; Feldenkirchen, 1999).

Such measures had four main effects. Firstly, they guaranteed a low level of wage dispersion across firms, much lower than those of the US, the UK, and even Japan, and even declining throughout the 1980s (OECD, 1993; Streeck, 1992). Second, they encouraged long-term attachment of employees to firms – for example, in 1993, the average length of employment was 7.5 years, as against 4.4 years in the UK and 3 years in the US. Low turn-over, in turn, encouraged firms to invest in developing firm-specific skills and in retraining (Abraham & Houseman, 1993). Third, these measures enabled work councils to get involved in firms’ strategic decisions regarding the introduction of new technologies or organisations, hiring and firing, mass layoffs, working hours, and early retirement pensions. Finally, they prevented companies, especially those exposed to international competition, from building their competitiveness on lower wage costs, producing a ‘productivity whip’, whereby less productive companies were forced to change or to leave the market (Vitols, 1997).

The potential competitive disadvantages introduced by strict labour regulations were counterbalanced by a set of measures aimed at providing companies with a highly skilled labour force. Differently from the US and the UK, the public vocational training system was expanded and training standards upgraded throughout the three decades after WWII. The so-called ‘dual’ training system was based on the idea of mixing company-based training with theoretical instruction in specialised vocational schools. In 1969, the Vocational Training Law regulated apprenticeship contracts by defining company’s duties as well as by assigning the responsibility to supervise and assess the achievement of certain training standards to Chamber of Commerce and Industry or Chambers of Artisans, the latter funded by compulsory fees for all companies.

While this integrated vocational training system increased the functional flexibility of workers and their adaptability to technological change, a series of laws were passed for alleviating the tensions arising from more radical structural changes as well as from business cycles (e.g. the Work Promotion Act in 1969). For example, adjustments to short-term demand contractions were dealt with through reductions of the average hours worked instead of reductions in the number of workers (Abraham & Houseman, 1993). During the crises in the mid- 1970s, beginning of the 1980s, and the early 1990s, regional labour offices widely resorted to subsidies for shorter working hours or even to early retirement schemes, to keep unemployment down.
The latter were particularly important for facilitating the maintenance of a balanced age structure, especially in traditional sectors (Vitols, 1997; Feldenkirchen, 1999).

From the mid-60s until the mid-70s Germany’s investments in basic science and industrial research tended to be sectoral and technology-targeted. In 1962 the Ministry for Atomic Questions was converted into the Ministry of Research and Technology (BTFM). Three major industrial strategies were implemented. The first was on data processing and computer hardware development, which channeled resources mainly to Siemens. The second was on nuclear power, focusing on fast breeder reactors. Third, both the federal and land governments heavily supported civil aircraft projects through subsidies and organised ‘rationalisation’ and concentration, which led to the creation of the MBB group, later one of the main partners in the Airbus consortium (Owen, 2012). Even when the federal government decided to privatise national companies – starting from the 1960s (e.g. Volkswagen and VEBA) and increasingly since the 1980s (e.g. Deutsche Telekom AG and Deutsche Post AG).15 – the Länder governments often maintained their shares in the company, as in the case of Volkswagen (the government of Lower Saxony) (Fasbender, 2004; OECD, 2003; TUC, 2011).

Since the mid-1970s, the German government increasingly developed its public R&D infrastructure built around two publicly funded networks of institutes, the Fraunhofer Society and the Max Planck Society. Fraunhofer institutes were explicitly aimed at filling the gap between basic science and company-based industrial research and at overcoming the disadvantages and scale bottlenecks faced by Mittelstand companies, that is, firms with a number of employees between 100 and 500. This public technological infrastructure was also complemented by a network of sectoral and local associations, focused on technology transfer, provision of training, and organization of focus groups for problem-identification and cooperative problem-solving.

The last pillar of the German model was a banking system focused on long-term lending to industry. During the 1950s, the German government built a number of public or quasi-public special-purpose banks, whose functioning and mandate adapted over the years with the changing needs of industries. For example, the Bank for Reconstruction (KfW), founded in 1947, increasingly moved away from direct lending and became a long-term refinance bank specialized in lending to banks strongly linked with industrial companies.16 The Mittelstand companies were mainly
served by the German Bank for Settlements (AG) as well as by a strong network of public saving banks and credit cooperatives, linked by a ‘three tier’ organizational structure, which allowed them to overcome scale disadvantages by aggregating credit demands (as well as savings) at the upper tiers (regional or national) while remaining strongly embedded in the local community.

The German Model went through important changes since the 1980s due to internal dissatisfaction and the re-unification.

In 1982, Helmut Kohl began to reduce the role of the government by cutting public expenditure and taxes as well as partially de-regulating the labour market. These measures, coupled with a massive privatization, involving sales of shares of companies like Volkswagen and Lufthansa, reduced the size of the government from 52% to 46% of GDP between 1982 and 1990.

With the reunification, the government adopted a dual system of industrial policy: continuity of the industrial policy for West Germany (alte/old Länder) and policies directed towards East Germany (Neue/new Länder) (OECD, 1998). The industrial policy measures in East Germany focused on the creation and development of new SMEs (both in manufacturing and services), infrastructural investments, and the privatisation and rationalisation of state owned enterprises (SOEs) (the public agency in charge was Treuhand Gesellschaft). In West Germany, industrial policy has remained very much focused on existing Mittelstand companies and their innovative capacity, especially those large medium-size companies (up to 1,000 employees), known as ‘hidden champions’, many of which dominate global niches, with 40%-90% of the global market shares (Simon, 1996; Venohr & Meyer, 2007).

The exact extent and details of Germany industrial policy are difficult to ascertain, as there are many different measures and actors (federation, Länder or municipalities) and different statistics cover different things. However, it is fair to say that it has one of the most active industrial policies in Europe (Karl et al., 2003).

Even with recent changes, the German public sector still owns important shares in companies and uses public procurement strategically. In 2006, the federal government had important direct holdings of more than 25% in 33 enterprises and owned some shares in further 112 enterprises. Resources obtained through
privatisation have been used, especially by Länder governments, for venture capital and public support for innovation. Public procurements are, while transparent, strategically designed. For example, they prescribe the use of certain materials, technologies or compliance to certain standards, which enables the government to promote certain types of companies or technologies.

Despite the maintenance of the basic policy framework, there has been a major shift in German industrial policy since the mid-1990s. Almost half the public spending on industrial policy has been devoted to environmental sustainability, energy efficiency, and renewable energy. Also, the support for the enhancement of the innovation capacities and synergies of Mittelstand companies has been further strengthened, as testified by the ZIM project for Mittelstand and the BioRegio programme aimed at the creation of regional public-private partnerships.

3.3. The US: The real pioneer

In the contemporary debate on industrial policy, the US is often considered to be the antithesis of Japan and the other East Asian countries in this respect. Whether they praise the US model or criticise it, most commentators start from the assumption – and it is no more than an assumption, as we shall see below – that the US does not have much industrial policy. However, the US has employed a huge amount of industrial policy throughout its history.

First of all, from its early days, the US was a pioneer of industrial policy (Chang, 2002 and 2007; Rauchway, 2007). One key justification of industrial policy we mentioned above – the infant industry argument – was invented by none other than the first American finance minister (Treasury Secretary), Alexander Hamilton, in his 1791 Report on the subject of Manufactures by the Treasury Secretary. The Report was, contrary to what many believe, not narrowly focused on tariff protection but discussed a whole range of (general and selective) industrial policy measures, including targeted subsidies, infrastructural development, financial development (the banking system, the government bond market), and the promotion of innovation through the development of the patent system.

Although it took a few decades since the publication of the Report before the pro-
industrial-policy faction in US politics became strong enough to implement Hamilton’s programme, from the 1830s, the US remained the most protectionist country in the world until World War II. Although its tariff protection lacked the careful selectivity of its East Asian counterpart, it was not a blanket protection either, as some sectors were more protected than others. Especially between the mid-19th century and the mid-20th century, the US government also invested heavily in infrastructure (e.g., the Pacific Railways, the mid-western canals), higher education (e.g., land grant colleges), and R&D (especially in agriculture), all with a considerable degree of explicit and implicit targeting.

Even after WWII, when the country attained industrial supremacy and started championing the cause of free trade and free markets, the US did not abandon industrial policy. Throughout the Cold War period, the US implemented a comprehensive industrial policy package including long-term procurement contracts, subsidies, investment guarantees, and strategic bailouts (Markusen, 1996). However, the post-WWII world order made it necessary for the US to play the role of new hegemon of the ‘free trade’ system and of the defender of the ‘free enterprise’ system against Communism, so it had to pretend that it was not engaged in industrial policy. As a result, industrial policy in the US after WWII was conducted under other names – defence policy, health policy, agricultural policy, and what have you – prompting the eminent American economic sociologist Fred Block to talk of a ‘hidden developmental state’ (Block, 2008).

Post-WWII US industrial policy was also strongly focused on translating cutting-edge technological research, much of which was generated through massive public funding of R&D (especially in defence and health), into commercial use. This was achieved through cooperation among a network of people with high levels of technological expertise – variously situated in state agencies (e.g. the ARPA [Advanced Projects Research Agency] of the Pentagon, the NIHs [National Institutes of Health], the NSF [National Science Foundation], and NASA [National Aeronautics and Space Administration]), industries, universities, and other research institutes. Between the 1950s and 1980s, the share of government funding in total R&D in the supposedly free-market US accounted for, depending on the year, between 47% and 65%, as against around 20% in Japan and Korea and less than 40% in several European countries (e.g., Belgium, Finland, Germany, Sweden).20

More recently, R&D funding has taken the form of grants, deferral of liability, tax
provisions and exemption (62% of which was spent on accelerated depreciation of machinery and equipment). During the 2000s, these industrial policy tools were structured within three main programmes. The first of these programmes, the Advanced Technology Program (ATP), managed by the National Institute of Standards and Technology (based under the US Commerce Department), focuses on the specific industrial technological needs and promotes private-public sectors partnerships, early-stage investment and risk-sharing in order to promote innovative technologies. The second programme, called the Small Business Innovation Research (SBIR), supports small technology companies by funding early-stage R&D projects and guaranteeing them full IPRs on the new technologies they develop, even though it was partly funded by the SBIR. To be eligible for this programme, companies must be American owned, employing less than 500 employees and being for profit. The third programme, that is, the Small Business Technology Transfer (STTR) addresses the same company types but, differently from the SBIR, it funds only R&D collaborations among a plurality of institutions and organisations (university, federally-funded R&D centres, non-profit research institutes) (Buigues & Sekkat, 2009).

Direct measures in support of R&D and SMEs are coupled with both trade policies and a strategic use of public procurements by local (that is ‘state’) governments. As for the former policy, bilateral agreements are used for opening new markets for American firms but, also, for restricting foreign competition and providing short-term economic reliefs to industries under stress. Even though antidumping and countervailing duty measures have been less frequently used since 2001, sectors such as agriculture, textiles forest products and steel have known various forms of protection or were subsidised (WTO, 2006; Ketels, 2007). As for demand side industrial policies, that is, public procurements, each local governments has its own procurement agency and defines its strategy independently under the overall supervision of the Office of Management and Budget (OMB). Some states assign preferences to local manufacturers or set local contents requirements.

Unfortunately, the ‘clandestine’ nature of post-WWII US industrial policy has meant that it has suffered from unstable funding, lack of coordination across different policy areas and between different actors, and excessive commoditisation of knowledge (Block, 2008; Ketels, 2007). In 2006, for instance, while the American Competitiveness Initiative established by President Bush announced a renewed commitment to science and technology policy, the Congress reversed this decision and proceeded with spending cuts in many programmes (Buigues & Sekkat, 2009, p.
However, on the whole, post-war industrial policy in the US has been quite successful, as testified to by the fact that the majority of the industries in which the US has international competitiveness have been developed through public funding of R&D and public procurement, especially in the names of ‘defence’ (computer, semiconductors, aircraft, internet) and ‘health’ (drugs, genetic engineering) (Medeiros, 2003; Block, 2008; Mazzucato, 2011; Pisano & Shih, 2012).

3.4. Korea: The most dramatic example

Between the 1960s and the 1980s, Korean industrial policy has followed a trajectory that is very similar to the Japanese one, but in a much more dramatic fashion than the Japanese one. This was partly out of necessity – Korea, technologically being so much more behind than Japan was, needed more forceful government intervention if it were to raise internationally competitive firms. However, it was also because, for historical reasons the private sector was far weaker than in Japan so that the Korean government was far less constrained in dictating the private sector than its Japanese counterpart did.

Korean industrial policy-making and -implementation were also more centralised than the Japanese ones (see Chang, 1993, for further details). The Korean planning ministry, the Economic Planning Board (EPB), which was ultimately in charge of industrial policy (although the Ministry of Commerce and Industry executed many of the policy measures), was much more powerful than the Japanese planning agency (not even a full ministry), the Economic Planning Agency. The EPB even controlled the government budget, which is in most countries including Japan the turf of the finance ministry. As a result, Korea’s ‘indicative’ planning (the Five Year Plans for Economic Development, practised between 1962 and 1993) – and industrial policy as a key component of it – was much more directive than the Japanese or even the French counterparts. As in Japan, deliberation councils existed, but the private sector firms had much less influence in their decisions than their Japanese counterparts.

Especially in the early days of the country’s economic development, the Korean private sector was totally at the mercy of government rationing of credit and foreign
exchanges. Credit rationing was possible because all banks, and not just special-purpose banks as in the case of Japan, were state-owned until 1983 and because even the privatised ones were in effect controlled by the government through heavy regulations until the early 1990s. Foreign exchange rationing was conducted through the so-called ‘foreign exchange budgeting’ system, which was based on legally mandated government monopoly of all foreign exchange transactions until the early 1990s (see Chang, 1993, for details). This gave the government a huge leverage over private sector companies, as Korea’s then low level of technological development and its paucity of raw materials meant that, without access to foreign exchanges, companies could not acquire necessary capital goods, intermediate goods, or raw materials.

The infant industries were heavily protected from imports – average manufacturing tariff rates were 30-40% until the 1970s and quantitative restrictions (e.g., import quotas) abounded well into the late 1980s (Chang, 1993 and 2005). Foreign exchange rationing also gave producers manufacturing consumer goods some ‘natural’ protection, as imports of those goods were far down the priority list in the government foreign exchange budget and therefore they could often not be imported due to the lack of the means to pay for it, not due to import controls and tariffs. Sometimes domestic taxes (e.g., luxury consumption tax) were used to restrain the imports of luxury consumption goods, even though their tariffs were not ‘prohibitive’ – in the 1980s, Scotch Whiskies, which had ‘only’ 100% tariff, fetched 9 times world market prices (Chang, 1993).

Domestic producers in strategic sectors were also protected from competition from TNCs producing in Korea, as there were regulations on FDI that were almost as strict as the Japanese ones (Chang, 1998). There were also regulations on technology licensing (both in terms of the quality and the price of the imported technology). As in the Japanese case, the purpose was eventually developing local producers with world-class productive capabilities.

Unlike in Japan, where there have been no significant SOEs in the manufacturing sector since the early 20th century, the government in Korea did not mind using SOEs when necessary. The most prominent example in this regard is the now-privatised (privatised in 2000) POSCO (Pohang Steel Company), which was the second largest steel producer in the world until the recent mega-mergers in the world’s steel industry and still the fourth largest.25
The Korean government was also a lot more involved in corporate restructuring in the private sector than the Japanese government was, not least because stock market regulations made hostile Mergers and acquisitions (M&A) virtually impossible. Especially when business downturns put firms into the danger zone, the Korean government would wade in to initiate M&A and production rationalisation (see Chang, 1993 and 2006, for further details). The state-owned development bank (Korea Development Bank) played a key role in the process, sometimes providing subsidised loans on extended maturity to firms under restructuring and sometimes taking a stake in those firms (sometimes even majority stakes, thereby in effect nationalising the firms in question).

Since the 1990s, the Korean industrial policy has gone through some dramatic changes – mostly decline (see Chang & Evans, 2005, for further details), although we may be entering a period of at least partial revival with the new government (as of 2013) showing distinctively more interest in industrial policy than any government since the mid-1990s.

Strongly influenced by neo-liberal ideologies propagated by US-trained free-market economists and intense lobbying by the private-sector conglomerates (the so-called chaebols) increasingly impatient to break away from state control, the Korean government started scaling down industrial policy since 1993. The most symbolic of this move were the termination of the Five Year Plan in 1993 and the abolition of the Economic Planning Board (EPB) in 1994 (it was merged with the Ministry of Finance). There was a further round of reduction of industrial policy following the 1997 financial crisis, which established neo-liberal ideological hegemony in the country. One important result of this round of reform was the transfer of international trade policy remit from the Ministry of Trade and Industry (MOTI) to the Ministry of Foreign Affairs (MOFA), which signalled that the government now understood international trade to be a matter of diplomatic negotiation (based on the international consensus that completely free trade is the goal) rather than an element of industrial policy.26

Capital market liberalisation since 1997 has exerted short-term pressures on companies and has negatively influenced the private sector’s role in investment and R&D. Between 1998 and 2010, private gross fixed capital formation (GFCF) as a percentage of GDP averaged 18.4%, a significant step down from the 23.7% between 1990 and 1997 (OECD, 2012c). The share of gross domestic expenditure
on R&D (GERD) that was financed by the private sector also declined from 76.3% in 1995 to 71.8% in 2010 (OECD, 2012a).

Despite this general trend towards the diminution of industrial policy in the last two decades, the practice of designating certain industries as ‘strategic’ and providing targeted supports has continued in Korea, albeit at a lower key. Bio-tech, nano-tech, and green-tech industries have been subject to such support, in the forms of R&D funding, credit guarantees and public funding for training (especially for the green-tech industries) (Kim & Koh, 2010). While these supports were not of the scope and scale of pre-1990s industrial policy, they were not insignificant either. The share of public spending in total R&D spending has crept up from the traditional 20% region to 26.7% in 2010. Given the continuous rise of R&D spending as a share of GDP in Korea in the recent decades, this means that the country, at 1.00% in 2010, has one of the highest government-financed R&D as a proportion of GDP in the world, behind Austria (1.08%) and Iceland (1.03%), tying with Finland, and above the OECD average of 0.74%. Since the late 1990s, there have also been attempts to develop industrial clusters in economically weaker regions (MKE, 2010; OECD, 2012b), but these have not been very successful, due to the lack of the thick institutional networks present in countries like Germany and Italy that have been the most successful with those policies.

3.5. Singapore: The ultimate pragmatist

Not least because of its status as a small city-state without natural resources, Singapore’s industrial policy has been very different from those of other East Asian countries, but in many ways the most successful – its per capita GDP (at current market prices) rose from US$516 in 1965 (when it gained independence) to US$50,123 in 2011 (SDOS, 2012). As of 2010, it had become the most industrialised country in the world, producing the highest MVA in the world (see Table 1).

Singapore’s small domestic market (2 million people at the time of separation from Malaysia in 1965) meant that it had to rely exceptionally heavily on external demand to industrialise. Accepting this, the country adopted a free-trade regime, making its industrial policy regime very different from those of the other East Asian countries. Moreover, given the paucity of local entrepreneurial talent and the lack of industrial technology, the Singapore government decided to work with TNCs much more
closely than the other East Asian countries. As a result, its FDI as a share of GFCF was the highest in the world (22.9% between 1971 and 1995), higher than even that of laissez-faire Hong Kong (7.6%) (Chang, 2006).

However, all of this does not mean that Singapore pursued a laissez-faire industrial policy, as many free-market economists suggest. On the contrary, the Singapore government has consistently taken a proactive role to support the manufacturing sector’s growth.

First of all, the Singaporean government has shown itself to be even more interventionist than that of Japan or Korea in certain respects, such as forced saving schemes, the labour market, and public housing programmes. The Central Provident Fund, which imposed mandatory contributions by employers and workers, accounted for 30% of domestic savings or 12% of national income since the early 1980s (Findlay & Wellisz, 1993, p. 8). The high saving rates stimulated higher levels of investments and capital accumulation in the Singapore economy – according to Huff (1999), Singapore had the highest national savings rate in the world in the 1980s (over 40%) and 1990s (48.2% between 1990 and 1997). The labour market was also highly regulated. Singapore initially started as a high-cost manufacturing producer (Huff, 1995, p. 1424), whose wage costs were higher than other competing newly industrialising Asian countries (Lim, 1983, p. 757). However, to enhance the competitiveness of Singapore’s labour-intensive industries, the government introduced a series of labour market regulations that included wage repression between 1972 and 1979 and curbs on wage increases through a centralised wage system (Fields & Wan, 1989). Through its Housing Development Board, the Singapore government has supplied around 85% of all housing in the country.

Second, precisely because of the recognised scarcity of resources and vulnerabilities as a small open economy, the government has set explicit directions to nurture the manufacturing sector’s growth. In 2010, a high-level committee (comprising the government, labour movement, private sector and academia), tasked by the Prime Minister to formulate medium-term economic strategies, recommended the retention of a “globally competitive manufacturing sector” at between 20-25% of the economy (SESC, 2010). As a city-state, policy formulation is highly centralised, with the implementation of industrial policy falling primarily under the mandate of the Economic Development Board (EDB) (see Schein, 1997; Chan, 2011, for more details on the EDB and its work). Strategic manufacturing clusters that are assessed
to have long-term economic potential are identified and targets are actively pursued. During the nascent stage of building the biomedical manufacturing cluster in the early 2000s, Singapore targeted to attract 15 world-class biomedical science companies by 2010. This goal was surpassed, with Singapore succeeding in attracting over 30 leading companies by 2012. Most recently in 2013, Singapore announced ambitious plans to build manufacturing capabilities in satellites to serve the space industry.

Third, Singapore’s policy towards TNCs, while extremely friendly, has not been laissez faire. Rather than taking a hands-off approach to the inflows of FDI and let the TNCs decide what to do, the Singaporean government has worked hard to attract FDI into certain areas that it regards as important for the future of the country’s economy, by offering a whole slew of custom-designed financial incentives. Subsidies offered to TNCs targeted desirable industries based on criteria such as employment, growth potential, technical contents, and value-added (Huff, 1999, p. 39). Between 1980 and 1990, Singapore received more FDI than any other developing country (Huff, 1995, p. 1425). Today, Singapore continues to offer Pioneer incentives (corporate tax exemptions on income from qualifying activities), Development and Expansion incentives (reduced corporate tax rate on incremental income from qualifying activities), and the Research Incentive Scheme for Companies (grants to develop R&D capabilities in strategic areas of technology). Singapore’s generous incentives were cited as a key reason why hard disk manufacturer Seagate chose to invest in Singapore over Hong Kong and Korea in 1982 despite Singapore’s lack of a domestic supply base (Peebles & Wilson, 2002, p. 100). This initial investment eventually earned Singapore the distinction of being the largest producer of hard disk drives in the world (45-50% of annual world output) between 1986 and 1996 (Wong, 2000, p. 155).

Fourth, in sectors assessed to be critical, the Singapore government set up SOEs – comprising Government-linked Companies (GLCs) and government statutory boards (such as the Housing Development Board) – rather than inviting TNCs. The world-famous Singapore Airlines is an SOE, while industries such as shipbuilding and telecommunications are also run by SOEs. As a result, it has a huge SOE sector (estimated to be 21.8% of GDP in 1998) (SDOS, 2001). For example, between 1970 and 1990, the share of the public sector in GFCF in Korea was around 10%, whereas the corresponding figure in Singapore was over 30% – 36% in the 1960s, 27% in the 1970s and 30% in the 1980s (Shin, 2005). It would not be an exaggeration to say that virtually all large firms in Singapore that are not transnational corporation (TNC) subsidiaries are SOEs.
Fifth, land use policies in Singapore incorporate a significant sectoral-targeting dimension, particularly given its lack of land resources. For instance, waterfront land that is allocated to the petrochemicals industry cannot be used to expand the port (and grow maritime services). In a recent land use plan (with a time horizon until 2030), the government announced new manufacturing zones “to support the growth of the manufacturing sector” (SMND, 2013). Land-related industrial policy measures also target specific clusters within the manufacturing sector. For instance, the land mass of seven small islands was tripled and amalgamated through the reclamation of 22km² of land to create Jurong Island – a petrochemicals hub. Contiguous land was also allocated to facilitate the growth of clusters in industries such as aerospace (Seletar Aerospace Park) and pharmaceuticals (Tuas Biomedical Park and Biopolis).

3.6. Finland: Defying gravity?

On the back of state-led corporatist industrialisation, Finland radically transformed itself from one of the poorest economies in Europe into one of the richest. According to the authoritative statistical work of Maddison (1989), among the 16 largest rich countries of today, only Japan (3.1%) achieved a higher rate of annual per capita income growth than Finland (2.6%) during the 1900-87 period (p.15, table 1.2). Norway tied with Finland in second place, and the average for all 16 countries was 2.1%.

Industrial policy in Finland involved close cooperation between the state, trade unions and private sector agents, such as the banks and industrial firms. This corporatist nature of Finland’s growth model has led to comparisons with the Asian economies, such as Korea and Taiwan (Vartiainen, 1999).

Like Singapore, Finland is a small open economy that emphasised state-directed capital accumulation that was supported by high public savings. During the 1950s and 1960s, public savings comprised as much as 30% of aggregate savings, and these surpluses were used to support private investments in capital equipment and to form public companies (Jäntti & Vartiainen, 2009). SOEs were established in industries that were more capital-intensive or deemed too risky for private enterprises. These industries included basic metal (Rautaruukki), pulp and paper (Stora Enso), chemical fertilizer (Kemira), and petroleum and oil products (Neste). In the early 1980s, SOEs were estimated to contribute 18% to Finland’s industrial value-
However, unlike Singapore, Finland eschewed foreign involvement during its early phase of industrialisation. Having been subjugated to foreign rule for centuries, draconian restrictions were imposed on foreign investments. In 1919, soon after the independence from over a century of Russian rule (which was preceded by six centuries of Swedish rule), it was stipulated that foreigners had to get special permission to establish a business and guarantee in advance the payment of taxes and other charges due to the central and the local states. In the 1930s, a series of laws were passed in order to ensure that no foreigner could own land and mining rights. It was also legislated that a foreigner could not be a member of the board of directors or the general manager of a firm. Companies with more than 20% foreign ownership were officially classified as ‘dangerous companies’ and therefore foreign ownership of companies was effectively restricted to 20%. As a result, while there was considerable foreign borrowing, there was little FDI during this period, a pattern that persisted at least until the 1980s when there was some liberalisation of foreign investment.

To achieve high levels of investments, the Finnish government invested heavily in productive equipment and offered accelerated depreciation and investment allowances. Other measures encouraging capital accumulation included interest rate controls and preferential credit for investments in capital equipment. Between 1961 and 1990, Finland’s share of investments (GFCF) in GDP was 26.9%, higher than the OECD average of 22.8% (World Bank, 2012).

To enhance the competitiveness and growth of its export industries, Finland repeatedly devaluated its currency in 1957, 1967, 1977 and 1982. Although devaluations are generally regarded as a ‘horizontal’ macroeconomic stabilisation policy, it also involves implicit targeting of sectors, as we highlighted earlier (see section 2.1). In Finland’s case, more outward-oriented sectors, such as the paper and pulp industry, benefited more from the devaluations than industries dependent on the domestic market.

In the past few decades, Finland’s industrial policy focus has shifted towards promoting innovation in general rather than particular industries, with the government continuing to play a key role, directly through R&D spending and indirectly through ‘horizontal’ measures that strengthen the science and technology foundation for
industries. During the recession in the early 1990s, the government remained committed to raising public R&D, even as it reduced most public expenditures (Georghiou, et al., 2003). Within the OECD, Finland had the third highest government-funded GERD (normalised by GDP) (1.00%) in 2010.

Finland’s ‘horizontal’ measures to create an enabling business environment that is conducive for innovation mark a departure from past initiatives which explicitly targeted specific sectors. Nonetheless, these measures still involve some degree of implicit targeting at technology-intensive sectors, as we had argued earlier.

First, access to funding for innovation was improved through various government initiatives (e.g., the Finnish Innovation Fund – SITRA) and organisations (e.g., Tekes – the Finnish Funding Agency for Technology and Innovation). SITRA, supervised by the Finnish Parliament, provided corporate funding to companies and played a key role in developing the venture capital industry in the early 1990s (Ylä-Anttila & Palmberg, 2007). Tekes, on the other hand, is the main source of R&D subsidies in Finland (see Toivanen, 2006, for more details on Tekes and the impact of Finland’s R&D subsidies.)

Second, nationwide networks of science parks and centres of expertise were developed from the 1980s to facilitate technology transfer and the commercialisation of research results (Lemola, 2002). At the macro-level, new innovations were supported through the specialisation of and cooperation between regions and clusters. At the micro-level, spin-off projects and incubators were nurtured by the science parks.

Third, Finland pioneered the concept of a ‘national innovation system’ in the 1990s (Miettinen, 2002), to foster public and private sector cooperation in developing, diffusing and utilising new knowledge and technologies. This involved adopting a broader and more holistic approach towards innovation processes and policies, ranging from education and science to innovations by firms and commercialisations of technological innovations (Georghiou et al., 2003). Today, the Strategic Centres for Science, Technology and Innovation (SHOKs) continues to emphasise innovation through the enhancement of collaborative platforms between the government, private sector, universities and research institutes.
3.7. Italy: Small is beautiful?

In 1960, Luigi Spaventa described Italy as a country whose economic position “is in between that of an underdeveloped and an advanced economy”. He pointed out that “though the initial ‘big push’ took place later than elsewhere, the Italian economy as a whole has been growing at a good, and often rapid pace over the past eighty years or so. [However] there has been some growth in the South only in recent years and only owing to heavy public intervention…” (Spaventa, 1960, p. 1077)

During the first two decades after the Second World War, the persistent technological backwardness of the Italian economy as well as the problems encountered by the central government in developing the South (the so-called ‘Mezzogiorno’) were at the centre of the policy agenda.

The central government tried to encourage the reconstruction and the expansion of the production capacity in selected strategic sectors, such as automobile, by providing money as well as subsidised intermediate goods (produced by SOEs) to private companies, such as FIAT. Moreover, engineering and mechanical companies that were not able to pay state loans back were nationalised under the holding company, the EFIM (Ente Finanziamento Industrie Meccaniche). Nationalisation was also used with respect to certain strategic industries, the most remarkable example being the constitution of ENEL in 1962, a new national agency for the provision of (very often subsidised) electric energy (Baldassarri, 1993; Federico & Giannetti, 1999).

During the 1950s and 1960s, SOEs were also very active in the modernisation of utilities, building of infrastructure, and investments in heavy industries, such as steel (through the Sinigaglia Plan) (Barca & Trento, 1997) and energy, initially with AGIP (for gas) and later with ENI (for oil and chemical products) (Sapelli, 1992). The IRI (Istituto per la Ricostruzione Industriale), a multi-sectoral holding company founded in 1933 and fully owned by the state, was a major tool for supporting the central government’s industrial policies aimed at reducing the North-South gap. A major innovation was represented by the Law No. 634/1957, according to which SOEs had to have 40% of their total investments and make 60% of new investments in
Southern Italy.

IRI’s strategic investment was also complemented by the loans provided by the Cassa per il Mezzogiorno (Cassa), a development bank set up in 1950 with the strong support of the US Government (USAID), as well as the Ten Year Development Plan for Employment and Income (Schema di sviluppo della occupazione e del reddito del decennio, 1955-1964), better known as ‘Schema Vanoni’. During the 1960s, thanks to the reform of the Cassa, as well as to a number of special banks supporting industrial and public investment – such as Special Banks for Industry and Infrastructure Development, or Istituti di Credito Speciale per l’industria e le opera pubbliche (ICS) – new resources were channelled towards a selected number of capital-intensive industries, such as steel and chemicals, or traditional sectors, such as food processing and textiles.40

Throughout the 1950s and 1960s, while the Southern regions experienced a state-led process of ‘dependent industrialisation’ (Andreoni, 2013d), the SMEs of the Northern regions experienced a fast export-led development. In 1957, by joining the European Economic Community, Italy signed a quadrennial plan of tariffs cuts (30% each time) which would have to be totally removed by 1969 (in fact Italy achieved this goal a few years ahead of schedule!). As it was accompanied by equivalent tariff cuts by other members, the fast industrialising regions in the North were able to boost the export of strategic products such as machine tools and automotive as well as textiles and other low-tech products, in which Italy was then competitive thanks to lower wages.

Differently from other European countries, during the 1970s Italy’s attempt to face the oil crisis through incomes policy resulted in massive failures. The government’s response to the crisis led to an overall increase in public subsidies from 1.2% of GDP in 1964 to 4.6% in 1975, up to 8.9% in 1985 (Federico & Giannetti, 1999). Unfortunately, subsidies were not strategically used for encouraging structural adjustments. For example, subsidies for temporary lay-offs of workers became permanent and were indifferently applied across industries. Strategic industries (steel-making, energy, petrochemicals) were granted subsidies and other measures for facilitating their industrial restructuring (Adams, 1991). Many troubled firms in strategic (and non-strategic) sectors were bailed out, resulting in the expansion of the SOE sector.41

While national champions struggled over the 1970s, Northern SMEs, very often
operating in traditional labour-intensive sectors (e.g. textiles, machine tools, furniture, etc.), successfully found their own flexible institutional responses to the crisis. ‘Industrial districts’ developed, based on clusters of co-located SMEs whose flexibility and productivity were mainly driven by external economies of scale, complementarities in production, industrial commons, and reduced transaction costs (Piore & Sabel, 1984; Becattini, 1987; Gobbo, 1989). Although industrial districts initially developed spontaneously, the national and regional governments encouraged their diffusion and growth by providing soft loans, which accounted for one-third of the total funds for investments over the 1970s.

The economic crisis and policy failures of the 1970s led to a profound reformulation of Italy’s industrial policy strategy. The 1980s witnessed a significant shift in industrial policy targets that became more and more focused on supporting R&D, innovation, and competitiveness, as well as the enlargement and the modernisation of SMEs increasingly challenged by increasing international competition especially in traditional medium- and low-tech sectors. With the exception of Japan, in the early 1980s, Italy saw the highest increase in public investments in R&D, although the results were quite modest, given the narrow range of policy tools adopted and the complex bureaucratic system which regulated the access to public support.

While other European countries started implementing privatisation and liberalisation policies over the second half of the 1980s, Italy resisted until 1992 when it faced the risk of a national bankruptcy. Over the 1990s, privatisation and liberalisation were aimed at reducing public debt but also improving the productivity of the newly privatised companies, while reducing SOE monopoly and inter-SOE collusion. Privatisations proceeded in two steps: firstly, major national banks owning shares of many public corporations were sold; secondly, SOEs were directly sold to private companies. In some sectors, privatisation produced the desired results, while in many others the lack of strategic vision led to the loss of control of strategic production assets, minimal benefits for consumers, and even the simple replacement of public monopolies with private monopolies (examples are in the telecommunications, with Telecom Italia, and in infrastructure, with Autostrade).

During the mid-2000s the privatisation process slowed down and state-owned holding companies (e.g., ENEL and ENI) even managed to increase their presence in the European and global markets. At the same time, the government intervened in the restructuring of FIAT by allowing the company to benefit from a strong line of
credit offered by recently privatised banks. The short-lived government of Romano Prodi (2007-8) attempted to start a new industrial policy course by both deregulating the service sector and, more importantly, proposing a new national industrial policy agenda called Industria 2015.

The Industria 2015 agenda recognised the need for coordinating some of the industrial policies that regional governments (almost exclusively in Northern regions such as Emilia Romagna) had been implementing over the years. The industrial policy package of Industria 2015 pursues three main strategies: (i) promotion of investments in innovation projects in areas of energy efficiency, logistics, life sciences, and the protection of artistic heritage; (ii) promotion of network amongst firms; (iii) new national venture capital funds. The political instability of the last years has, unfortunately, largely undermined the effectiveness of this national industrial policy strategy.

3.8. Brazil: Against all odds

The period of 1950-1980 in Brazil was characterised by a long period of state-led industrialisation (Ocampo, 2006). Public sector indicative planning was the norm in Brazil as well as in the rest of the Latin American region. Industrial policy was mainly aimed at creating new industrial sectors, changing the prevalent pattern of specialisation in primary commodities and promoting technology-intensive activities.

The main industrial policy strategy of this period was set up in the 1950s and consisted in the introduction of a protectionist regime based on ad valorem tariffs. The Federal Government had the discretionary power to control the level and the types of imports. The Law of Similarities (Lei do Similar Nacional) stated that a product could only be imported if it could be proved that a similar product was not produced in Brazil. These measures were intensified during the 1960-80 period within an import substitution industrialisation (ISI) strategy.

As a result of these industrial policy measures, Brazil successfully entered new strategic sectors, such as petrochemical and renewable fuels (ethanol production with the Pro-alcohol policy which led to Petrobas) and established the bases for the development of new technologies. Brazil’s upgrading into new technological areas
was sometimes very successful, as in the case of the aircraft industry (Embraer) or agribusiness (Embrapa; see Andreoni, 2013a) but not in some others, such as in the attempt to develop the computer industry or in the attempt to upgrade existing sectors, such as textiles and automotive.

The Debt Crisis during the 1980s induced the Brazilian government to introduce, at least formally, a ‘New Industrial Policy’ package (1985-1988). The total number of special trade regimes was reduced and the average manufacturing tariff rates went from 90% to 43%. However, given the strong opposition of domestic producers, reforms were not so radical. Non-tariffs barriers and the Law of Similarities were not removed, and these, together with the remaining tariffs, allowed many marginal producers to survive (Kume, 1989; Hay, 2001; Figueiredo, 2008). During the late 1980s and throughout the 1990s structural adjustment policies (financed by conditional financing programmes from the IMF and the World Bank) were initially directed to trade liberalisation and privatisation of public enterprises, while from the mid-1990s they increasingly focused on macroeconomic stabilization (the ‘Real Plan’).

The 2000s signaled the return of selective (sector specific) industrial policies in Brazil. In November 2003, the first Lula government announced the Guidelines for an Industrial, Technology and Foreign Trade Policy (PITCE), whose goals were twofold: (i) increasing industrial competitiveness by boosting technological development in key sectors and, thus, promoting the export of higher value-added products; (ii) developing the scientific and technological systems for capturing opportunities in production activities such as oil and gas, agriculture and pharmaceuticals. The Brazilian Industrial Development Agency (ABDI) and the Council for Industrial Development (CNDI) (made up of 23 Government Ministers, the BNDES President and 14 industry representatives) were created for coordinating and implementing the new PITCE industrial policy package and for facilitating the dialogue between the public and private sectors. Four strategic sectors were targeted: semi-conductors, software, pharmaceuticals and medicines, and capital goods.

In terms of innovation strategy, PITCE was focused on three industries: biotechnology, nanotechnology and biomass/renewable energies. Also, a new legal framework was introduced comprising the Innovation Act (Lei do Bem), the Biosecurity Act and the Biotechnology Development Policy. Both industrial and innovation policies were coupled with highly specific financing programmes, such
as the Profarma (pharmaceutical) and the Prosoft (software) as well as two super-sectoral programmes called Strong Industry and Innovate Brazil, managed by the Brazilian Development Bank BNDES (for a total investment of R$ 4.4 billion). The sectoral programmes are aimed at overcoming infrastructural bottlenecks and increasing Brazil’s competitiveness in targeted sectors. The super-sectoral programme targets the innovation capacity of Brazil and promotes various forms of cooperation and partnerships among private companies, universities and research institutes, government agencies and labour unions. In 2004, the adoption of an integrated funds management model ‘made it possible to integrate a large fraction of investments in funds by transversely bridging them in line with government policies, eliminating duplication and scattershot initiatives’ (ABDI, 2006, p. 20).

For the 2008-10 programme, the second Lula government launched an ambitious industrial policy package Productive Development Policy: Innovate and Invest to Sustain Growth (PDP) aimed at addressing for main challenges: (i) to sustain the expansionary cycle by maintaining the rate of growth in GFCF ahead of the GDP; (ii) to upgrade and diversify the export basket, which is dominated by primary commodities and low-tech manufactures; (iii) to boost the innovation capacity of Brazilian companies through specialisation in high value production activities and through the development of large firms controlling global value chains; (iv) to increase the competitive and distributive effects of the expansionary cycle by broadening access to credit for micro- and small enterprises.

The PDP is a complex policy package structured along three main axes. First, there are programmes promoting strategic areas (healthcare, ICT, nuclear energy, defense, nanotech and biotech), managed by the Ministry of Science and Technology (Bothelo, 2011). Second, there are programmes to consolidate and expand international market positions with the help of the state-owned development bank, the National Bank for Economic and Social Development (BNDES). The targets of these programmes are: aeronautics, oil, natural gas and petro-chemicals, bio-ethanol, mining, steel, pulp and paper, and meat. Third, there are programmes to strengthen industrial competitiveness under the direct control of the Ministry for Development, Industry and Foreign Trade (MDIC) (Government of Brazil, 2008; Ferraz et al., 2009).

During the implementation of the PDP, particular emphasis was given to the increase in competitiveness and the increase in international investments by the national champions in resource-based industries (Devlin & Moguillansky, 2012, p. 13). Also,
the funding base of BNDES was substantially expanded in order to allow the country to reach the GFCF of 21% by 2010 while the spread for credit lines in trade of capital goods was substantially reduced (Government of Brazil, 2008 p. 24).

The current industrial policy – Plano Brasil Maior (PBM), issued by the Roussef government in August 2011, embraces a broader scope and concentrates more on infrastructure, compared to the PDP. PBM also focuses on strengthening production chains and diversifying/upgrading exports (especially for SMEs) through tax reliefs, trade remedies (e.g., anti-dumping measures), and financing and loan guarantees for exporters. Since the 2008 global financial crisis, Brazilian producers have been protected from exchange rate appreciation and the worldwide economic slowdown, especially through the financial support of the BNDES, exemption of payroll taxes, and preferences in government procurement.

In the last few years, the Brazilian government has finally changed its restrictive macroeconomic policies, implemented since 1996, which contributed hugely to the dramatic premature de-industrialisation of Brazil – the share of manufacturing in GDP fell from the peak of 27.2% in the mid-1980s to 14.6% in 2011 (World bank: http://www.tradingeconomics.com/brazil/manufacturing-value-added-percent-of-gdp-wb-data.html). First, tentatively following the 2008 crisis and then aggressively since 2012, it has abandoned the high interest policy (for much of the time since 1996, it had literally the highest real interest in the world). The lowering of interest rates has naturally led to the depreciation of (the very overvalued) Real, the local currency. These macroeconomic changes have significantly relieved pressure on the manufacturing industry as a whole and especially the export-oriented firms.

In April 2012 the PBM entered in its second phase and is now concentrating on the Brazilian industrial competitiveness challenges (Canuto et al., 2013). The PBM is redesigning the policy target based on production systems concepts, instead of production chain ones, and trying to identify new instruments to strengthen industrial policy effectiveness and favour public-private collaboration (such as by establishing a new public-private governance scheme, including sectoral competitiveness councils) (Kupfer, 2012).
3.9. China: The new frontier

Since the late 19th century, the Chinese government has played an important role, with varying degrees of success, in mobilising resources, developing infrastructure and nurturing strategic industries, regardless of the political regime (the Qing dynasty, the Nationalist government, and the Communist government).42

During the transition towards a market economy in the 1980s and the 1990s, industrial policy continued to weigh heavily on the minds of Chinese state planners and many initiatives in the 1980s were inspired by the experiences of Japan and Korea. In 1987, an Industrial Policy Department was established under the State Planning Commission and in March 1989 the concept of industrial policy was explicitly mentioned for the first time in an official document, that is, the State Council’s paper Decision on Current Industrial Policy Priorities. It was followed by the more comprehensive and integrated Outline of State Industrial Policies for the 1990s in March 1994, which highlighted the need to accelerate the development of mainstay and high-technology industries, and to readjust the composition of foreign trade by strengthening manufacturing competitiveness. The June 1995 Provisional Regulations of Guidance on Foreign Direct Investment and subsequent December 1997 revision mapped out guidelines for high-technology sectors where foreign investments were encouraged, restricted or prohibited (see Zhang & Long, 1997; Yu, 1999, pp. 75-6; Liu, 2005, pp. 34-43, for further details).

China’s industrial policies are embodied within its Five-Year Plans. The Sixth Plan (1981-1985) marked a departure from past industrial plans by being more comprehensive and outward-oriented. Foreign trade and capital were encouraged in order to facilitate the import of advanced technology into the country. Promotion of high-technology industries and R&D were recurring themes in later Five-Year Plans. Strategic industries, or “pillar industries”, were identified based on their importance to China’s national security and economy (e.g., defence, coal, electric power and grid, telecommunications, petroleum and petrochemical, civil aviation and shipping in 2006) and growth potential (e.g., alternative fuel cars, biotechnology, environmental and energy-saving technologies, alternative energy, advanced materials, new-generation information technology, and high-end equipment manufacturing in 2007).

As China undertook economic liberalisation, it drew on the experiences of East Asia.
Similar to Singapore, China’s export growth has been supported by the investments of TNCs. Like Korea and Japan, China has successfully developed large domestic enterprises. As such, China’s industrial policy shares certain characteristics with its East Asian counterparts and goes beyond direct tariffs, subsidies and trade protectionism.43

First of all, key industries that have been identified in the Five-Year Plans for development were given targeted supports. They were protected from foreign competition through tariffs and non-tariff barriers, such as local contents requirements. They were supplied with subsidised loans from state ‘policy banks’, such as the Export-Import (Exim) Bank of China, the Agricultural Development Bank of China (ADBC) and China Development Bank (CDB).44 Commercial bank loans were also made in line with industrial policy goals.45 According to Ferri and Liu (2010), SOEs received 65% of the loans from commercial banks between 1998 and 2003, despite accounting for only 25% of China’s economy. Imputed interest rates on debts offered to private enterprises were also found to be 25% to 33% higher than that offered to SOEs.

Second, through the licensing system, investments were directed in strategic ways. For example, foreign investments were channelled into targeted sectors and designated geographical areas such as Special Economic Zones (SEZs). For another example, the government also controlled the geographical distribution of investments. This was evident in the 1960s when the government located new industries in inland areas so as to distribute industrial development away from the concentrated coastal areas.47 In the early days of the open-door policy, coastal areas were reprioritised for government investments, in order to maximise their growth impacts and the access to foreign markets. More recently, the growing concern with regional disparities has once again compelled the government to shift the focus of its investments (especially infrastructural investments) to the inland areas.48

Third, to develop what Nolan (2001) described as a ‘national team’ of enterprises in strategic sectors, the Chinese state initiated M&A by administrative decree. For example, state-mediated consolidation of smaller, uncompetitive firms in the electronics industry led to the formation of larger companies such as China Electronics Corporation and SVA Group. Over the years, the government has continued to pursue its policy of industry consolidation to develop large internationally competitive companies, with one recent example involving the merger of two SOEs.
– when China Electronics Corporation acquired Irico Group, a photovoltaic equipment manufacturer – in early 2013.

Fourth, industrial clusters were promoted to harness the benefits of agglomeration effects, such as closer integration between suppliers, producers and customers, on the one hand, and more rapid innovation growth, on the other hand (OECD, 1999; Arvanitis & Qiu, 2008; Barbieri et al., 2012). Emphasis was placed on developing clusters in different towns and cities with unique pillar industries. For instance, manufacturing districts such as Shunde specialise in electrical goods while manufacturing towns such as Xiaolan (locks and electronic acoustics) and Guzhen (lighting fittings) have also emerged within major cities such as Zhongshan.

Fifth, policies were deployed to facilitate transfers of technologies from more economically advanced nations. There were regulations on technology imports and TNCs were made to form joint ventures with Chinese companies, most of them being SOEs or associated with government partners. Through joint ventures, the state retained effective control over foreign affiliates so as to advance Chinese interests (Roehrig, 1994). Other technology transfer strategies included majority-stake acquisitions of and mergers with foreign companies from advanced countries (some more successful than others) – including Sweden (Volvo), the UK (MG Rover), the US (IBM’s personal computer business), Austria (Fischer Advanced Composite Components), France (Adisseo) and Korea (Ssangyong Motors) – and incentives to entice foreign companies to set up R&D centres in China.

Finally, export subsidies and currency devaluations have been used in order to enhance China’s export competitiveness in international markets. China’s export restraints, such as on rare earth used by industries, have also influenced global supply and prices. With export subsidies and restraints prohibited under the World Trade Organization (WTO), trade disputes against China’s alleged practices remain commonplace (USTR, 2010, 2012a, 2012b).

4. Lessons for the UK

4.1. Some general remarks on ‘drawing lessons’ from
international experiences

Before we draw concrete policy lessons for the UK from the experiences of other countries, let us make a few remarks on the exercise itself.

It should be made absolutely clear right at the beginning that we are not trying to derive from the case studies presented in this study some universal recipes transferable to any country, when each country has its unique political conditions, policy traditions, and economic conditions (see Rose, 1991, on the limits of policy transferability). Instead they are aimed at expanding policymakers’ imagination by presenting a plurality of possibilities in terms both of policy goals and of policy tools.

Attempts to draw lessons from other countries in relation to any policy generate scepticism in all countries, but that reaction is particularly strong when it comes to industrial policy in the UK – industrial policy, it is often argued, however successful it may have been in other countries, like Germany, China, or Finland, simply cannot work over here, because it is against the country’s history of laissez-faire capitalism and its tradition of individualism.

One problem with this view is that it is based on a mistaken view of the British history. As we briefly mentioned earlier, between the industrial policy reform of Robert Walpole in 1721 until the country’s transition to free trade in the 1860s, Britain (as it was then) was in fact the pioneer of industrial policy (Chang, 2002, pp. 19-24). It is because he knew this history that Friedrich List, the German economist who is mistakenly known as the father of the infant industry argument (when the real father is Alexander Hamilton), wrote in the 1840s that Britain’s preaching of free trade to relatively backward nations, like Germany and the US, was like ‘kicking away the ladder’ (Chang, 2002, pp. 4-5). In turn, Alexander Hamilton is known to have drawn inspirations from Walpole’s policies in inventing his infant industry argument, so much so that he was accused of being a ‘Walpolean’ by his opponents who did not like his belief in government intervention (Chang, 2002, p. 25). So, it is a convenient myth for the opponents of industrial policy that industrial policy is against the British tradition, but this is simply not true.

Now, even those who acknowledge the importance of the Walpolean tradition in propelling Britain to the position of the world’s leading industrial economy may,
rightly, point out that the tradition has been forgotten over the last two centuries, with a partial exception of the period between the 1940s and the 1960s, when the country tried – not very successfully – to establish a more systematic industrial policy, prompted by the successes of Germany and France, which then used such policy much more actively. How would you revive a tradition that has been dormant for most of the last 150 years? However, one should remember that old traditions can be, and have been, revived after long intervals. Indeed, France, a country that most British people think has been run on an unbroken policy tradition of active state intervention, was very non-interventionist between the fall of Napoleon in 1815 and the end of World War II in 1945 (and much less protectionist in the first half of the 19th century) (Kuisel, 1981; Chang, 2002). Its interventionist tradition was revived after a 130-year hiatus.

More generally, all the success cases of industrial policy are countries that have actively learnt from the more successful countries, despite the fact that the latter are very different from themselves, in terms of policy traditions, institutional set-ups, and culture. Just to cite some prominent examples from the countries we examined in this report: in the 18th and the early 19th century, the US and Germany learnt from Britain’s industrial policy; in the late 19th century Japan imported a lot of policies and institutions from Germany; in the 20th century, Korea and China have aggressively learnt from Japan. Indeed, the history of economic policy shows that the most successful countries are those that willingly admit their shortcomings and do their utmost to learn from other more successful countries.

Also, there is a curious asymmetry in the view of the British sceptics of learning lessons from other countries. While they are very keen to emphasise the difficulty of the UK learning lessons from countries with different institutions and history, they tend to be quite cavalier when it comes to other countries learning lessons from the UK’s policies and institutions, as seen especially in the constant lecturing by those people to their European neighbours that they should make their labour market more flexible or their financial markets more liberal, following the British examples (although these lectures have become less frequent and less strident after the 2008 crisis). They never explain why the British institutions and policies are easier to transplant than others, but the argument is, at best, based on the unwarranted (implicit) assumption that more market-oriented institutions are somehow more ‘natural’ and therefore more easily transplantable and, at worst, a blatant case of double standards.
Indeed, if anything, an active use of industrial policy has been much more widespread than the UK model of 'industrial policy by default'. As we mentioned above, the UK itself had used industrial policy actively in the past, and almost all the other successful economies have used active industrial policy to one degree or another at one point of time or another. While this does not mean that it will be easy to transplant some industrial policy measures from Finland or Brazil to the UK, it does mean that there cannot be any presumption that such transplantation would be impossible.

4.2. Specific Issues

4.2.1. Vision

One thing that comes out strongly through the review of industrial experiences in other countries is the importance of the national vision. If Hamilton’s vision that his country can one day become a powerful industrial nation, like Britain, lost out to Jefferson’s vision, harking back to the days of yeoman farmers, the US may have remained a richer version of Argentina today. Without Japan daring to dream that one day it will beat the Americans in the car industry (in 1955, the US produced 7 million cars, against 70,000 for Japan), we would have had no Toyota, and its luxury brand, Lexus. If Finland – a tiny nation of 3-4 million people with seven centuries of colonial history – did not aspire to compete in the most difficult industries with the best nations in the world, it would have maintained its specialisation in logging – not an easy thing to avoid, when you have one of the largest endowments of timber per capita in the world. Without China – once one of the poorest nations in the world – believing itself to be capable of becoming the next superpower (which may or may not come true), its industrial policy efforts would have been much less ambitious than what it has been and the result of it much more modest. And so on.

Economists are usually averse to talk in terms of ‘vision’ because it introduces an element of unpredictability and arbitrariness in what they see as a ‘science’. Indeed, the rationalist framework with which most economists work these days has become a critical hindrance to our understanding of the economic world, as it reduces all our decisions to a totally predictable (at least in probabilistic terms) response to structurally given incentives. However, the world is shaped by those people who
refuse to do the ‘rational’ things and who come up with an alternative vision that most other people think will fail. That is what the inventors of radical new technologies do. That is what entrepreneurship is really about. And that is what the successful industrial policy-makers have achieved.

In the last three decades, the UK has been dominated by a vision of its future that has turned out to be highly misleading. This vision has told people that the decline of the British manufacturing industry is nothing to worry about – or even something to celebrate – given that we have now entered a post-industrial society where manufacturing does not matter anymore. The vision has exaggerated the extent of and the potential for productivity growth in the financial industry by ignoring the extent of fraudulent and/or socially unproductive financial activities. This vision has constantly told people that industrial policy is not a reason why other countries may be doing better than the UK and that, even if that were the case, such policy cannot be used in the UK because it is fundamentally against the country’s tradition and values.

The events following the 2008 financial crisis have given a shock to the UK national complacency based on this faulty vision. Now there is a greater recognition in the UK establishment that the vision that it has held over the last three decades may have been mistaken and that there has to be an alternative long-term economic vision. However, old habits die hard and the old vision keeps re-asserting itself, not least because powerful financial interests back it up, so the UK has not been able to come up with a viable alternative vision for its future.

Without a new vision rejecting the comforting stories about the inevitability of the British industrial decline and the futility of industrial policy, the UK will never be able to come up with a viable economic strategy for the coming years, whatever the detailed measures of industrial policy it may want to adopt. We are glad to report that the Secretary of the Department of BIS himself was effectively stressing the same thing when he said in a private letter to the UK Prime Minister and Deputy Prime Minister that “sense however that there is still something important missing - a compelling vision of where the country is heading beyond sorting out the fiscal mess; and a clear and confident message about how we will earn our living in future [italics added]” (Cable, 2012).
4.2.2. Institutional settings

Our review shows that different countries have run industrial policies in very different institutional settings, which have differed not just across countries but also across time within the same country. The conclusion we draw from our case studies is that, while some institutional settings are more favourable for the success of industrial policy, it is not as if there is one particular institutional setting that a country must have in order to have a successful industrial policy. Two aspects may be highlighted.

First, our study reveals that a 'joined-up' government – with good communication between different departments and between different levels (national, regional, and municipal) and ideally with an effective coordinating agency (like the French Planning Commission, Japan's MITI, or Korea's EPB) – is certainly more conducive for successful industrial policy. This is not only because a lot of industrial policy is about coordinating interdependent activities but also because different things are done more effectively in different departments and at different levels of government, which inevitably leads to a coordination problem. In this regard, it is also helpful to be explicit about the existence of industrial policy, as pretending that it does not exist increases the chance of different departments failing to coordinate their activities or even undermining each other, as we have seen in the case of the US.

In this regard, the current institutional setting of the UK government is actually not against an effective industrial policy. The Department of Business, Innovation, and Skills (BIS) may not have the budgetary control that Korea's EPB had (which actually was a huge exception), but it has a remit that is much broader than what a typical 'ministry of trade and industry' has had in most countries, including many we have reviewed in this report. The BIS controls and works with agencies in a variety of issues, ranging from skills development to insolvency, from consumer protection to intellectual property rights, from international trade to land use, and from low-pay issues to space technology. If the activities between these agencies are well coordinated, it can actually be a very powerful vehicle for industrial policy.

The second institutional dimension of industrial policy that we wish to highlight concerns non-governmental institutions. Our study confirms the conclusion from earlier studies, mostly related to the Japanese and other East Asian experiences (Johnson, 1982; Dore, 1986; Wade, 1990; World Bank, 1993) that 'intermediate' institutions that promote communication and cooperation between the government
and the private sector increase the likelihood of industrial policy success. General employers’ associations, sectoral industry associations, ‘deliberation councils’ (especially in Japan and Korea), and trade unions (especially in Germany and Finland) have played important roles in this regard.

Our study actually permits us to go one step further and argue that industrial policy success is promoted by the existence of thick networks of public, semi-public, and private agencies, variously (depending on the country) made up of government agencies, large enterprises (both private-sector – national and foreign – enterprises and SOEs), key financial institutions (including regional, as opposed to national), alliances of SMEs, sectoral industry associations, trade unions (and other bodies representing worker interests), universities, research institutes, and so on.

Depending on how they are structured and interact with each other, these networks of institutions have played key roles in innovation in cutting-edge technologies (especially in the US, Finland, Brazil, and Korea), diffusion of technologies (especially in Singapore, Germany, Brazil, and China), skills formation (especially in Japan, Germany, and Singapore) and the development of world-class SMEs (especially in Italy, Japan, and Germany). Once again, there are no set formulas here, but the lesson is that the ‘industrial commons’ – created through the cooperation in the provision of inputs with public goods character and/or high fixed costs and through the cross-fertilisation of ideas – that these networks establish and nurture are vital in promoting technological innovations and quality improvements.

The UK may not be able to easily replicate these networks, given that they have been the results of a long evolutionary process, based on trial-and-error (with some degree of luck thrown in), but there are some of the above-mentioned institutions that may be established without fundamentally changing the country’s overall institutional structure and political economy. We discuss some of these in the issue-based sections below (e.g., institutions that may promote more ‘patient’ capital or help SME developments).

4.2.3. Finance and corporate governance

One thing that should be obvious from our review is how much of industrial policy is
not about money. There are many important industrial policy measures that are about the sharing of vision, coordination among interdependent activities, network-building among relevant actors, and encouraging selective cooperation among potentially competing agents, in which financial transfers play at best the role of sweeteners. This is good news in times of ‘austerity’.

However, many industrial policy measures are about money. When so many technologies are embodied in machines, there is no way a significant increase in productivity or a significant shift in production structure that can happen without major investments. Provision of adequate infrastructure and skills also costs money – sometimes vast sums, especially in countries like the UK that has neglected these things for substantial periods. A serious increase in R&D will require a lot of money, while even the schemes to help SMEs may require a non-negligible amount of money, if they are to have significant impacts. In countries with more successful industrial policy records, various ways have been found to finance and subsidise these necessary things through government intervention and public-private partnerships.

The UK government of course spends vast sums of money in funding or subsidising R&D and infrastructural development, but, compared to other countries, these spending are often less (in proportional terms) and less well targeted. The UK’s government-financed R&D spending as a percentage of GDP was 0.58% in 2010, lower than the average in the European Union-27 (0.68%), OECD (0.74%), and the US (0.92%), a vocal advocate against government intervention. Arising from weaker public investments, the UK’s average share of government GFCF in GDP was 1.8% between 2000 and 2010, lower than its OECD counterparts such as Korea (5.4%), Japan (3.8%), Finland (2.6%), the USA (2.5%) and Italy (2.3%) (OECD, 2012c).

Recently, the establishment of a national development bank in the UK, in the image of the likes of the German KfW or the Brazilian BNDES, has been discussed, but unfortunately the coalition government has settled for creating a small investment fund, rather than a real development bank. But, given the positive role that development banks have played – not just in Brazil and Germany but also in Japan and Korea, this option should be considered more seriously.

Financial regulation could also play an important role in industrial policy. Even if the UK does not want to go as far as countries like Japan and Korea in the old
days, or China today, and explicitly compel banks to lend to particular industries or projects (‘directed lending’) or to introduce regulation requiring that they lend more than a certain proportion of their money to productive enterprises, it could introduce other regulatory measures to simulate the effects. For example, it could discourage consumer loans and housing loans by increasing capital reserve requirements for them. This would, as well as dampening the housing bubble and reducing consumer debts, indirectly increase loans to productive enterprises. With two major banks (the RBS and the HBOS) in public ownership, such re-direction of lending does not even have to be based on a new regulation – it could be done simply through an internal directive of a corporation. The fact that the British government refuses to do even such a thing shows how beholden it is to the financial sector lobby – it is not even willing to exercise the ultimate shareholder prerogative, the supposed bedrock of Anglo-American capitalism, for fear of offending the financial sector.

More broadly speaking, the UK needs to find a way to make its financial market provide more ‘patient capital’ so that long-term-oriented industrial policy is in sync with enterprise management. Of course, this cannot be done in a way that was done in, say, Germany (where the co-determination system made hostile takeover virtually impossible) and Japan (where cross-shareholding made it very difficult). However, the point is to reduce the power of short-term shareholders, and we can certainly find some other measures that provide such service without fundamentally changing the architecture of the British financial system. Possible measures include, most mildly, the prevention of the publication of quarterly results (as recommended by the Kay report), tax reduction for dividends from longer-term shareholding, heavier taxes for capital gains made from shorter-term shareholding, and, most strongly, the introduction of greater voting rights for longer-term shareholders.

4.2.4. Innovation

Countries with successful industrial policy all show strong commitments to innovation and technological developments. Of the seven advanced countries reviewed in this report (that is, nine countries minus China and Brazil), only Italy had a lower R&D intensity (gross R&D spending as a percentage of GDP) than the UK in 2010 (1.26% vs. 1.80%).53 The UK’s figure was lower than that of Singapore (2.09%) and the OECD average (2.38%), while the other countries were more than 55% higher (Germany, 2.80%; the US, 2.83%; Japan, 3.26%). Notably, Korea (3.74%) and
Finland (3.90%) had more than double that of the UK.

Of particular concern is also how the UK’s R&D intensity has declined over the years. Among the 10 countries in our study, the UK is the only country that saw a fall in its R&D intensity between the periods 1991-1995 (1.98%) and 2006-2010 (1.79%) (Table A.2 in the appendix). Improvements for the other countries ranged from 0.12%-points (Italy) to 1.54%-points (Finland) during the period.

The UK is certainly capable of doing much better than this, not least because it is one of the world leaders in scientific research (around 10% of world output). However, such research is poorly translated into industrial strength (it produces only around 1% of world patents). Between 2004 and 2011, the number of patents in force in the UK fell by 6% (from 473,904 to 445,380) (WIPO, 2012). By contrast, the number of patents rose in the US (by 29%, 1.63 million to 2.11 million), Japan (by 40%, 1.10 million to 1.54 million) and Korea (by 105%, 331,437 to 678,005) over the same period. Korea, which lagged behind the UK less than a decade ago, now has 1.5 times the number of UK patents. Some believe that the solution to this problem is to introduce the US-style system, where maximum incentive is created for academics to establish profit-making firms based on their research, but other countries – Japan, Finland, Korea, and Singapore – have promoted their technological developments mainly through other means. Alternative arrangements need to be explored (see O’Sullivan, 2011; Wessner & Wolff, 2012), while current efforts like the catapult centres as well as the attempts to overcome the so-called ‘valley of death’ and the scaling-up challenges should be strongly supported (House of Commons, 2013).

The UK government also needs to reassert its role in boosting innovation. The UK’s poor performance in total R&D expenditure is to an important degree due to its weak support for public R&D spending. In the OECD, the UK had the second lowest publicly-funded R&D (as a percentage of GDP) at 0.59% in 2010, marginally ahead of Italy (0.55%) – a result that is reflected in its relatively low and declining R&D intensity (Table A.2 in the appendix). Even the US government, the supposed champion of free markets, spent significantly more on public R&D. Its publicly-funded R&D intensity was 1.01% in 2010.
4.2.5. Managing TNCs

As it should have been clear throughout our report, one important – and increasingly important – issue in industrial policy is how to maximise the benefits from the presence of TNCs, while minimising their costs.

In the UK context, the most contentious issue regarding TNCs has been tax avoidance through transfer pricing, especially through the overcharging of brand licenses, technology fees, and certain inputs. While this has significant fiscal implications, especially in the short run, it is less important for the long-term health of the economy, for which what the TNCs do in terms of technology transfer, training, and local sourcing matter far more than the tax revenue they generate.

Until recently, countries, including many of the ones reviewed in this report (especially Japan, Finland, Korea, and China), have put explicit conditions on technology transfer, local sourcing, and ownership restrictions (including joint venture requirements). These days, some of these – such as local contents requirements and foreign exchange balancing requirements (where the subsidiary of a TNC is required to export at least as much as it imports) – are banned through the TRIMs (Trade-related Investment Measures) agreement of the WTO. However, there are other measures that are not, such as those imposing conditions regarding joint venture requirement, the hiring of local labour, technology transfer, and the conduct of R&D in the host country. Governments can also provide targeted subsidies, directed credits, and tailor-made infrastructure for TNCs, provided that these do not violate the MFN (most-favoured nation) provision (Thrasher & Gallagher, 2008, cited in Chang, 2011).

Moreover, even explicitly banned performance conditions for TNCs have always been used informally, based upon negotiations with the TNC concerned, including by the UK government in the 1980s and the 1990s. However, if these informal requirements are to be effective, the government needs to know what it wants to achieve through them, so the establishment of a clear vision is going to be helpful in this respect too. Moreover, the UK, now increasingly dependent on attracting and retaining TNCs in manufacturing industries, should learn from the more active use of ‘carrots’ by the Singapore government, often tailor-made for the needs of the particular TNCs that it wants to attract.
4.2.6. SMEs

Different countries reviewed in our report have helped SMEs in different ways, and with different degrees of successes, but some of the measures used may be applicable to the UK. Realistically speaking, it will be very difficult for the UK to replicate the thick institutional tissues supporting the SMEs in Germany or Italy – made up of industry associations, local banks, universities, specialised training institutes, and so on – but it can do at least some certain things to improve its support for SMEs.

First of all, it should be able to at least increase financing for SMEs. Once again, given the country’s existing financial structure and political economy, it may be very difficult for the UK to set up a specialised bank for SMEs, whether explicitly (as in Korea) or implicitly (as in the case of regional banks in Germany or Italy), but the UK government can still increase credit availability for SMEs by imposing some conditions on the lending by the state-owned banks or in relation to the ‘funding for lending’ scheme in such a way that financing for SMEs is increased.

Second, it would be possible for the UK to replicate some of the institutions that help SMEs in countries like Germany and Italy. Organisation of similar SMEs into cooperative arrangements for high fixed-cost activities – like export marketing, R&D, and the purchase of technical or management consultancy services – may be encouraged. The UK government may help this by providing subsidies or tax reductions for these arrangements or providing some subsidies towards bringing in Italian or German experts to advise on the issue. It may also provide some of these inputs itself, by setting up agencies providing ‘extension services’ for SMEs.

4.2.7. Skills and training

Our study shows that more skills, higher-level skills and different kinds of skills need to be developed, if the UK wants to be able to enhance its industrial competitiveness, that is, expanding and scaling-up its manufacturing base and developing industrial activities with higher value-added and higher wages. The UK government cannot ignore the existence of skills gaps and mismatches, which are hindering the country’s firms’ capacities for transforming and translating research outputs into industrial
activities at the shopfloor level. Skills cannot be built in a day: their development requires long-term investments in learning processes and institution building, as the development of the German integrated vocational training system has shown. Moreover, today’s skills supply not only has to match today’s skills demands but should also anticipate tomorrow’s skills demands, as the Singaporean and Korean success stories have shown.

Future transformations of the industrial landscape in a given country are not only the results of quantitative expansions of existing activities but continuous introduction of new activities and qualitative changes in existing activities. This means that existing companies’ perceptions of future skill needs may not necessarily be accurate. A way to prepare the country for both these quantitative (more skills) and qualitative (different and higher skills) transformations is to develop what we call skill profile benchmarks, based on the knowledge of industry-specific skill profiles, which are stylised representations of the kinds of skills that the generic firm in a specific industry has to be equipped with in order to perform certain productive activities (Andreoni, 2013e). Skill profile benchmarks complement the assessment of current industrial skills gaps and mismatches by suggesting the specific kind of industrial skills required by countries which want to prepare their future manufacturing landscape.55

5. Looking Ahead

Policies for the future depend on key decisions that are made today. The continued loss of manufacturing capabilities in the UK disadvantages the economy over the long-term because the manufacturing sector boosts technologically-driven productivity growth and has strong interdependencies with other high-value sectors, especially high-value-added services, in the economy. Although exactly what would be high-value industries in 20, not to speak of 50, years’ time is difficult to predict, what is certain is that the UK’s potential to tap into the most profitable supply chains of the future and capture value will largely depend on the industrial capabilities that it builds and retains today.

Despite what the opponents of industrial policy may have us believe, industrial policy has always been around, even though some countries have given it another name, like the US has done throughout its history, and even though others have had it
without realizing and thus failing to properly organise it, like the UK has done in the last three decades. However much it thinks it is avoiding ‘bad’ kind of industrial policy by avoiding targeting, the UK government is still targeting its policies at different types of activities. Given this, it is better to accept that targeted industrial policy is necessary and try to get the targeting right, rather than pretending that there is no targeting and making a mess of the policy.

And industrial policy is here to stay. Countries like China and Brazil are going to step up their industrial policies, as they try to break into the premier league of world industry. Whatever the big rhetoric at the central government is, a lot of industrial policy is going to chug along in countries like Germany and Italy, as their industrial policies are deeply rooted in local structures. The US will keep at its industrial policy through federal R&D funding, and perhaps keep denying that it has any industrial policy. Singapore may continue its emphasis on free trade, but it will keep targeting strategic industries and setting explicit goals, in order to maintain its manufacturing base. Countries like Japan and Korea, having toned down their industrial policies since the 1990s for various good and bad reasons, are now trying to revive at least some of their industrial policy measures, especially in high-technology industries. Finland has successfully restructured its industrial policy by putting great emphasis on funding innovation and will press on with that strategy. Most of the countries we have reviewed in this report are also very keen to take pole positions in the ‘green’ technologies and are introducing a lot of industrial policy measures to promote them.

By constantly being in denial about the need for better industrial policy, the UK is going to fall further and further behind in manufacturing industries. The once-comforting thought that this does not really matter because the City will step into the breach is looking increasingly unrealistic. Unless something is done to reverse the manufacturing decline of the country – and industrial policy will be an integral part of that something – the UK risks falling behind.

Notes

1. This is a more refined version of the definition provided in Chang (1994a, ch. 3, pp. 60-1), which defines industrial policy as a policy aimed to affect particular industries (and firms as their components) to achieve the outcomes which are perceived by the state to be efficient for the economy as a whole.

3. Karl Aiginger, a key author of the European Commission’s industrial policy, acknowledges that, while the Commission has maintained “the primarily horizontal approach [in which] measures are general and provide for a favourable competitive environment (that is, they are not industry-specific, selective, or conducive to the deceleration of structural change)”, it increasingly acknowledges that “the effects of broad horizontal policies can vary significantly from industry to industry, that competitiveness needs specific policy mixes for specific sectors, and that some sectors may require complementary measures that are not necessary or relevant in other sectors” (Aiginger & Sieber, 2006, p. 579).

4. Production capabilities are those capabilities specifically needed for firms to perform different production tasks as well as to adapt and undertake in-house improvements across different technological and organisational functions.

5. An interesting consideration in the context of poor developing countries is that they can be locked up in what Pritchett et al. (2012) calls ‘capability trap’. This refers to a situation in which a developing country government develops only a narrow set of standard capabilities that are necessary for the continuous attraction of foreign aid, which in the long run undermine its ability to develop policies that are genuinely necessary for the country. OECD (2013) also discusses this issue.

6. So, for example, Japan and Korea succeeded in their industrial upgrading efforts because they started developing difficult industries well before they looked ‘realistic’ – the automobile industry for Japan in the 1950s or the steel industry for Korea in the 1960s – by using the export earnings from industries like textiles, cheap garments, and electronics, which conformed to their comparative advantage at the time.

7. Rodrik (2008) stresses that ‘[t]he conceptual difficulties involved in statistical inference in this area are so great that it is hard to see how statistical evidence could ever yield a convincing verdict’ (p. v).
8. More specifically in relation to randomized controlled trials (RCTs), they can be useful techniques for evaluating policies that are implemented at the local level because they have fewer problems with selection bias than observational methods do. However, they tend to be less effective when we want to evaluate policies, like industrial policy, whose aim is to generate spillovers and long term impacts. Even when RCTs have strong “internal validity,” meaning that they are very likely to have identified the effect of treatment among the participants (e.g. certain firms receiving a research grant), they are less likely than observational methods to have “external validity”, meaning that the causal effect found among the participants may not apply to other groups (Rodrik, 2008). Also, because most randomized controlled trial studies cannot measure the outcomes very frequently, the evaluators may miss the true causal effect if the policy has a nonlinear effect, as it is often the case (Woolcock, 2009).

9. The 16 countries are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, the Netherlands, Norway, Sweden, Switzerland, the UK, and the USA.

10. Even some measures that are frequently thought to be Japanese inventions are, when we go back in history, not so – for example, export promotion through tariff rebate on inputs used for exported goods, which many believe to be a postwar Japanese invention, is a measure that was actively used by the UK in the 18th century, especially by the government of Robert Walpole (see Chang, 2002, on the history of development policy in today’s rich countries).

11. The 12 countries are Austria, Belgium, Denmark, Finland, France, Germany, Italy, the Netherlands, Norway, Sweden, Switzerland, and the UK.

12. In the last two decades, the Japanese economy has not done as well as the four decades preceding it. However, its economic performance, especially in the 2000s, has not been as bad as people often think. First of all, despite two decades of lacklustre growth, at 4-5%, its rate of unemployment has remained one of the lowest in the OECD. In terms of growth, during the 1990s, at 1.0%, Japan was the second most slowly-growing economy (in per capita terms) in the OECD (the slowest was Switzerland at 0%). In the 2000s, however, its performance was basically median among the 16 core OECD countries (see footnote 2 above for the list). Its annual per capita GDP growth rate, at 0.9%,
was higher than that of Italy (-0.3%), Denmark (0.5%), and France (0.6%) and basically the same as those of the US, the UK, Canada, Belgium, and Norway (all 1.0%) and only marginally lower than those of Germany and Switzerland (both 1.1%). During this period, Australia and Finland did best at 1.8%, followed by Sweden (1.6%), Austria (1.4%), and the Netherlands (1.2%).

13. Over the 1990s, only 37 of the 235 implemented programmes were administered by the central government.

14. It is reported that, between 1991 and 2004, 'the percentage of closure of enterprises was systematically higher than the percentage of new business launches' (Buigues & Sekkat, 2009, p.188).

15. In the 1960s, additional shares of some state-owned companies (Volkswagen, VEBA, etc.) were issued at sub-par value so that they could be bought by people with limited incomes for a preferential price. These shares were called people’s shares (Volksaktien). This procedure enabled some 4.5 million Germans to become shareholders with a total amount of roughly 500 million Euro. Later on, this complicated procedure (because of the necessity of reviewing the income situation of purchasers) was changed (Fasbender, 2004).

16. Today KfM is still owned by the Federation (80%) and the Lander (20%).

17. The measures aimed at introducing higher degrees of flexibility in the labour market and reducing unemployment rates were also at the core of Schroder’s Agenda 2010.

18. The German government’s statistics include financial subsidies, interest free-grants, subsidies for R&D and (increasingly) tax reliefs as public industry support. However, aids to SOEs or semi-public institutions as well as funds for basic research and institutes such as Fraunhofer, Max Planck, Leibnitz and Helmholtz are not included (Buigues & Sekkat, 2009).

19. The emphasis and destination of resources to high tech and innovation is also detailed in the recent Government Report on 'The High Tech Strategy for
Germany’ 2010.

20. The share of federal government in total R&D spending in the US was 53.6% in 1953, 56.8% in 1955, 64.6% in 1960, 64.9% in 1965, 57.1% in 1970, 51.7% in 1975, 47.2% in 1980, 47.9% in 1985, and 47.3% in 1989 (estimated). See Mowery & Rosenberg, 1993, p. 41, table 2.3.

21. The positive and significant impact of the ATP projects on multi-use innovation, infrastructural technologies and inter-industry licensing is assessed in Nail and Brown (2006).

22. Semiconductors were first developed through US defense research funding. When the two main firms – Fairchild and Texas Instruments – subsequently got locked in costly patent suits, the US Department of Defense intervened to resolve the situation by imposing a patent pool between the two companies (Perelman, 2003, p. 56). The US government gave the industry a further boost by setting up SEMATECH, a joint venture of 12 firms with ARPA funding, in 1987 set up as a means to fight off the Japanese technological challenge (see Block, 2008, on SEMATECH).

23. Compared to Japan, Korea had a shorter history of capitalism, having been forced to open up to the outside world only in 1876, as opposed to 1853, in the case of Japan. Also, during the colonial rule by Japan (1910-45), growth of Korean capitalists was discouraged, if not made impossible. The political and social turmoils that followed the end of the colonial rule and the Korean War (1950-53) also resulted in a lot of churning in the enterprise hierarchy. On top of that, the government of General Park Chung Hee, which came to power in a coup d’etat in 1961, nationalised all banks in 1961 (see Amsden, 1989, for historical backgrounds to Korean industrialisation).

24. For example, until the early 1990s, the government de facto decided who are going to become the top managers of the banks.

25. When the Korean government decided in 1968 to apply to build its first modern steel mill, the World Bank advised a group of donor countries to decline the
application on the grounds that the project was not viable. This was not an unreasonable advice, given the circumstances. The country's biggest export items at the time were fish, cheap apparels, wigs, and plywood. The country did not even possess deposits of the key raw materials of iron ore and coking coal. At the time, it could not even import them from nearby China because of the Cold War, so they had to be imported from Australia and Canada. And, to cap it all, the Korean government proposed to run this as an SOE. A perfect recipe for disaster from the mainstream view, but the company became the most efficient steel-producer in the world within 10 years of establishment and is now the second largest steel producer in the world. For further details on POSCO, see Amsden (1989) and Chang (2010, ch. 12).

26. This change has been reversed by the in-coming government (as of 2013), which is one clear signal that it takes industrial policy more seriously than recent governments.

27. The land area of Singapore was 582km² when it gained independence in 1965, one-third the size of London (1,570km²) and half the size of New York City (1,213km²).

28. Between 1970 and 2010, the sum of total trade (exports and imports) as a percentage of GDP, a measure of an economy's openness, averaged 345%, significantly higher than the US (20.8%), Japan (22.7%), Germany (53.8%) and Korea (66.6%) (World Bank, 2012).

29. Interestingly, even in Hong Kong, the only laissez-faire country in East Asia, all land is publicly-owned. This shows the particular importance that housing has in city-states.

30. In 2001, GLCs were estimated to account for 12.9% of Singapore’s GDP in 1998, with the non-GLC public sector accounting for another 8.9% (SDOS, 2001).

31. The majority of land in Singapore is publicly owned, with the government empowered to acquire the rest.
32. For the list of the 16 countries, see the Japan section.

33. Despite the massive external shock that it received following the collapse of the Soviet Union, which accounted for over one-third of its international trade, Finland ranked at a very respectable joint-5th among the 16 countries in terms of per capita income growth during the 1990s. According to the World Bank data, its annual per capita income growth rate during 1990-99 was 2.1% (equal to the Netherlands), exceeded only by Norway (3.2%), Australia (2.6%), and Denmark and the USA (2.4%).

34. Public investments were primarily to strengthen the industrial base and encourage private capital accumulation (Kosonen, 1992).

35. Following the Second World War, the Finnish government made a strategic decision not to lower the tax rate to pre-war levels.

36. Industrial value-added includes the value-added from both manufacturing activities and the processing of raw materials. In Norway, another Nordiac country that established SOEs in basic industrial sectors, SOEs contributed only 10% of industry value-added in the early 1980s (Kosonen, 1992).

37. From the 12th century until 1809, Finland was part of Sweden; thereafter, it existed as an autonomous Grand Duchy within the Russian empire until 1917.

38. Nonetheless, although the foreign ownership ceiling of companies was raised to 40% in 1987, this was still subject to the consent of the Ministry of Trade and Industry (Bellak & Luostarinen, 1994, p. 17).

39. Accelerated depreciation allowances benefited holders of existing capital while investment allowances encouraged firms to invest in new capital.

40. With the centre-left government in power in 1963, which attempted an overall redesign of the national industrial plan (the so called piano straordinario) and the reform of the Cassa in 1965, investments in manufacturing development reached
half of total IRI's investments.

41. The number employed in manufacturing SOEs went from 185,000 in 1953 to 451,500 in 1974 (Federico & Giannetti, 1999).

42. Written archives of industrial planning in China generally date back to Sun Yat-sen's (1922) Shiye Jihua (Industrial Plan), which emphasised the state’s key role in creating “socialism” and developing basic heavy industries (Kirby, 1990).

43. Chang (2011) provides a detailed list of industrial policy measures in East Asia.

44. Marukawa (2011) provides examples on how companies in the automobile industry benefited from state credit. For example, Chery expanded into overseas markets with financial support from the China Exim Bank while Geely borrowed funds from local governments to finance the acquisition of Volvo Cars in 2010.

45. Chapter IV, Article 34 of the 1995 Law of the People’s Republic of China on Commercial Banks highlights that “A commercial bank shall conduct its loan business in accordance with the need for the development of the national economy and social progress and under the guidance of the state industrial policy”.

46. Foreign investments are classified into four categories in different industries: (i) encouraged, (ii) permitted, (iii) restricted, and (iv) prohibited.

47. In the early 1950s, the coastal area contributed 70% of China’s industrial output, despite making up less than 20% of total land area (Zhang & Long, 1997).

48. Between 1993 and 2003, the average annual FDI inflows as a percentage of GDP was significantly higher in eastern coastal regions such as Guangdong (13%) and Fujian (11%) compared to the national average (4%) (Poncet, 2010, p. 115).

49. China’s policy stance on industry consolidation was reaffirmed by its Ministry of Industry and Information Technology (MIIT)’s Guidance on Corporate Mergers
and Acquisitions to Accelerate the Growth of Key Industries in January 2013, which highlighted its aim to grow global champions in the automotive, iron and steel, cement, shipbuilding, aluminium, rare earth metals, electronics and pharmaceutical industries (MIIT, 2013).

50. While explicit technology transfer conditions are curtailed under China’s WTO obligations, implicit measures are not forbidden. In China’s 2011 Catalogue for the Guidance of Foreign Invested Industries, ownership restrictions are listed in most manufacturing industries.

51. Ssangyong, acquired by SAIC in 2004, was sold on to Mahindra Motors of India in 2011.

52. Among our chosen countries within the OECD, only Germany had a lower share of government GFCF in GDP (1.6%) between 2000 and 2010, compared to the UK.

53. The UK’s R&D intensity is also higher than China (1.76%) and Brazil (1.13% in 2008) but this is cold comfort as the two countries are at a different stage of development.

54. A large body of research indicates that public R&D spending does not crowd out private R&D spending, but rather, has a complementary effect across a diverse range of countries: Finland (Czarnitzki et al., 2007), Germany (Aerts & Schmidt, 2008; Hussinger, 2008), Japan (Koga, 2005) the United States (Feldman & Kelley, 2006) and the OECD (Guellec & Van Pottelsberghe, 2003; Falk, 2006).

55. Of course, defining specific skill profile benchmarks for each industry should not make us forget that the same production process can actually be performed by different combinations of production capabilities. Nor should we be tempted to ignore the fact that these skills have to be complemented by appropriate investments in the expansion of firms’ production capacity.
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Appendix

Table A.1: Manufacturing Indicators for the 10 Countries in the Study, 2010

<table>
<thead>
<tr>
<th>Country</th>
<th>MVA per capita</th>
<th>MVA as % of GDP</th>
<th>MHT as % of total MVA</th>
<th>MVA as % of World MVA</th>
<th>MX per capita</th>
<th>MX as % of total exports</th>
<th>MHT as % of total MX</th>
<th>MX as % of WMT</th>
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</table>


<table>
<thead>
<tr>
<th>Country</th>
<th>MVA per capita</th>
<th>MX per capita</th>
<th>MHT MVA as % of total MVA</th>
<th>MVA as % of GDP</th>
<th>MHT MX as % of total MX</th>
<th>MX as % of total exports</th>
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<td>86.8</td>
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<td>39.3</td>
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</table>

Data source: UNIDO (2013)

Notes: Manufacturing Value Added (MVA) and GDP are in constant 2000 US dollars. MHT, MX and WMT refer to medium and high-technology, manufacturing exports and world manufacturing trade respectively.

Table A.2: Manufacturing Indicators for Top 60 Manufacturing Nations by MVA per capita, 2010
<table>
<thead>
<tr>
<th>Country</th>
<th>MVA per capita</th>
<th>MX per capita</th>
<th>MHT MVA as % of total MVA</th>
<th>MVA as % of GDP</th>
<th>MHT MX as % of total MX</th>
<th>MX as % of total exports</th>
<th>MX as % of WMT</th>
<th>MVA as % of World MVA</th>
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Table A.2 cont.: Manufacturing Indicators for Top 60 Manufacturing Nations by MVA per capita, 2010
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<th>Country</th>
<th>MVA per capita</th>
<th>MX per capita</th>
<th>MHT MVA as % of total MVA</th>
<th>MVA as % of GDP</th>
<th>MHT MX as % of total MX</th>
<th>MX as % of total exports</th>
<th>MX as % of WMT</th>
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Data source: UNIDO (2013)

Notes: Countries whose names are in italics are the ones included in this report. Manufacturing Value Added (MVA) and GDP are in constant 2000 US dollars. MHT, MX and WMT refer to medium and high-technology, manufacturing exports and world manufacturing trade respectively.
Table A.3: Gross R&D expenditure as a percentage of GDP (%) (average)

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Source: Authors’ calculations based on OECD (2012a)


Table A.4: Gross Fixed Capital Formation (GFCF) as a percentage of GDP (%) (average)

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Source: Authors’ calculations based on World Bank (2012), OECD (2012c), SDOS (2012)

Notes: 1/ The public-private GFCF breakdown was unavailable in the countries for some periods: Brazil (1995-2007), China (1991-1994), Germany (1991-1994), and Japan (1991-2000); 2/ Percentages for private GFCF and public GFCF may not sum to total GFCF because their averages use a shorter time period due to data limitations.
Industrial Policy for the Medium to Long-term

by

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University of Warwick

&

Alan Hughes,
University of Cambridge

December 2013

***
1. Introduction

This paper is concerned with industrial policy. It is not concerned with an assessment of current policy. It seeks instead to set out the key principles which should guide policy development for the medium to long term. We set out the different ways in which industrial policy may be defined and the case for governments adopting an industrial policy. We emphasise the policy challenges which arise in a world of rapidly developing and potentially transformative new technologies and innovation opportunities. We advocate an approach which adopts a holistic systems perspective. This approach encompasses policies addressing both market and wider system failures and spans the domains of science policy, technology policy and innovation policy as integral to a modern industrial policy.

The proposed approach emphasises both sector and technology specific policy domains. It emphasises the particular challenges which arise in designing and implementing policy in the specific context of the UK economic system with its particular institutional architecture governing product, labour and in particular capital markets.

2. What is Industrial Policy?

There currently exists a wide variety of definitions of industrial policy. In their review of industrial policy in Europe, Foreman-Peck and Federico (1999) adopt a very broad perspective. They define industrial policy as “every form of state intervention that affects industry as a distinct part of the economy” (Foreman-Peck and Federico, 1999, p3). A more focused approach, but still broad in its implications, emphasises the structural aspects of industrial policy and the relationship between it and the strategic objectives of national governments. Industrial policy is thus a set of “structural policies designed to strengthen the efficiency, scale and international competitiveness of domestic industrial sectors, typically contains an element of national champions, of self-reliance in bringing about growth and development’ (Soete, 2007, p273). Similarly, Chang (1994) identifies industrial policy as being “aimed at particular industries (and firms as their components) to achieve the outcomes that are perceived by the state to be efficient for the economy as a whole” (Chang, 1994, p66).
A helpful and broad recent definition is the following:

"Industrial policy is any type of intervention or government policy that attempts to improve the business environment or to alter the structure of economic activity towards sectors, technologies or tasks that are expected to offer better prospects for economic growth or societal welfare than would occur in the absence of any such intervention ..."

(Warwick, 2013, pp. 16-17).

Within industrial policy it has been conventional to distinguish between ‘horizontal’ and ‘selective’ industrial policies. The latter are aimed specifically at improving the performance of particular industries or firms while the former are designed to benefit the economy more generally. However, the distinction is not always clear-cut. For example, since sectors differ in their research intensity or their reliance on transport infrastructure, ‘horizontal’ policies to encourage R&D or to improve the road network will help some more than others. All definitions of industrial policy have at their core a concern with economic growth, and especially productivity growth. Productivity performance is also central to ‘national competitiveness’ which might be understood in terms of achieving economic growth and successful participation in international trade. Since manufacturing is more internationally tradable and has achieved higher rates of productivity growth than services, industrial policy has often focused on support for this sector. The increased vertical spread of business models that bundle for example manufacturing activities and service provision means that this focus will need to broaden in the years ahead to vertically related value chains.

Long-run productivity performance depends upon decisions to invest, innovate, and adopt new technology, which in a market economy will be sensitive to incentive structures. This means that a wide range of government actions which comprise ‘industrial policy’ can potentially have an impact on productivity growth. It also means that science, innovation and technology policy should be seen as closely related to or an integral part of industrial policy. In the context of designing a medium to long term industrial policy for manufacturing it is important to emphasise the way in which technical change and innovation are integrated into policy development. Policy must be sufficiently reflexive to respond to unexpected or rapid changes in technical and scientific advance affecting the location, structure, scale and nature of the manufacturing sector and its links with the wider economy.
3. What is the rationale for Industrial policy?

The classic justification for industrial policy in mainstream economics is that it remedies market failures, for example, by providing public goods, solving coordination problems, or subsidizing activities with positive externalities. For example, there is good reason to believe that the social rate of return considerably exceeds the private rate of return to R&D and leaving it to the market will mean too little R&D. It is quite straightforward to see how arguments of this kind might, in principle, be used in favour of ‘horizontal’ industrial policies.

The case for selective industrial policies has always been more controversial. However, the modern mainstream economics literature highlights three arguments in their favour, namely: infant-industry related capital market failures, agglomeration externalities, and rent-switching under imperfect competition. At the same time, a number of pitfalls in the use of such policies have been noted in this literature.

The ‘infant-industry’ case is for temporary protection of industries which are not currently internationally competitive but will be when productivity has improved through increasing returns and, in particular, learning by doing. The case for intervention really depends on the capital market’s inability to finance these activities even though they will become privately profitable, perhaps because the learning effects accrue to the industry as a whole rather than being firm-specific. A key issue is whether the government can credibly commit to the policy intervention being temporary.

The advent of the new economic geography has increased awareness of the potential importance of agglomeration benefits which accrue when economic activity is characterized by external economies of scale. As city size increases, productivity gains can be realized through knowledge spillovers, better availability of intermediate inputs and the advantages of a thicker labour pool. Policy interventions may then be justified on the grounds of spatial externalities\(^1\). In cases where size matters, there may be gains from policy interventions that facilitate the expansion of an agglomeration or, indeed, the establishment of a successful cluster which obtains first-mover advantages.
The rent-switching argument came to prominence through the work of Brander and Spencer (1985). The argument here is that in cases of strategic rivalry in international trade, the state can influence entry and exit decisions by offering subsidies that result in higher market share for its firm at the expense of a foreign rival and redistribute super-normal profits accordingly. Because government values objectives other than private profits it may be able credibly to commit to finance entry where capital markets cannot. Whether such interventions will succeed may be hard to predict, and where their size and/or timing turn out to be inappropriate they may be expensive failures. However, Airbus appears to have been a successful example of a rent-switching industrial policy; Neven and Seabright (1995) estimated that Airbus was likely to produce an acceptable rate of return for Europe over fifty years while at the same time reducing Boeing’s profits significantly and slightly cutting world-wide aircraft prices. That said, Airbus would not be easy to repeat – and was possibly illegal under WTO rules.

An example of an attempt to summarise the wide range of policy instruments based on these and related arguments is shown in Exhibit 1, derived from Warwick (2013)

Exhibit 1 - Examples of Industrial Policy Instruments

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<td>Employment Taxes</td>
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Exhibit 1 is wide-ranging and includes a number of instruments that relate to problems facing UK manufacturing. For example, concerns about the absorptive capacity of firms with regard to taking advantage of technological opportunities might be addressed by policies to improve R&D capabilities; technology funding might be focused on helping businesses through the ‘valley of death’; capital market policies might target the need for more ‘patient capital’; instruments under the land category would be relevant to facilitating agglomeration and co-location of activities and to the shortfall in transport infrastructure; skills policies relating to the quality of education and the content of syllabi may need to be designed to address future labour force requirements in manufacturing and its value chains etc.


Current thinking and policy possibilities go beyond traditional market-failure arguments to embrace notions of ‘systems failure’, especially with regard to innovation and technical change. A systems approach focuses on coordination problems in the context of promoting the development, awareness and exploitation of new technological opportunities. The old approach to selective industrial policy identified sectors or firms to support but this new approach is based on selecting new
ideas as they emerge from the science base or working back from sectoral problem-solving and technical challenges to the science base. Whereas the old vocabulary was about ‘picking winners’, the new terminology is that of ‘choosing races and placing bets’ (Hughes, 2012).

There are certain core elements of a systems approach, typically three are identified (Edquist, 2005). The first consists of the agents operating within the particular system domain (e.g. country, region, or sector). This includes not only private sector consumers and businesses, but also the public sector in its various manifestations and the third (or charitable) not-for-profit sector. Private sector firms in the system identify commercially attractive opportunities and devise business models to exploit them. In doing this they must invest human and financial capital and a wide range of intangible assets including R&D, design and ICT. A firm’s investment in R&D both generates new knowledge and increases capacity to absorb ideas from external sources (Cohen and Levinthal, 1990). The second element is usually defined as “institutions” which are not to be understood as organisations or entities, but rather as the norms of conduct or rules of the game, including contractual legal and regulatory systems within which agents operate. The third element is usually defined in terms of the connections between agents. This will include, but is not restricted to, market connections. System connections include a wide variety of non-market relationships including collaborative and formal and informal interpersonal and inter-organisational networking connections. There may be significant variations across sectors, regions, technological trajectories and national systems in the strength, nature and variety of connections and their interplay with institutional differences (Lundvall, 2007).

The institutions and connections may be thought of as defining the “institutional architecture” within which the agents operate. This institutional architecture may then be used to characterise differences between national systems, their patterns of coordination and the way they impinge on the ability of private sector firms to identify and exploit business opportunities. This architecture will affect both the nature of systems failures and the feasibility and effectiveness of “traditional” policy measures applied in different systems (Dodgson et al, 2011; Edquist, 2005; Lundvall, 2007, Nelson, 1993). This is related to the concept of “varieties of capitalism” which has been used to suggest that the nature of investment will differ significantly between countries (Hall and Soskice, 2001) (see Exhibits 2-4). In relation to investment generally, and R&D in particular, it has been argued that the UK variety of liberal market capitalism inhibits long-term investment compared with more coordinated varieties exemplified by Germany and Japan (Dore, 2000). Impatient capital markets
driven by an over-concern with short-term movements in stock market prices, the threat of takeover, and arms-length relationships between the providers and users of finance, serves to promote short-termism in investment decisions (Haldane and Davies, 2011; Kay, 2012; Hughes, 2013). System architecture may also alter the nature of innovation by inhibiting incremental innovation. Impatient capital markets may be complementary to labour markets focused on hire and fire relationships which inhibit more stable labour contracts that foster investment in firm specific training and skills (Exhibit 2).

**Exhibit 2 - Varieties of Capitalism**

The highly influential ‘varieties of capitalism’ approach to the analysis of economic policy and performance was originally developed by Peter Hall and David Soskice (2001). The core of the approach is based on a comparison between 2 ideal types, the co-ordinated market economy (CME) and the liberal market economy (LME), which comprise different environments in which firms operate. In the real world, the purest cases of the CME and the LME are Germany and the United States, respectively. Each of these economies can be thought of as having a different set of complementary institutions and, as a corollary of this, different comparative advantages in production, trade, human capital formation, and innovation.

The relevant aspects of these ideal types with regard to firms concern corporate governance, education and training, interactions with other firms, and industrial relations. Exhibit 3 illustrates the institutional complementarities that Hall and Soskice (2001) highlight as key characteristics of, respectively, the German CME and the American LME. As these diagrams suggest, the idea is that the value of one institution is enhanced by the presence of the others.

It should also be noted that the policies appropriate to each type of economy differ; for example, well-designed competition policy is a much more important attribute for the LME. A further dimension not shown here but emphasized by Cusack et al. (2010) is that CMEs (LMEs) are found in countries whose elections are based on proportional representation (majoritarian system). Given the interlocking nature of these institutional configurations it might be that they tend to be persistent such that countries do not readily switch from LME to CME or vice versa.
Hall and Soskice (2001) argued that CMEs would be relatively strong at ‘incremental innovation’ marked by continuous, small-scale improvements to existing product lines and production processes while LMEs would be more successful at ‘radical innovation’ which entails substantial shifts in product lines, the development of new goods or major changes to the production process. In terms of international trade, LMEs would have revealed comparative advantage in high-tech sectors based on tertiary human capital and CMEs would specialize in sophisticated engineering products requiring the deployment of long-term patient capital and a highly-skilled cooperative labour force.

A further major implication of varieties of capitalism is that CMEs with proportional representation and centralized wage bargaining will sustain relatively large shares of the workforce and superior international competitiveness (lower relative unit labour costs) in exportable manufacturing i.e. will be less exposed to de-industrialization of employment (Iversen and Soskice, 2010). The argument is that institutional arrangements in these economies will deliver high levels of training combined with wage restraint.

Subsequent empirical work has tried both to test how far economies correspond to these ideal types and whether these predictions about comparative advantages are confirmed by the evidence. This is clearly work in progress but some empirical support has been found. Schneider and Paunescu (2012) find that there are several intermediate varieties of capitalism, but that there are some ‘pure’ CMEs and LMEs. These have institutional configurations that are perfect mirror images of each other. The LME is characterized by lower employment protection, shorter average employment tenure, lower collective bargaining coverage, less occupational training and more university training, more cross-border mergers and acquisitions and strategic alliances, and greater stock market capitalization than the CME. They also find that countries can and do move between varieties (Exhibit 4). However, the UK as an LME and Germany as a CME match these profiles in a stable way.

**Exhibit 3 - Coordinated and Liberal Market Economies: Complementarities across sub-systems in Germany and the USA**

<table>
<thead>
<tr>
<th>Complementarities across subsystems in the German coordinated market economy</th>
<th>Complementarities across subsystems in the American liberal market economy</th>
</tr>
</thead>
</table>
Note: LR = Long Run, rjvs = relationship-based joint ventures

Exhibit 4 - Varieties of Capitalism, 1990-2005

<table>
<thead>
<tr>
<th>Cluster</th>
<th>1990</th>
<th>1999</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>State-dominated economies</td>
<td>TURKEY</td>
<td>TURKEY</td>
<td>PORTUGAL</td>
</tr>
<tr>
<td>ITALY</td>
<td></td>
<td>PORTUGAL</td>
<td>GREECE</td>
</tr>
<tr>
<td>SPAIN</td>
<td></td>
<td>GREECE</td>
<td>TURKEY</td>
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<td>Belgium</td>
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<td>SPAIN</td>
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<tr>
<td>GREECE</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Coordinated Market Economies</td>
<td>Austria</td>
<td>Austria</td>
<td>Austria</td>
</tr>
<tr>
<td>Germany</td>
<td>Czech Republic</td>
<td>Belgium</td>
<td></td>
</tr>
<tr>
<td>Denmark</td>
<td>Italy</td>
<td>Germany</td>
<td></td>
</tr>
<tr>
<td>Finland</td>
<td>FRANCE</td>
<td>FRANCE</td>
<td></td>
</tr>
<tr>
<td>Sweden</td>
<td>Germany</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FRANCE</td>
<td></td>
<td>Belgium</td>
<td></td>
</tr>
<tr>
<td>Netherlands</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hybrid economies</td>
<td>Norway</td>
<td>South Korea</td>
<td>Poland</td>
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<td>--------------------------</td>
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<tr>
<td>Japan</td>
<td></td>
<td>Poland</td>
<td>ITALY</td>
</tr>
<tr>
<td>Hungary</td>
<td>Norway</td>
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<tr>
<td>Norway</td>
<td>Czech Republic</td>
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<td>Japan</td>
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<td>South Korea</td>
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<td></td>
<td></td>
<td>Japan</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Liberal Market-like economies</th>
<th>Australia</th>
<th>Denmark</th>
<th>Spain</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Zealand</td>
<td>Sweden</td>
<td>Finland</td>
<td></td>
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<tr>
<td>Rep. of Ireland</td>
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<tr>
<td>Switzerland</td>
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<table>
<thead>
<tr>
<th>Liberal Market Economies</th>
<th>Canada</th>
<th>Switzerland</th>
<th>Switzerland</th>
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</thead>
<tbody>
<tr>
<td>USA</td>
<td>Finland</td>
<td>Denmark</td>
<td></td>
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<tr>
<td>UK</td>
<td>Rep. of Ireland</td>
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<td></td>
<td>New Zealand</td>
<td>Canada</td>
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<td></td>
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<tr>
<td></td>
<td>USA</td>
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</tbody>
</table>

Notes:
**Bold:** Economies discussed as CMEs by Hall and Soskice;
**Italics:** Economies discussed as LMEs by Hall and Soskice
**CAPITALISED:** Economies discussed as Mediterranean by Hall and Soskice
Source: Derived from Schneider and Paunescu (2012) Table 1, p.10.
4.1 Varieties of Capitalism: Radical vs. Incremental innovation: An unhelpful distinction?

In the wider innovation literature radical innovations are most often defined in terms of fundamental shifts in the relationship of performance to price in the development of new industries, products or processes, and/or the pervasiveness of their effects across sectors. They are also linked to fundamental organisational changes within firms as well as between them. Radical innovations are, however, also frequently associated with subsequent long processes of incremental innovation within the firms and sectors where they occur. This makes simple binary classifications of sectors questionable (Fagerberg, 2005; Verspagen, 2005; Powell and Grodal, 2005; Sorescu et al., 2003; McDermott and O’Connor, 2002).

Salter and Alexy (2013) provide a useful overview of this area. They point out that where attempts have been made to measure the frequency of radical innovations, it appears that they may take decades to develop and are extremely infrequent, maybe occurring once in every three decades (Anderson and Tushman, 1990; Tushman and Anderson, 1986; McDermott and O’Connor, 2002). The implication is that in the average industry firms may operate and workers may work their entire lives without ever experiencing a radical innovation. Moreover, it appears that such innovations are best thought of as not specific to certain sectors and therefore not easily revealed in patterns of relative comparative advantage across sectors. Instead they are pervasive across many sectors i.e. they are what are known as general purpose technologies (Helpman, 1998).

It also appears to be the case that appropriating the value from radical innovations when they do occur depends critically upon the ability to implement and develop competitive strategies around substantial investment in incremental innovation. This has led to the emergence of a substantial literature on sectoral systems of innovation. This eschews simple twofold binary distinctions between sectors and their innovation systems. Instead it favours a more granular approach emphasising inter alia the interplay between technological opportunity and appropriability conditions (i.e. how value is captured by businesses). It also emphasises the way in which the nature of a sectoral system and the types of innovation it embodies can vary over time (Malerba, 2004 and 2005). Competition and competitive advantage shifts from ‘radical’ product innovation to ‘incremental’ product and process competition over a sector life cycle (Utterback, 1994). This has more to do with the maturity of a sector
than its ‘high-tech’ status. It is also apparent that innovation in general is increasingly influenced by the pursuit of open collaborative and networked models. Rather than emphasising a contrast between liberal markets and coordinated markets this suggests a cross national move towards more inter-firm collaboration arguments (Chesborough, 2003 and 2006). When more direct measures of innovation outputs rather than indirect measure such as patents are used, it appears that company level variables dominate, with few signs of country effects (see, for example, Tellis et al., 2009). Moreover as Aoki (2010) argues it appears increasingly that similar business ‘architectures’ are emerging in the world’s leading businesses which are global in character rather than defined by national boundaries. He provides an overview of relevant changes in Japan\(^2\). Finally, other organisational and networked based approaches have argued that the tight interconnections in coordinated economies such as Japan and Korea have been central in the past to their ability to outperform US firms in radical innovation rather than inhibit them (Aoki, 1988; Hager and Hollingsworth, 2000, Nonakka and Konno, 1998). Furthermore, an examination of detailed sector patterns of, for example, patenting (as we have shown above) reveal that even taking these patent proxies at face value, CME economies in many cases demonstrate comparative advantages in radical as opposed to incremental innovation (see, for example, the detailed discussion in Akkermans et al., 2009).

There is also abundant evidence to suggest that sectors which are classified as low-tech are also characterised by innovations of a transformative or radical kind (see, for example, the discussion in Von Tunzelmann and Acha, 2005). A particularly striking example here is the role of information technology in transforming business models and productivity in the United States in particular, as well as in other economies.

### 4.2 Varieties of Capitalism and Industrial Policy

A danger inherent in any analysis which characterises varieties of capitalism as consisting of a given set of structures observed at a point or period in time is that it can neglect the analysis of the way in which institutions evolve and change. As Hall and Gingerich (2009) point out, different varieties of capitalism can have embedded in them factors which will predispose systems to react to shocks in ways which are consistent with the established beliefs and practices of the firms and workers in those economies. Thus in response to an external shock a liberal market economy, it is hypothesised, will seek to pursue even more liberal market policies by more
deregulation. On the other hand, in coordinated market economies the reverse is posited to be true. In thinking about the next 30 years, the question is whether liberal market economies such as the UK will be better served by more of the same or by an attempt to alter structural characteristics which inhibit the future development of the economy.

This is precisely the area in which the debate about industrial policy is now being conducted. It should lead to a fundamental re-examination of the way in which intermediate coordinating organisations can be created in LME varieties of capitalism. Current industrial policy debates emphasise the need to develop strategies around the allocation of resources to strategic sectors. Insofar as those sectors and technologies involve the accretion and consolidation of wide ranges of knowledge and expertise then the development of institutions (e.g. catapult centres (TSB, 2011) which have the potential to assist in these connections, become a central part of industrial policy.

The great interest in such intermediate institutions in the UK (and the USA) at present indicates the extent to which this message is being absorbed into industrial policy debates. Economies characterised as liberal market economies and coordinated market economies each contain within them sectors which are characterised as experiencing both radical and incremental innovation. This means that a view will need to be taken on a much more granular basis of the particular factors likely to inhibit or encourage innovation in each sector. Basing policy on an aggregated view of how the economy looks on average, or on its inherited structure from the past is not helpful.

5. Market Failures and System Failures

The mainstream market failure arguments we have set out earlier provide important rationales for public sector intervention, but rarely provide sufficient guidance for the degree of intervention in particular instances or different systems; nor do they address the many other potential institutional and connection failures which may arise when a systems based approach is adopted. System failures can arise from various sources. Transition and lock-in problems, for example, arise from inertia due to substantial sunk investment by private and public sectors in existing or dominant
technologies. These are linked to transition failures in moving to new technological structures which pose major problems of investment and business reorganisation (e.g. in the switch to low carbon vehicles (HMG, 2008; King, 2008). Then there are institutional system failures arising from a lack of congruence between formal and informal rules and incentives affecting different parts of the organisation of the system. A particularly prominent case is the alleged difference in norms and incentives between academic scientists and the private sector in conducting research. Here it is argued that the former emphasise open publication and disclosure, whilst the private sector, in its pursuit of research connected to private exploitation, is committed to secrecy and patent protection. This has engendered a major debate in the UK over the extent to which the allocation of public funds should be directed according to the motivations and the incentives of the former as compared to the latter, the nature of UK university-industry links, and the design of intermediary organisations on the boundaries of universities and industry (Royal Society, 2011; Hughes, 2012; Hauser, 2010; Mina et al., 2009; Deiaco et al., 2012; Hughes and Kitson, 2012).

One of the most important implications arising from the development of more systemic views has been the emphasis placed upon the development of demand side as well as supply side policies in addressing lock in and transition problems and uncertainties. This is based around the potential role of the public sector as a procurer of R&D. More specifically, it emphasises the role of public procurement in influencing the scale, direction and form of the provision of the goods and services it purchases (Edquist et al., 2000; OECD, 2010a; Connell and Probert, 2010). Public procurement is then seen as a potentially important innovation policy device for reducing uncertainty in areas where lead user activities are important. Public procurement can also be seen as complementary to supply side measures linked to standard market failure arguments which, through taxation and subsidy, influence the relative prices at which businesses conduct their innovation related activities (OECD, 2010b).


An important aspect of productivity growth is the effective assimilation of new
technology across the system. This highlights the importance of industrial policies in terms of their impact on the speed of diffusion of innovations. As is widely recognized, policy can impact on lags in diffusion through provision of information and the improvement of market and non-market connections between firms and other agents. This includes information which as a public good may be subject to market failure. Beyond this, however, it is important also to think about the determinants of technology diffusion in terms of absorptive capacity of firms and the profitability of adoption, as is proposed by probit models (Geroski, 2000), both of which may be influenced by industrial policy.

Absorptive capacity entails the ability to search for, evaluate, assimilate, and exploit knowledge. This is underpinned by education and skills but also by investments in intangible capital including crucially R&D (Griffith et al., 2004) but also economic competences including training, flexibility in use of business models, effective cooperation with research organizations, and organizational capabilities etc (Harris and Moffat, 2013). This offers a wide range of possibilities for both horizontal and selective industrial policy potentially to make a difference by focusing on increasing firms' absorptive capacity. More generally, the adoption of a new technology depends on the net present value of investment. This can also be affected by the business environment, for example how costly and time-consuming it is to invest in a start-up firm, environmental regulations, tax rules etc.

Diffusion of new technologies may also be inhibited where system lock-ins occur due to the strength of major sunk investments supporting existing technologies e.g. electric v petrol driven automobiles. Here sector based selective industrial policies may include the use of demonstrator or pilot plants and public procurement.

Some of these points can be illustrated by a notable recent success for the UK, namely, the relatively rapid diffusion of ICT which illustrates the value of the probit model of diffusion as well as the importance of horizontal industrial policy. The contribution of investment in ICT to growth of labour productivity over 1995-2005 was about twice as large in the United States and the UK compared with France or Germany (Timmer et al., 2010). ICT diffusion has been influenced by the absorptive capacity of firms, in particular investments in intangibles such as organizational capital and the quality of the labour force, but also by the profitability of investment in ICT capital which has a bigger productivity payoff if it is accompanied by organizational change in working practices and is therefore encouraged by low
adjustment costs. Neither high employment protection nor product market regulation that inhibits the entry of new firms is conducive to a strong contribution of ICT to economic growth. The diffusion of ICT in the UK has been promoted by the relatively light-regulation environment and by the expansion of higher education (Conway, 2007). However, it is also important to recognize that management practices matter as well and in the case of IT appear to be a crucial part of absorptive capacity (Hughes and Scott Morton, 2006). In the UK context, Bloom et al. (2012) show that American-owned multinationals have used IT more effectively than either domestic firms or other multinationals. On a European-wide basis, these authors find that this same pattern emerges and that the key advantage of the American multinationals lies in people-management practices.

7. Innovation Systems, Institutional Architecture and the UK variety of Capitalism

The UK share of capital investment in output has been low relative to competitor economies for many decades and continues to be so, both for the whole economy and for manufacturing. The growth rate of the fixed capital stock was negative for the period 2000-07. The growth of capital per worker in manufacturing has been about the average of competitor countries. Investment since the financial crisis has been particularly poor both absolutely and in comparison with competitor countries. Business investment remains around 20% below where it would have been had it continued to grow at its pre-2008 average rate and projections for investment growth in the next four years are around 6%, little more than half that forecast by the Office for Budget Responsibility in late 2012.

7.1 Investment in R&D

As with overall investment the UK has occupied a relatively weak and worsening position in terms of the overall R&D effort. This is a characteristic of manufacturing R&D spend as well as of the overall business R&D spend. The UK’s R&D effort,
especially in the manufacturing sector, is hugely reliant on overseas funding and also is carried out disproportionately by the subsidiaries of overseas organisations located in the UK. The vast bulk of R&D is carried out by a relatively small number of large firms and compared to other countries is relatively concentrated in high technology sectors (Hughes, 2013; Driffield, 2013).

7.2 Finance and Short-termism

There is substantial qualitative and quantitative evidence of short termist influences on investment decision taking in the UK (Hughes, 2013). These influences have increased over time. Survey based approaches show evidence of significant proportions of managers holding perceptions of short-term pressures especially in capital intensive sectors with long gestation periods. Econometric estimates for samples of non-financial companies in the period 1980-88 suggested that cash flows accruing six months in the future are underestimated by 5% relative to non-myopic discounting. Cash flows which do not accrue for five years are underestimated by almost 40%. The latest estimates for a large combined sample of US and UK firms covering the last 20 years suggest that short-termist influences have increased in importance since the 1980s (Haldane and Davies, 2011).

The UK variety of capitalism is heavily reliant on the use of internal cash flows to fund investment. Equity markets have not played a substantial role in funding new investment. Instead they have served as a vehicle for high levels of mergers and acquisitions and intense short term performance monitoring and corporate governance (Hughes, 2013). As a result cash flow is, for example, positively related to investment in R&D intensive firms in the UK (Bond et al., 2003). Shareholder value-enhancing corporate governance characteristics in the UK have had a negative impact on the propensity to invest in long-term R&D projects. They have enhanced the responsiveness of corporate strategy to short-term expectation of financial markets with detrimental effects on long-term R&D investments. This is not the case in Germany which has a bank based financial system engendering long term relationship which is conducive to investment to R&D intensive businesses. British firms that do engage in R&D are a self-selected group, with significantly better cash flow and where financing constraints tend to be less binding (Bond et al., 2003).

International comparative studies show that stronger shareholder protection is
associated with larger stock market capitalisation, but also with lower innovative activity (Honoré et al., 2011). These results imply a weaker performance for the UK driven by its financial system. International comparisons also show that widely held businesses tend to have higher R&D activity than family controlled businesses. This effect is however much weaker in the UK than in other European countries. This may reflect the absence of large block shareholders in the UK to act as a buffer against short-term performance pressures in its more dispersed market based governance systems (Munari et al., 2010).

Knowledge intensive SMEs in technology intensive industries continue to be constrained by a lack of early stage finance in the UK. The UK has the largest venture capital market outside the USA in absolute terms. It invests relatively little in early stage investments, and is sensitive to stock market volatility (Hughes, 2013). It is also the most international venture capital market with a relatively low weight of investment in the home country. Whereas around 60% of funds in the UK have some investment outside the UK, only one third of German funds invest outside that country (Mayer et al., 2005).

### 7.3 Systems thinking, Industrial Policy and the future for the UK variety of Capitalism

In thinking about the next 30 years, the question is whether a “liberal market economy” such as the UK will be better served by more of the same or by an attempt to alter structural characteristics, which inhibit the future development of the economy. This is precisely the area in which the debate about industrial policy is now being conducted. It should lead to a fundamental re-examination of the way in which intermediate coordinating organisations can themselves be created in economies, such as the UK, which lack them. It should also lead to a continued emphasis on the role of public procurement of R&D as an essential way of supporting early stage growth in knowledge intensive manufacturing SMEs. Whilst systems thinking is now used extensively to analyse innovation policy, it is not reflected explicitly in the current policy debate over the empirical or conceptual basis for industrial policy, although there has been some attempt to develop industrial policy thinking in the light of innovation studies (e.g. Bianchi and Labory, 2006).
8. Science Policy, Technology Policy, Innovation Policy and Industrial Policy

There have been a number of attempts to distinguish between science policy, technology policy and innovation policy. It is useful to discuss this before turning to their link with industrial policy.

Exhibit 5 - A Typology of Policy Domains

<table>
<thead>
<tr>
<th>Science policy</th>
<th>Innovation Policy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus: Production of scientific knowledge</td>
<td>Focus: Overall innovative performance of the economy</td>
</tr>
<tr>
<td>Instruments:</td>
<td>Instruments:</td>
</tr>
<tr>
<td>Public research funds granted in competition</td>
<td>• Improving individual skills and learning abilities (through general education system and labour training)</td>
</tr>
<tr>
<td>(Semi-) Public research institutions (i.e.: laboratories, universities, research centres…)</td>
<td>• Improving organisational performance and learning (i.e. ISO 9000 standards, quality control, etc.)</td>
</tr>
<tr>
<td>Tax incentives to firms</td>
<td>• Improving access to information: Information society</td>
</tr>
<tr>
<td>High education</td>
<td>• Environmental regulation</td>
</tr>
<tr>
<td>Intellectual property rights</td>
<td>• Bioethical regulation</td>
</tr>
<tr>
<td></td>
<td>• Corporate law</td>
</tr>
<tr>
<td></td>
<td>• Competition regulations</td>
</tr>
<tr>
<td></td>
<td>• Consumer protection</td>
</tr>
<tr>
<td></td>
<td>• Improving social capital for regional development: Clusters and industrial districts</td>
</tr>
<tr>
<td></td>
<td>• Intellectual benchmark</td>
</tr>
<tr>
<td></td>
<td>• Intelligent, reflexive and democratic forecasting</td>
</tr>
</tbody>
</table>

Technology policy
Focus: Advancement and commercialisation of sectoral technical knowledge

Instruments:
• Public procurement
• Public aid to strategic sectors
• Bridging institutions (between research world and industry)
• Labour force training and improvement of technical skills
• Standardisation
• Technology forecasting
• Benchmarking industrial sectors

Source: Lundvall and Borrás (2005)

Exhibit 5 shows a useful recent typology. The focus of science policy is on the production of scientific knowledge. The instruments associated with it are focused on the role of public research funding, tax incentives to firms, higher education and the role of intellectual property rights in relation to accessing the public knowledge base. Technology policy is seen as more concerned in advancing towards the commercialisation stage and in their classification is linked to sectoral bases for technical knowledge. In this domain public procurement, strategic action in relation to selective sectors, the development of bridging institutions, technology forecasting, benchmarking and standardisation all play an important role. Innovation policy is
then seen as moving to more overall performance aspects and is linked to a set of “institutional architecture” arrangements operating at that level. These cover a wide range of skill and organisational based activities, information flows and regulation in relation to a wide range of environmental corporate and competition policy areas as well as consumer protection. This aggregation here is not at the level of sectors, but may include the development of geographically focused policy instruments.

In their analysis of the basis for policy in the science, technology and innovation policy domains Lundvall and Borrás (2005) draw the familiar distinction from a systems perspective between a neo-classical economic approach which focuses on market failures and a systems based approach. In the latter a critical step is made by recognising that pure arm’s length and anonymous relationships between producers and users is logically incompatible with what they regard as the ‘real’ world of markets. In that world markets are organised and “constitute frameworks for interactive learning between users and producers” (Lundvall and Borrás, 2005, p613). They point out that there is a strong overlap between the instruments of intervention, in particular as the analysis moves from technology policy towards innovation policy.

In moving on to industrial policy, work based on sectoral and technological systems is central.

9. Sectoral Systems

In a study of six sectoral systems of innovation (SSI), Malerba (2004) concludes that “the principle role of the policy maker is to facilitate the self-organisation of the SSIs within the relative policy domain. An important consequence of this is that the policy-making process is itself the reflection of bounded rationality and learning in the presence of high heterogeneity in technical change and the innovation process. The sectoral system approach is an alternative to the concept of the optimising policy-maker, which characterises the market failure approach to innovation policy …” (Malerba, 2004, pp500-501).

An important insight of the sectoral systems approach is that innovation systems operate at multiple levels and within and across national economies and
technologies. Each sectoral system therefore forms an intersection of different networks generating particular kinds of knowledge. The policy-maker therefore is faced not with the problem of analysing market failures per se, but system failures in terms of the interrelationship between the various sources of knowledge and the actors involved in the sectoral system. Thus “sectoral analyses should focus on the systemic features of innovation in relation to knowledge and boundaries, the heterogeneity of actors and networks, institutions, and transformation through co-evolutionary processes. As a consequence, the understanding of these dimensions becomes a prerequisite for any policy addressed to a specific sector.” (Malerba, 2004, pp501-502).

Adopting this approach emphasises the need to see any policy towards the sectoral system of innovation linked to the broad range of other policy domains in which government may attempt to operate, including science policy, industrial policy and competition policy. The policy-maker needs to take into account the geographical boundaries which may differ across sectoral systems of local, national and international actors and institutions. This implies a granular approach to the formation of sector policies of which innovation policy per se is only one component.

Malerba (2004) concludes that “in general, if governments should intervene, they should do so at an early stage in the development of new sub-systems and new SSIs. Such intervention at an early stage may have a tremendous impact.” Finally, Malerba (2004) notes, that the costs of creating the knowledge base for understanding the emergence and development of sectoral systems of innovation are substantial and frequently cross the standard industrial classifications which define sectors in most sets of national and industrial accounts.

10. Technological Systems

A technological system may be defined as “a network or networks of agents interacting in a specific technology area under a particular institutional infrastructure to generate, diffuse and utilise technology. Technological systems are defined in terms of knowledge or competence flows rather than flows of ordinary goods and services. They consist of dynamic knowledge and competence networks.” (Carlsson and Jacobsson, 1997, p.268). Whilst recognising that technological systems may be
international in character, they argue that they are likely to have very strong national, regional or local dimensions. Technological systems failures may arise from lock-in problems as firms, institutions and networks become tied into old technologies. Similarly, the accumulated absorptive capacity of firms may limit or shape their research processes to focus on relatively localised knowledge and related sectors. A central policy issue is to what extent innovation should be concerned with improving the efficiency of existing systems as opposed to building new systems. In the first case policies are essentially concerned with creating bridging institutions and other activities to strengthen an existing system with an emphasis on enhanced diffusion of best practice. In the second case the object of the policy would be the development of processes to create diversity and, as Carlsson and Jacobsson put it, “to build options in the sense of stimulating and protecting technological and institutional diversity and by enhancing industry’s awareness of new technology”. (Carlsson and Jacobsson, 1997, p.270).

In relation to networks as part of the technological system, important government policy functions may be related to matching firms within a technological system that have currently good contact or linking separated actors, such as universities and researchers. Finally, the behaviour of different “agents” and institutional architectures (educational organisations, and in particular universities, as well as the role and nature of the financial system) may also play a critical role.

The evolution of systems may span several decades. From a policy point of view the question of the stage of development of the technological system is critically important in relation to the extent and nature of policy interventions. As with SSI, policy may be most effective in the early stages of the evolution of the technological system. Diversity should be the prime policy objective. A fundamental role for the policy-maker is then identified as being to raise awareness of new technological opportunities. This imposes a major knowledge gathering and opportunity identification role for policy-makers to either coordinate or fulfil. Secondly, for awareness to lead to action requires a combination of lead customers and financing, and access to these may vary across national boundaries. There is an important role for the university sector in identifying new technologies and spinning off firms exploiting that technology.

In each of these domains industrial policy may have an important role to play. This may be as a direct lead procurer through advanced purchase itself and/or
through the shaping of policies to encourage knowledge exchange between the university and industrial sectors. Finally, interventions to promote new directions in technology systems are unlikely to be marginal. They are likely to require substantive investments and policy will require a strong element of anticipating change. This requires a system for the early identification of potential new directions and potential systems failings in their development.

11. The Design of System-based Industrial Policy

The sectoral systems and technological systems approaches reveal the importance of policy design as much as policy instruments per se. The bureaucratic and informational constraints on the exercise of industrial policy should not be taken as given. Three key elements to the design of industrial policy may be identified (Rodrik, 2006).

The first of these is “embeddedness” (Rodrik, 2006). Industrial policy development needs to be embedded in private sector networks and hence be able to draw upon and connect with and between information sources in that sector. This is a characterisation of policy which stands in sharp contrast to the mainstream top down economics model in which the government as a ‘principal’ designs a rule to provide incentives to the private sector as ‘agents’. The agents are then expected to respond and act in a socially desirable manner (typically in the resolution of “market failures”). This approach takes the information asymmetry and lack of connections as given. Autonomous bureaucrats incentivise agents to respond to the “altered” market signals. This model is counterproductive in the context of industrial policy (Rodrik, 2006). In practice, “the government has only a vague idea at the outset about whether a set of activities is deserving of support or not, what instruments to use, and what kind of private sector behaviour to condition these instruments on. The information that needs to flow from the private sector to the government in order to make the appropriate decisions on these are multidimensional and cannot be communicated transparently through firms’ actions alone. A thicker bandwidth is needed.” (Rodrik, 2006, p.26).
This approach occupies the ground between the view of the autonomous industrial policy-maker of the neo-classical economic approach and the private capture, and suborning, of industrial policy makers by private enterprise emphasised in the “political economy” critique of coordinated selective planning approaches to industrial policy. It entails “strategic collaboration and coordination between the private sector and the government” (Rodrik, 2006, p.2). This needs to be designed to uncover significant bottlenecks and constraints, the design of effective interactions as well as of evaluations. It also critically involves learning from mistakes as the policy evolves. A wide range of institutional developments may serve this purpose from informal and formal development forums through to advisory councils and intermediating Research and Technology Organisations. From this perspective industrial policy is a process of learning and discovery. This approach is entirely consistent with the emphasis on policy learning in the innovation systems literature.

The second feature of institutional design is the necessity of combining sticks with carrots so that there are not only incentives, but also disincentives based on the weeding out of investments that fail or activities that become “honourable dead-ends” (Rodrik, 2006). The designation of industrial policy as a process of discovery means that policy makers and the political system must accept a failure rate consistent with the underlying riskiness of the activity being supported. These carrots and sticks need to be combined with full public accountability for the sums dispersed and the performance of the investment or activity supported under the industrial policy.

The sectoral and technological systems approaches both emphasise the potential role of industrial policy support at the earlier stages of systems formation. The impact of learning and of increased knowledge sharing and coordination at this stage is also emphasised. These relationships and their implications may also be important at the more mature phase of a sector’s development in the phase of changing underlying demand or competence or resource based constraints. Moreover, once new specialisations are developed there may remain obstacles to sufficient subsequent investment in resources to develop them.

If a particular economy is not able to attract sufficiently skilled and capable resources, either in terms of financial or human capital, then industrial policy may need to be concerned with the design of ways to promote the role of users to pull through and stimulate innovation in emerging upstream developments (Arora and Gambardella, 2006). This point is intimately related to the role that industrial policy may play in
stimulating multiple partners to take part in development processes, arising from early stage technological breakthroughs, as technologies emerge into potential commercialisable opportunities. It is important to note in this connection that the absence of venture capital funding in early stage developments may place an even greater emphasis on the role of early stage lead users and in particular the role of the public sector as a lead user procurement mechanism (Connell and Probert, 2010).

12. From Science Policy through to Industrial Policy

In the light of the foregoing discussion about the implications of developing a selective industrial policy and the need for careful policy design, an attempt is made in Exhibit 6 to encompass the key elements in policy design. Exhibit 6 takes the view that the term “industrial policy” is best conceived in a granular context, in relation to the specific technology or sector which is being considered for government support.

Exhibit 6 - From Science Policy to Industrial Policy

The top bar in the diagram represents a flow of ideas from the public and private sector research base towards commercialisation. The direction of flow implies
linearity, but there are multiple non-linear feedback loops in the process. This is captured by the loops in the top bar. The length of time this process may take is captured by the indicative timescale across the top of the diagram. It is important to note that the time scales over which the process operates may vary significantly from sector to sector and technology to technology. The conventional breakdown of policy into science policy, technology policy, and innovation policy is shown beneath the development arrow bar. Industrial policy (and in particular selective industrial policy as conventionally defined) is shown as primarily focussing on policy support for the sectors in which the new products and processes are commercial developed and implemented.

In the middle of the diagram is a funnel which represents the process in which emerging ideas from the science base are gradually narrowed down as they proceed towards commercialisation in a particular sector or sectors. This funnel is shown as an “open” innovation funnel (Chesborough, 2003, 2006) with inward and outward flows of ideas and resources in the development process. The potential for unexpected development and spin-off opportunities is represented by the arrows emerging from the funnel whilst inputs and complementary investments from potential adopters or users of the technology are represented by inward arrows. The openness of the innovation process itself may of course vary from sector to sector and in the different stages along the overall innovation process.

The iterative evolutionary process from research to economic effects and the open innovation funnel will typically involve multiple investments beyond the original public and private sector research investments. The transition from early stage activities funded by the public sector to final commercialisation will, in particular require private sector investments which are usually many multiples of the original science base investment.

The bottom third of the diagram represents a schematic overview of a systems approach to policy. It shows on the right hand side of the diagram a sectoral systems approach looking backwards to technologies from sectors. This shows, as important pull factors, lead customers in both the public and private sectors. The technological systems approach is represented on the left side of the diagram. It represents the selection of technologies to support on the pathway to development and innovation in existing or new sectors. This selective approach is identified as choosing races and placing bets rather than picking winners.
The implications for policy are shown under the heading of industrial strategy which is shown as an integrative policy process spanning the sectoral and technological systems approaches. Understanding value chains is shown as central to this policy process. It informs the choice of both technology races to enter and sectors to support. This requires a granular approach to policy rooted in the specifics of particular technologies and the way value is created and captured.

The technology support process is also to be understood as one in which the support provided is to be seen as an option to invest more, or to withdraw. At each stage of the process of development policy support should therefore be designed so far as possible to allow an options approach. Advances through the path to commercialisation leads to the discovery of new technical and commercial knowledge and this must be used to revise planned support. In this way initial investments have the opportunity to be topped up or modified as developments show potential promise whilst “honourable dead-ends” may cease to receive support for further stages of development.

The final key policy element shown in the diagram is diffusion. Policy design should encourage the entry of potential users along the development path and also the diffusion of innovations across firms in the sectors where implementation occurs.

13. Industrial Policy in the UK

13.1 Learning from the Past

Although there are many examples of successful industrial policies in developed economies (Chang et al, 2013) ‘Industrial Policy’ has long had a bad press in the UK. There is a good reason for this, namely, the policy failures of the 1960s and, especially, the 1970s. It is salutary to remember this episode since it would be very unfortunate to repeat these mistakes. Although the widely recognized failures of that period relate to selective policies, there were also serious flaws in the design of horizontal policies.
Selective industrial policy in the 1970s focused on support for firms and industries including through subsidies and nationalization and was a mixture of ‘defensive’ and ‘strategic’, although skewed to the former. Although ‘picking winners’ may have been the aspiration, “it was losers like Rolls Royce, British Leyland and Alfred Herbert who picked Ministers” (Morris and Stout, 1985, p. 873). There was a very clear tendency for subsidies to be skewed towards relatively few industries, notably aircraft, shipbuilding and, latterly, motor vehicles (Wren, 1996a). The high expenditure on shipbuilding is striking since this was clearly an industry in which the UK no longer had a comparative advantage in the face of Asian competition. More generally, there was quite a strong bias towards shoring up ailing industries which is well reflected in the portfolio of holdings of the National Enterprise Board (Wren, 1996b), in the pattern of tariff protection across sectors (Greenaway and Milner, 1994), and also in nationalized industries where the prevalence of very poor rates of return reflected a lack of political will to eliminate productive inefficiency (Vickers and Yarrow, 1988).

Policies to subsidize British high-technology industries with a view to increasing world market share in sectors where supernormal profits might be obtained were notably unsuccessful in this period in a number of cases including civil aircraft (which by 1974 had cost £1.5 billion at 1974 prices for a return of £0.14 billion (Gardner, 1976)), computers (Hendry, 1989) and nuclear power (Cowan, 1990). A combination of subsidies to American producers linked to defence spending and the relatively small size of the British market undermined these attempts at rent-switching. Contrary to popular perception, however, there actually were some successes, notably in pharmaceuticals and aerospace.

In pharmaceuticals one major impact of government may have been through the drug-purchasing policies of the NHS. The Pharmaceutical Price Regulation Scheme (PPRS) has shaped the incentives facing pharmaceutical companies. This provided a distinctive form of rate of return regulation which could be manipulated by the Department of Health to encourage R&D in the UK (Thomas, 1994). Even so, a more important aspect of government support may well have been through the science base and, in particular, the existence of elite research universities with world-class departments together with public funding for research through the Medical Research Council.

In aerospace Rolls-Royce was nationalized in 1971 and successfully privatized in 1987. This saved a company that had made a disastrous error in signing a fixed price
contract to supply the RB-211 engine to Lockheed, a decision which bankrupted it when development and production costs rose far above initial estimates. Eventually, the sale of Rolls-Royce realized £1.36bn for the government compared with net subsidies of £0.83bn over the previous 20 years and Rolls-Royce went on to become the highly-profitable, second largest producer of civil-aircraft engines in the world (Lazonick and Prencipe, 2005).

Several failures in horizontal industrial policies in the 1960s and 1970s also deserve a mention. First, investment subsidies, which amounted to about 10% of fixed investment at their peak in 1978, represented very poor value for money. The econometric evidence is that they had little effect on the volume of investment over the long run (Sumner, 1999) with the implication that there was a massive deadweight cost. Second, the UK spent heavily on R&D; at 2.3 per cent of GDP in 1964 this was second only to the United States and a high fraction was government financed. Unfortunately, this seems to have been badly directed and to have had little impact on productivity performance. Ergas (1987) summed up British policy as much too concerned with trying to produce radical innovations and too little aimed at effective technology transfer. Third, the persistence of protectionism and the weakness of competition policy undermined productivity performance by underwriting managerial failure and dysfunctional industrial relations (Crafts, 2012). Finally, the tax system was characterized by very high marginal direct tax rates such that Tanzi (1969) described it as the least conducive to growth of any of the countries in his study.

After the election of the Thatcher government in 1979, the stance of supply side policy changed markedly. Selective industrial policies were phased out, horizontal policies were downsized and narrowed in scope with the ending of most investment and employment subsidies, while competition in product markets was strengthened considerably, initially through reducing trade barriers and deregulation rather than by strengthening anti-trust policy. Privatization, reform of industrial relations, and restructuring taxation were the new priorities. By 1987/8 grant-equivalent expenditure on industrial subsidies which had peaked at £8.9bn (1980 prices) in 1970/1 had fallen to £0.4bn (Wren, 1996a).

Selective industrial policy fell out of favour partly because the 1970s experience led to disillusionment and partly because international treaties and, in particular, EU rules on state aids constrained policy. Department for Trade and Industry expenditure
on industrial policy measures was £421.4 million in 1997/8 (prior to devolution) of which £121.9m was on science and technology schemes, £171.3m for support for small firms, and £128.2m on regional policy, almost all of which went on Regional Selective Assistance (Wren, 2001). Whereas in 1981/6 state aids were 3.8 per cent of manufacturing GDP by 1994/6 this had fallen to 0.9 per cent.

The changes that Labour made after its landslide victory in 1997 were to strengthen some aspects of horizontal industrial policies with a new emphasis on R&D, investing in public capital, strengthening competition policy, and a long term strategic commitment to public education and science base expenditure. Only in 2009, in the throes of the financial crisis, was there an announcement of rebalancing of industrial policy towards a somewhat more selective approach with New Industry, New Jobs (BERR, 2009). Nevertheless virtually all (91%) of state aid to industry in 2006 was for horizontal rather than selective policies (Buigues and Sekkat, 2011).

The most obvious improvement in horizontal policies from the 1970s was to increase competition across much of the economy through the abandonment of protectionism, entry into the Single Market, deregulation and, ultimately, a strengthening of competition policy through new legislation in 1998 and 2002. These changes had positive effects on productivity performance (Criscuolo et al., 2004; Griffith, 2001; Proudman and Redding, 1998). The 1980s and 1990s also saw major changes in industrial relations prompted by high unemployment and trade-union legislation but pushed forward by stronger competition which promoted changes in working practices (Machin and Wadhwani, 1989; Gregg et al., 1993).

In other important respects, horizontal policies were less satisfactory and reflect regulatory failure government failure or, at least, political constraints. Four areas where this has been apparent are energy and water regulation, transport infrastructure, land-use planning, and the structure of taxation. The privatisation of the water and energy sectors and the subsequent regulatory frameworks put in place led to chronic under-investment in R&D weakened innovation and in the case of energy reduced the UK’s technological and commercial capacity in nuclear generation (Cave 2009 CST 2005, CST 2009a). More generally from a growth perspective, the UK has been investing too little in infrastructure (CST 2009b). To maintain the level of public capital to GDP at a growth-maximizing level, investment of about 2.7 per cent of GDP would be needed (Kamps, 2005) but the average since 1997 has only been about half of this while the major investment in road building
justified by the Eddington Report (2006) has not been made. The LSE Growth Commission (2013) has argued that failures in the institutional architecture need urgently to be addressed to deal with this issue. Land-use planning regulation creates massive allocative inefficiency and reduces labour productivity both by making land unduly expensive and by restricting city size which means that agglomeration economies are foregone and spatial adjustment is impeded – successful British cities are too small (Leunig and Overman, 2008). One of the implications is an implicit regulatory tax rate of around 300 per cent which makes office space in cities like Leeds and Manchester much more expensive than even New York and San Francisco (Cheshire and Hilber, 2008). The Mirrlees Review made a powerful case for tax reforms which it claimed would have significant positive effects on the level of GDP and its growth rate. The key it argued is to reduce personal and, especially, corporate income tax paid for by raising consumption and property taxes. The proposals made include implementing a land-value tax, ending exemptions from VAT, and making a normal rate of return non-taxable (Mirrlees et al., 2011).

The overall trajectory of UK industrial policy since the 1970s is perhaps best described as seeking to improve the workings of a liberal market economy (LME). In particular, the emphasis on strengthening competition and industrial relations reform has worked in this direction. The contrast with the earlier (failed) experiments of the 1960s and 1970s that sought to introduce a version of ‘corporatism’ into the UK economy is quite striking.

The liberal market competition-focussed policy from the 1980s onwards was accompanied by persistently higher levels of unemployment compared to earlier decades. This led to major public sector policy expenditures to promote small and medium sized enterprises as the key ingredient in the recipe for job creation and increased attention to innovation as a source of productivity growth.

13.2 From Industrial Policy to Enterprise and Innovation Policy

Enterprise policy is designed to promote the small and medium sized enterprise (SME) sector (defined as those businesses employing less than 250 people). The promotion of enterprise was initially linked to the belief that SMEs were to
be the primary generators of employment and jobs. Later initiatives focused in addition on the promotion of technology intensive SMEs and spin offs to promote commercialization from the science base as part of a more general shift of emphasis to innovation policy.

The shift in policy emphasis towards the promotion of innovation has frequently involved both direct grants and elements of selectivity based on sectors or technologies.

A range of systems-inspired innovation-related policies were reinforced or introduced from the 1990’s onwards as a result of a series of innovation policy reviews (DTI, 1998; DTI, 2003a; DIUS, 2008; BIS, 2011). These systems policies focused on networked and collaborative connections both between businesses and between businesses and the science base. These were often linked to specific technological systems, e.g. biotechnology or nanotechnology. System connections within specific geographical localities were also emphasised in the identification and promotion of innovation clusters (DTI, 2003b). In relation to innovation inputs R&D tax credits were introduced in 2000 for small firms and extended to larger firms in 2002.

The review of innovation policy in 2003 (DTI, 2003a) led to a rationalization of innovation policy support. Its delivery was transferred to a non-departmental executive agency, the Technology Strategy Board (TSB). The central policy ‘products’ under its domain included the Collaborative Grant for R&D (linking large and small firms and the science base), Knowledge Transfer Partnerships (linking SMEs and Higher Education Institutions (HEIs) through co-funded postgraduate placements), and Knowledge Transfer Networks (linking businesses in a sector)\(^7\). TSB programmes and initiatives have frequently selected sectoral or technological approaches.

At the same time there were also major changes in funding the science base. In 2001 the Higher Education Innovation Fund (HEIF) was introduced. This was intended as an extra “Third-Stream” of support for English HEIs. It was to sit alongside the Dual Support streams of Research Councils and Higher Education Funding Councils to promote business-industry links. In 2004, following the Lambert Review of Business-University Collaboration (HM Treasury, 2003), the Science and Innovation Investment framework 2004-2014 was launched. It included a long term commitment to increase public sector R&D faster than the rate of GDP growth. Assuming this was matched
by the private sector this was designed to raise the overall UK R&D to GDP ratio from 1.9% in 2004 to 2.5% by 2014. It was accompanied by a range of measures designed to upgrade the HEI capital stock and to place HEI research funding on a full economic cost basis.

The most recent developments in policy (BIS, 2011) have been associated with the recognition of the importance of establishing a richer set of institutional interconnections between universities and the business community and the development of sectoral and technological strategies. This has included the development of a set of “Catapult” centres focused around a selected set of themes and technologies. This followed a review of practices in other countries and under the auspices of the Technology Strategy Board has led to the creation of seven catapult centres once again selectively focused on a range of sectoral or technological domains (Hauser, 2010; TSB, 2011). Finally the use in the United States of the public procurement of R&D from SMEs through the Small Business Innovation Research (SBIR) Programme has been imitated in the UK.

Policy towards start-ups and SMEs included experimentation with a wide range of measures designed to meet capital market failures in the provision of risk capital and loan finance for SMEs as well labour market failures in the provision of SME training. The idea that SMEs are generally finance constrained because of capital market failures is wide spread. As a result most countries including the UK have a variety of loan guarantee and other support schemes to ameliorate capital market finance failures. It is clear that in periods of financial crises, such as in 1991 and 2008, smaller businesses report difficulties in obtaining access to finance or, in periods of high interest rates, complain about the price of such finance. Outside of these periods, however, the evidence suggests that UK SMEs in general obtains nearly all the finance they seek and that this comes primarily from banks. A particular difficulty in estimating financial constraints in times of financial instability and recession is that it is difficult to distinguish a lack of borrowing because the lenders are unwilling to lend or because the borrowers have lost the appetite to borrow in difficult financial circumstances (Armstrong et al., 2013; Cosh et al., 2010). Evidence of financial constraints for particular groups of SMEs, such as those involved in the relatively risky knowledge intensive or R&D intensive businesses, is more persuasive and has led to the introduction of a variety of innovation and R&D related policies. These include support for firms such as direct grant support and tax credits for R&D, alongside support for investors such tax breaks on capital gains and for investments in early stage and technology intensive businesses. Pressure for yet more support
The burgeoning of small business support across multiple departments and policy measures from the 1980s onwards meant that by 2003-4 it was estimated that the sector was receiving nearly £8bn in support (roughly £220 per person of working age in the UK) (Hughes, 2010). This support included £3.6bn of foregone revenue through tax breaks (reduced corporation tax rates, VAT small traders exemption, SME R&D tax credit Enterprise Investment Scheme Venture Capital Trusts). It also included £1.7bn of training and skills subsidy. A relatively small amount (£425 million) was associated with the then DTI innovation policy support which included the TSB policy weapons discussed above (PACEC, 2006). The retreat from industrial policy has thus been associated with a massive commitment of resources to support ‘enterprise’.

13.3 Learning from Enterprise and Innovation Policy

It is difficult to measure the extent to which manufacturing as a whole has benefitted from the horizontal and selective support activity for enterprise and innovation. Nor is it easy to assess the overall effects on the SMEs sector as a whole of the overall degree of subsidy. However the R&D intensity of manufacturing compared to the other sectors; the emphasis on commercializing engineering and physical sciences, and identification of certain manufacturing and “high-tech” sectors in SMART and TSB activity has meant that the sector has probably been a disproportionate recipient of innovation policy support.

In relation to SME support policy generally, Hughes (2010) compares size sector and age matched samples of SMEs in 1991, 1997 and 2004 and concludes that there was little change in the proportions exporting, innovating or training over the period. Rates of collaboration with HEIs were however higher in 2004 than earlier years. Outside of periods of macro-financial crisis there was no sign of market failures in access to finance. SMEs typically obtained the funding they sought (see also Cosh et al., 2007). There have been numerous evaluations of schemes to underwrite loan guarantees and to support venture capital. A useful recent review of these schemes (Ramlogan and Rigby, 2012) concludes that, in the case of the UK, schemes such as the loan guarantee scheme show positive effects, but that schemes supporting
venture capital have a much weaker track record.

There are severe problems in evaluating the impact of innovation policies. First, the outcomes may take many years to appear. Second, the outcomes are typically heavily skewed with about 10% of the “treated” firms accounting for 70-80% of all the gains from a scheme, and third, there are problems of good firms being selected into the scheme which would have done well anyway compared to control group firms who weren’t “treated” (see e.g. Hughes and Martin 2012).

A number of evaluations of the innovation policy schemes discussed above have nevertheless been made using methods which attempt to address these issues. Compared to the analyses of selective and other horizontal policies, the outcomes are more favourable and suggest a positive impact for policy intervention.

An econometric analysis of the impact of the SMART scheme on Total Factor Productivity yielded no significant effects (Harris and Robinson 2004) but a series of other evaluations combining case studies with econometrics and exploring skewness found a range of positive effects. These were concentrated in a small proportion of firms taking part in the schemes. These included positive impacts on sales, employment, access to other resources and ability to meet the firms’ technical innovative and business objectives (PACEC 2001, 2011).

The Knowledge Transfer Partnership Scheme has supported over 5,000 partnerships. Around 60% of firms reported that their technical objectives were met and around 40% that their commercial objectives were met. In the period 2001-2 and 2007-8 between 5550 and 6010 net additional jobs were created generating around £1.7billion gross value added (of which the 25% most successful businesses accounted for 70%). This represented additional gross value added of between £4.70 and £5.20 per £1 government support (Segal Quince Wicksteed, 2002; Regeneris Consulting, 2010).

The Collaborative Grant for R&D has been estimated to have generated substantial behavioural additionality in terms of business and HEI processes for managing collaboration relationships and innovation. In addition since 2004, it was estimated to generate 13,350 net additional jobs and £2.9 billion additional gross value added. For each £1 of grant there was £6.71 of additional gross value added (PACEC, 2011).
The HEIF funding stream led to the injection of £592 million extra funding into the university sector between 2001 and 2007. This was estimated to have yielded between £2.9 billion and £4.2 billion gross additional knowledge exchange income which universities attracted from business and other external user sources (PACEC/ CBR, 2009).

In relation to the overall policy spend on direct and indirect (tax based) innovation and SMEs, Foreman-Peck (2013) shows that in the period 2002-4 SMEs which received innovation policy support (either directly through e.g. SMART or indirectly through R&D tax credits) were more likely to innovate than other businesses. Innovating businesses also grew faster than other businesses. His estimates suggest that SME innovation support policy cost £320 million p.a. in 2002-4 and yielded a return of £1,180 million p.a. in 2002 prices. He notes that the cost of R&D tax credit support was significantly higher than the other direct innovation support and that the R&D tax credit has a much smaller take up. As a result he concludes that ‘much of the return to innovation could apparently be earned without the expensive tax credit’ (Foreman-Peck, 2013, p68). In addition, a recent qualitative study HMRC (2010) focusing on business decision-making processes in relation to R&D tax credits and grants concluded that the R&D tax credits were almost always described by firms in the sample as a “bonus”. They had little if any effect on decisions to conduct individual pieces of R&D work. On the other hand, grants, such as SMART, appeared to be crucial to start-up companies in particular and in the early stages of the life of research-based SMEs. The application process for a grant induced indirect benefits in terms of the discipline involved in putting together the proposal. The grants also exerted a leveraging effect on other funding by providing “kudos” for the company. It also had positive effects on staff recruitment and retention. This suggests that tax credits are a relatively inefficient way to supporting SME innovation activity.

14. Industrial policy, the Challenge of Globalization and the ‘Second Unbundling’

Globalization entails reductions in trade costs and increased international mobility of capital. A major implication is that the relative attractiveness of locations that
business chooses for different stages of production in the value chain including manufacturing may change over time. Indeed, a notable feature of the past quarter century has been the rapid expansion of ‘vertically-specialized’ trade where value added to the final product sold to the consumer has been built-up in a series of different locations perhaps in several countries (Yi, 2003). Linked to this has been the so-called ‘2nd Unbundling’ in which technological change, especially in terms of ICT, has made it possible to disperse production stages that previously had to be performed in close proximity (Baldwin, 2006).

These developments have implications that change the optimal composition of industrial policies compared with the less globalized world in the earlier technological era of the 1970s (Baldwin and Evenett, 2012). First, with regard to selective industrial policies, it may be necessary to re-think the notion of giving support to particular manufacturing sectors and think instead in terms of interventions targeted at stages of production in a value chain. Second, the increased mobility of some factors of production means that it may be important not only to consider externalities but how far these will be internalized to the UK. This means that compared with earlier times, the weight of subsidy should tilt towards ‘high-spillover, low-mobility’ factors – for example, horizontal policies should emphasize human capital rather than transferable technology. Third, corporate taxation has to be designed for a world in which there is greater tax competition which typically implies lower marginal rates than in a closed-economy setting.

Perhaps most important of all is to recognize the value of increasing the ‘stickiness’ of economic activity by making alternative locations less good substitutes. This results from advantages that cannot easily be replicated elsewhere. In particular, this suggests that policies to nurture successful agglomerations deserve a high priority. It may be appropriate for the British government to follow the lead of the Dutch (CPB, 2010) and consider what a successful portfolio of British cities would look like in future and how this can be underpinned. This calls for an approach different from that of traditional industrial policy with its emphasis on subsidies to physical investment or promoting particular manufacturing industries. Instead, it will be important to develop well-designed transport infrastructure and land-use planning policies. Unfortunately, these are areas in which British policies leave a lot to be desired.

Increased international mobility of capital also entails ‘tax competition’. As corporate tax rates are lowered in other countries, a policy response may be required from
the UK in order to maintain its attractiveness for FDI. The prediction of simplistic models of tax competition is that there will be a ‘race to the bottom’ and corporate tax rates will tend to zero (Razin and Sadka, 1991). This has not happened because, in practice, capital is only imperfectly mobile even in the manufacturing sector and its choice of location is influenced by other factors besides taxation. Small countries, for example, Ireland and Luxembourg, find it attractive to cut tax rates because their domestic capital stock is relatively small because the increase in the tax base compensates for the lower tax rate. For larger countries such as Germany and the UK, this is not the case, while political constraints and considerations of fairness mean that, in any case, for these countries, cuts in corporate taxes will be relatively limited (Plumper et al., 2009). This implies that if policymakers are concerned to combat tax competition they will need to focus on instruments that aim to improve human capital, the regulatory environment and infrastructure.

### 15. Institutional Architecture and the Future of Industrial Policy

We are proposing a different system based approach to medium to long-term industrial policy to that on which past UK policy has been based. There are nevertheless important lessons to be learned from past UK experience. These relate in particular to the ability of governments to design and deliver policy. This is a question of government failure. A systems approach might address these issues in four ways. First, there is a need for policy to be designed in an embedded way which eschews top down design and implementation. Second, in the face of uncertainty and the need for reflexive policy learning, an options approach would be essential. Third, there would be a requirement to build policy design and information processing capacity. Finally it would embody the creation and design of policy intermediaries to enhance the connectedness of the system and improve its institutional architecture.

We have discussed each of these in earlier sections. Here we address a final and central problem relating to the provision of an institutional architecture that will ensure longer term stability in policy design and implementation. Exhibit 7 summarises a recent proposal to address this problem in relation to UK infrastructure while Exhibit 8 provides examples of relevant institutions from the UK, Australia and the USA.
The Office for Budget Responsibility (OBR)

The OBR is an independent fiscal watchdog that became a statutory body in April 2011 as a result of the Budget Responsibility and National Audit Act.

The OBR examines and reports on the sustainability of the public finances. It was set up with the strict instruction to provide only positive commentary, not normative commentary, on government policies. The Act gives the OBR right of access to Government information it may require for the performance of its duty, in addition to access to relevant officials and others.

A Memorandum of Understanding (MOU) was created between the OBR and those government departments with which it interacts most, namely the HM Treasury, HM Revenue and Customs and the Department for Work and Pensions. This is not a legally binding agreement but provides details of the working relationship between these four institutions. The OBR has an annual budget of £1.775m, a dedicated staff of 18 civil servants and three committee members (Chote, 2013).
Hosted by the National Institute of Standards and Technology (NIST), AMNPO is staffed by representatives from federal agencies with manufacturing-related missions as well as fellows from manufacturing businesses and universities.

Recommended by the Advanced Manufacturing Partnership Steering Committee and endorsed by the President’s Council of Advisers on Science and Technology (Advanced Manufacturing Partnership Steering Committee, 2012), AMNPO is charged with implementing a whole of government advanced manufacturing initiative to facilitate collaboration across federal agencies; and convening and enabling private-public partnerships focused on manufacturing innovation and engaging U.S. universities.

By coordinating resources and programmes, AMNPO will enhance technology transfer and help businesses overcome technical obstacles to scaling up production of new technologies.
The Australian Productivity Commission

The Productivity Commission, created in 1998, is the Australian Government’s independent research and advisory body on a range of economic, social and environmental issues affecting the welfare of Australians.

It is an advisory body and does not administer government programs or exercise executive power. Its contribution hinges on the value of the independent advice and information it provides.

Its operating principles include Independence (The Commission operates under the powers of its own legislation, with its own budgetary allocation and permanent staff, and reports formally through the Treasurer to the Australian Parliament); transparency; and taking a community-wide perspective (Australian Productivity Commission, 2013).

In the light of these examples the establishment of an Office for Manufacturing for the UK may be one way of encouraging stability industrial policy design and implementation.

16. The Office for Manufacturing (OfM)

Future industrial policy will play a key role in how the government seeks to capture future value from the manufacturing sector. This would be best achieved by a holistic systems perspective, addressing both market and systems failures and spanning the domains of economic, science, technology and innovation policy. To implement this approach, it is critical that the Government has, in the future, an institutional architecture with the capacity to deliver industrial policy in the medium to long-term.

One way to do this could be to introduce an ‘Office for Manufacturing’ with challenge,
coordination, and evaluation functions for future industrial policy in order to ensure future policies work effectively to strengthen industry and rebalance the economy.

The remit of the OfM would be:

• To scrutinise industrial policy and support its coordination: The OfM will facilitate coordination across departments for existing and proposed industrial policies, and will work with other departments to seek out beneficial opportunities for coordinated action.

• To evaluate the impact of industrial policy: This would include ongoing analysis of data and policy outcomes, to support the development and implementation of future policies.

• To provide an audit function by producing an annual report on manufacturing in the UK. This would include analysis of manufacturing data using current Standard Industrial Classification and wider metrics including manufacturing services as advocated earlier. The report would be produced against the long term science and innovation investment framework.

• To support long-term progress being made against the challenges for Government set out in the Foresight, Future of Manufacturing report: Work to be refreshed every five years.

Given the cross governmental role of the OfM, it would be most appropriate for it to report to the Chancellor or a Cabinet Office Minister, potentially the Minister for the Cabinet Office or the Minister for Government Policy. To support its cross-Government role, it would be appropriate for the small team of staff to be drawn from across Government, with oversight provided by a handful of independent Commissioners.

It is likely that an Act of Parliament would be needed to establish the OfM, which was
the case when the OBR was established. This included the following:

“Right of access (at any reasonable time) to all Government information which it may reasonably require for the performance of its duty….Entitled to require from any person holding or accountable for any government information any assistance or explanation which the Office reasonably thinks necessary for that purpose”.

A Memorandum of Understanding (MOU) would need to be in place between those departments which the OfM interacts most frequently.

Notes

1. These are now recognized as examples of the ‘wider economic benefits’ which can accrue from transport projects, see Department for Transport (2006).

2. See also Streeck (2009) and Carlin (2009) more generally.

3. See, for example, Metcalfe (2005), Dodgson et al., (2011), BIS (2011) and for a comparison of systems and market failures, Chaminade and Edquist (2010).

4. See for example CST (2007)

5. On discovery driven planning in uncertain projects see McGrath and MacMillan (2009) and for real options and related stage gate models of assessing progress in uncertain projects see Cooper (2008),

6. For an analysis of a number of intermediate technology organisations which represent variations across countries in policy design incorporating the elements of Exhibit 6 to different degrees see Mina et al. (2009).

7. Another long running innovation policy scheme the Small Firms Merit Award for Technology (SMART) offering grants for early stage technology projects was in
2004 relabelled the Grant for R&D and devolved to the Regional Development Agencies. It also began with the targeting of specific technologies on sectors. Following the subsequent demise of the RDAs it was re-labelled SMART and re-launched under the auspices of TSB in 2011. In 2012 the TSB was also given responsibility for the launch and management of the “Catapult” intermediate technology organizations linking businesses and HEIs in selected technology and sectoral domains.

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