The 2008 Productivity and Competitiveness Indicators
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Annex A: Productivity and Competitiveness Indicators

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Executive Summary

This paper is an annual publication reporting progress on UK productivity performance, with a focus on looking at progress on the underlying drivers of productivity: Investment, Innovation, Skills, Enterprise and Competition. While raising productivity growth is a long-term objective, given the current global economic climate this paper is also considers possible short term impacts on productivity growth and the policies the Government is putting in place to address these issues.

Public Service Agreement 1 (PSA1) is to ‘Raise the Productivity of the UK Economy’, with progress measured by UK trend productivity growth rates over the economic cycle and performance relative to the competitor economies of the US, France and Germany. Raising UK productivity is a long-term objective but that there may be short-term issues to consider in achieving this objective, such as the impact of the current economic conditions on the drivers of productivity.

The Productivity and Competitiveness Indicators is an annual publication forming part of the ongoing monitoring of progress towards achieving PSA 1, by analysing a broad range of measures across the fundamental drivers of productivity growth to arrive at a balanced assessment of how well the UK is performing relative to its competitor economies. The Indicators were first published in 1999, and annual updates have been published since 2001. This report refreshes the existing set of indicators to help us better monitor progress on UK productivity performance.

HM Treasury estimates that the previous economic cycle ended in 2006. On this basis, UK productivity performance was relatively strong over the last economic cycle, averaging 2.4 per cent per annum between 1997H1 to 2006Q2. There has also been continued progress in closing the productivity gap with France and Germany and the UK has maintained pace with the US productivity performance. The evidence presented in this paper suggests that the UK retains strengths in the form of its science base, high-level skills, openness to international competition and effectiveness of regulatory and competition regimes. There is scope for further improvement in areas such as business investment, R&D expenditure and leadership and management skills.

Analysis of business cycles indicates that productivity (measured in terms of output per worker) tends to decline at the bottom of the economic cycle as changes in employment tend to lag changes in output. The latest data shows that UK productivity growth rates have started to slow, which is consistent with changes in other economic indicators at the moment (GDP and employment), reflecting the global
economic slowdown. It will be important to monitor how the downturn is impacting on the long term trend rate of productivity growth and take measures to ensure that short-term issues do not impact on the long-term capacity of the economy and therefore the trend rate of productivity growth. Chapter 2 on The Business Cycle and Productivity provides a short assessment of the possible implications of the economic downturn on productivity and the five drivers and emphasises what should be monitored closely, and which policy areas might require action. The summaries of each of the five drivers below highlight the specific aspects that are likely to be most significant.

**Investment**

Investment in physical capital is an essential determinant of economic growth and is undertaken to improve technology, productive efficiency and future capacity.

The UK benefited from a period of unusual macroeconomic stability over 1997 and 2007, helping create the conditions for investors to act with confidence. Recent global economic difficulties are creating exceptional challenges for macroeconomic policy makers which are impacting on macroeconomic stability. The Government’s priority is to guide Britain through these challenging times, supporting households and businesses affected by the global economic difficulties, and ensuring stability in the financial sector.

Government is also working to ensure both public and private investment, essential for continuing productivity growth, is maintained during these difficult economic conditions. The 2008 Pre-Budget Report¹ (PBR 2008) announced a package of fiscal measures to contribute to support domestic demand, and in particular, bring forward £3bn of capital expenditure. The government has also introduced a number of initiatives to ensure that companies, both large and small have access to finance during the present difficulties.

Progress is being made on investing in infrastructure necessary for sustained productivity growth. Evidence suggests investment in rail infrastructure has contributed to reduced journey times and higher reliability of rail performance. Looking forwards, the Department for Transport has issued a consultation on the transport goals and priorities for 2014-19 and beyond,² as part of the continuing response to the Eddington Transport Study and the Stern Review ensuring that transport contributes to economic growth and tackling climate change. The Government has announced work on *Digital Britain*, a report that will develop a strategic framework for the digital communications sector,

¹ [http://www.hm-treasury.gov.uk/d/pbr08_completersreport_1721.pdf](http://www.hm-treasury.gov.uk/d/pbr08_completersreport_1721.pdf)
with an interim report published on 29 January,⁵ to inform Government of the options and prospects for a universal broadband infrastructure, a liberalised and fully functioning spectrum market providing the spectrum to support new ICT services, and investment in digital content.

**Innovation**

Innovation is the successful exploitation of new ideas, encompassing the implementation of new or significantly improved products, processes, marketing and organisational changes that contribute to increased productivity and competitiveness.

Data from the most recent innovation surveys suggest that UK enterprises are on average as likely to be innovation active as the EU average. The UK has a strong science base but spends less than its competitors in terms of research and development (R&D) as a share of GDP, particularly on business R&D. The UK economy’s pattern of sector specialisation also results in a lower number of patents (although apparently highly valuable) and designs granted. UK firms perform better on the other indicators of innovation performance, for example the UK has a high number of registered trademarks, reflecting the extent of wider forms of innovation. Furthermore, the UK tops the list of EU countries that have provided information on the proportion of firms’ turnover coming from sales of new or significantly improved products. A relatively large number of innovators make use of network relationships, principally with customers and suppliers.

The impact of the slowdown on business innovation behaviour is still unclear, and there is a mixed picture from business on how they will be changing their innovative activity. The evidence suggests that it is not likely that there will be a drastic decline in R&D investment as a proportion of GDP; however, it is possible that specific types of R&D in specific sectors by specific firms might be affected. The Government is working to ensure that funding is available, particularly among small firms.⁴ In the short term, it will be important to understand whether there are any particular barriers in place that are preventing businesses from being able to continue innovation activities, particularly those driven by financial considerations. In the longer term, progress on developing an innovation nation should be made, building on actions set out in the DIUS 2008 White Paper.

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³ http://www.culture.gov.uk/what_we_do/broadcasting/5631.aspx
⁴ http://www.businesslink.gov.uk/bdotg/action/detail?itemId=1081750153&type=ONEOFFPAGE&site=0&furlname=realhelp&furlparam=realhelp&ref=&domain=www.businesslink.gov.uk
Skills

Skills are important for productivity as more skills enable individuals to work more effectively within the workplace and help facilitate the introduction of new innovative ideas and practices within the production process. Alongside the supply of skills, the need to match the provision of skills to the requirements of employers and then utilise these skills effectively within the workplace are important factors underpinning UK’s progress in the skills area.

The evidence suggests that the UK has made good progress in raising basic skills such as literacy and numeracy and that more individuals are attaining higher qualification levels. There is also evidence to suggest that for the UK, skills attained by achieving a certain level of education match the skills demanded by employers relatively better compared to other competitor economies, such as France, Germany and the US.

The empirical evidence on the impact of the current economic conditions on skills investment suggests that there could be an increase in university enrolment and on-the-job training by firms. In the short term, it will be important to ensure that individuals maintain their skills, particularly those who become unemployed. PBR 2008 has announced measures to support individuals and employers in developing their skills during the current economic downturn, for example the Government is putting further resources into Train to Gain to help people to retrain before they are made redundant. The Employment Summit on 12 January also announced a further £0.5bn over two years to support individuals who are unemployed for 6 months or more. Moreover, the Government is committed to using its leverage with contractors and suppliers to promote training in the workplace, particularly through apprenticeships; hence, it will consider making it a requirement that successful contractors have apprentices as an identified proportion of their workforce.

Looking ahead, the Government remains committed to its longer-term ambition, as set out by the Leitch Review, to achieve a world-class skills profile for the UK by 2020.

Enterprise

Enterprise, the seizing of new business opportunities by both start-ups and existing firms, is an important source of productivity growth and wealth creation. Overall, the UK tends to perform better on enterprise than France and Germany, but less well relative to the US.

The UK performs well in the areas of access to finance (in terms of levels of venture capital investments) and effectiveness of its regulatory framework (in terms of ease of doing business).

The available evidence makes it difficult to make forecasts about the impact of the current slowdown on business formation and the stock of businesses. Thus, in the short term, it will be important to continue to monitor business behaviour, and issues such as access to finance and cash flow, to remove barriers to entry and expansion and ensure viable businesses stay operational during the current slowdown.

There is scope for further improvement in terms of developing a positive enterprise culture, enhancing the effectiveness of investment in knowledge and skills and in promoting business innovation. Attitudes to, and experience of, enterprise in the UK are positive and have exhibited some improvement relative to other countries but still lag those of the US. In addition, people in the UK are still less likely to have the aspiration or motivation to start a business in UK.

In the longer term, the Enterprise Strategy\(^6\) launched alongside Budget 2008 outlines the framework which will inform and structure the Government’s enterprise policy to address areas where further improvement can be made.\(^7\) A number of specific Enterprise Strategy measures have already been delivered. As far as promoting an enterprise culture, the first Premier League enterprise programme with Manchester City Football Club, extending its community programme, has been launched. In relation to building on investment that has already been made in knowledge and skills, the Government has established, together with the entrepreneur Peter Jones, the first National Enterprise Academy, offering enterprise qualifications to over 16s. As far as the regulatory framework is concerned, the Government has embraced a new approach to regulating small firms (employing fewer than 20 people) with a ‘think small first’ policy that includes considering whether small firms can be exempt from requirements without affecting essential protections.

**Competition**

Competition is important for productivity as a greater level of competitive intensity encourages new entry and increases the pressures on incumbent firms to improve product quality and reduce prices, as well as to develop new and innovative products and production processes.

The UK performs well on the competition driver, with significant progress being made towards reducing administrative burdens and the

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\(^7\) BERR & HMT, 2008, Enterprise: Unlocking the UK’s talent, p.5
UK remains an open economy that is in a position to reap the benefits of international trade and inward investment.

There is scope for further improvement in the UK competition regime, such as improving the speed of decision-making under the Competition Act 1998 and Enterprise Act 2002. Nevertheless, the evidence does support the view that the increased powers to the competition authorities determined through provisions of the above Acts continue to have a positive impact.
1. Introduction

1.1 Policy Context

The Government recognises that higher rates of UK productivity growth are essential to sustaining high and rising rates of economic growth, improving the standard of living of UK citizens and maintaining the UK’s position as a dynamic, open and thriving economy. As such, the 2007 Comprehensive Spending Review (CSR07) has set the Public Service Agreement 1 (PSA1), with the aim of ‘Raising the Productivity of the UK Economy’. Progress against this target is measured by UK trend productivity growth rates over the economic cycle and performance compared to the US, France and Germany. However, PSA1 is part of a set of 30 PSAs which have substantial linkages. The set of PSAs cover four broad areas: sustainable growth and prosperity; fairness and opportunity for all; stronger communities and better a quality of life; and a more secure, fair and environmentally sustainable world.

1.2 UK Productivity Performance

Over the past decade there has been a marked improvement in the UK’s productivity performance, which has seen the UK narrow its productivity gap with France and Germany and keep pace with the performance of the US. This has occurred against a background of increasing global competition and substantial reform across a range of economic policies.

In ‘Productivity in the UK: The Evidence and the Government’s Approach’, the five drivers of UK productivity were identified as Investment, Innovation, Skills, Enterprise and Competition. Since 1999, the UK’s performance on these drivers has been monitored via the annual publication of the Productivity and Competitiveness Indicators. International comparisons are included within these Indicators, which allow the benchmarking of UK performance relative to the UK’s main competitors (identified as the US, Germany and France).

The Indicators are grouped under each of the drivers, and taken together provide a balanced assessment of the UK’s productivity performance. It should be emphasised that the drivers do not work in isolation: there are substantial linkages and complementarities between them.

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8 [http://www.hm-treasury.gov.uk/d/pbr_csr07_psa1.pdf](http://www.hm-treasury.gov.uk/d/pbr_csr07_psa1.pdf)
9 See [http://www.hm-treasury.gov.uk/pbr_csr07_psaindex.htm](http://www.hm-treasury.gov.uk/pbr_csr07_psaindex.htm) for a complete list of PSA Delivery Agreements.
10 [http://www.hm-treasury.gov.uk/d/ACF1FBA.pdf](http://www.hm-treasury.gov.uk/d/ACF1FBA.pdf)
This paper uses a refreshed set of indicators (see Annex A for a complete list of Indicators) and other evidence to assess UK productivity performance to date. It also considers the impact of current economic conditions.

1.3 Progress on outcomes

While the five drivers can help us to understand what is driving productivity in the UK and to identify areas where more could be done, we are ultimately interested in tracking productivity performance.

Productivity performance is measured using two main average labour productivity measures: the average output (GDP) produced per worker, and per hour worked. GDP per hour worked is the preferred measure because it takes account of variation in hours worked, due for example to differences in holiday entitlements and part-time work. However it is not measured consistently across countries, so GDP per worker tends to be used instead. Box A discusses in further detail the different productivity measurements.

**Box A: Productivity Measures**

There are a number of different measures of productivity whose suitability depends on the purpose of analysis and the availability of data. Total Factor Productivity (TFP) measures (relating a measure of output to all production inputs, not just labour) are closest to the economic definition of productivity. Since the estimation of TFP is quite data intensive, technical and methodologies are still being developed. Average Labour Productivity (ALP) tends to be favoured for policy purposes. ALP is straightforward to measure and has clear policy links to the government objective of raising trend growth in the economy.

Productivity performance using both GDP per worker and GDP per hour worked measures is assessed over the business cycle to control for the effect of cyclical distortions.

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11 Productivity can also be measured at region industry, firm and plant as well as national level, see Productivity in the UK 6, [http://www.hm-treasury.gov.uk/d/bud06_productivity_513.pdf](http://www.hm-treasury.gov.uk/d/bud06_productivity_513.pdf)
12 Although the international consistency of hours-based measures has improved.
13 Also called Multi-Factor Productivity.
14 TFP tends to be estimated at the national level as the ratio of an index of outputs to an index of inputs, and econometrically at a sectoral or firm level.
15 This is gross value added per labour input, Y/L.
16 Even though it is a potentially biased measure of the underlying productivity that TFP tries to measure. Growth in ALP reflects growth in TFP but also e.g. changes in the capital/labour ratio (e.g. due to changes in labour utilisation over the business cycle), outsourcing, and random fluctuations.
17 Economic output depends on two things: the number of people working and how much they produce. ALP measures have clear links to this wider objective.
18 See Chapter 2 for details on how productivity is influenced by the economic cycle.
Figure 1.1 shows year-on-year changes in GDP and GDP per worker on a quarterly basis over 1970Q1 to 2008Q2 as well as year-on-year changes in output per hour worked over 1993Q2 to 2008Q2. The variance in GDP growth has fallen markedly since the 1990s, contributing to a similar fall in the variance of GDP per worker. Research suggests that this has been due to a more benign pattern of shocks, structural change (for example, the IT revolution, just-in-time production), and improved macroeconomic policies. It should be noted that recent global macroeconomic difficulties have had a marked impact on the macroeconomic performance of a number of countries, including the UK. The idea that excessive macroeconomic volatility is an obstacle to productivity growth is largely supported by the evidence.

Figure 1.1: Annualised changes in GDP per worker, GDP and GDP per hour worked

Data for the previous economic cycle (1997H1 to 2006Q2) shows trend productivity growth of 2.4 per cent per annum, a substantial improvement on the 1.9 per cent per annum over the previous economic cycle between 1986Q1 to 1997H1. The latest ALP data shows a slowdown in productivity growth rates. Chapter 2 on The Business Cycle and Productivity provides more detail on how productivity performance may be affected by a downturn in the economy. It will be

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19 This is the earliest period for which data on hours worked is available.
20 Industrial countries went through two broadly synchronized monetary policy cycles; the accommodation-disinflation cycle of the 1970s and the early 1980s, and the widespread tightening in 1988–89 to reverse liquidity injections after the 1987 stock market crash. Also, significant steps toward financial deregulation were taken in many industrial countries in the late 1970s and early to mid-1980s (cf Drees and Pazarbasioglu, 1998, and BIS, 2002).
21 See Aghion and Howitt (1998).
22 Estimation of the economic cycle is carried out by HM Treasury. More information at: http://www.hm-treasury.gov.uk/fiscalpolicy_trend.htm
important to continue to monitor how individual drivers are being affected throughout the downturn to understand how this may impact on trend productivity growth across the whole cycle and take measures to ensure that short-term issues do not impact on the long-term capacity of the economy and therefore the trend rate of productivity growth.

The rest of this section focuses on international comparisons of productivity for which data is available on an annual basis.

Figure 1.2 demonstrates the substantial progress that the UK has made in closing its productivity gap with France, Germany and the US (measured in terms of GDP per worker). Over 1997 to 2007, the productivity gap with Germany was closed, with the UK leading Germany in 2007 by 3 percentage points. Over the same period, the gap in output per worker with France narrowed from 15 to 10 percentage points, while the gap with the US remained broadly constant at 28 percentage points.

![Figure 1.2: GDP per worker Comparison, 1996-2007](image)

Performance has followed a similar pattern on an output per hour basis, as shown in Figure 1.3.\(^\text{25}\) Between 1997 and 2007, the gap in output per hour with France narrowed from 22 to 18 percentage points, the gap with Germany narrowed from 25 to 13 percentage points, and the gap with the US remained broadly constant at 19 percentage points.

\(^{25}\) Productivity comparisons on an output per hour basis take account of the shorter working week and longer holidays in France and Germany.
The UK has improved its productivity performance although a substantial gap with our main competitors remains. Addressing these gaps will lead to further gains in the UK’s standard of living. The refreshed set of Indicators provides an assessment of the UK’s relative strengths and weakness, and identifies areas requiring further improvement.

1.4. Structure of paper

The rest of this paper is structured as follows:

- Chapter 2 provides a short assessment of the possible implications of the business cycle on productivity and the five drivers.

- Chapters 3-7 are devoted to the five individual drivers of productivity (Investment; Innovation; Skills; Enterprise; and Competition), with:
  - a short introduction on how the driver in question fits into the productivity framework.
  - the key factors and relationships influencing the driver.
  - an update on progress made on the productivity agenda under the driver using the refreshed set of indicators and other evidence of the impact of Government policies.
References


2. The Business Cycle and Productivity

2.1 Introduction

This chapter examines the theoretical expectations and empirical evidence regarding the potential impact of the business cycle on productivity and its drivers, with the primary purpose of highlighting which indicators should be monitored closely, and which policy areas might require action.

2.2 Theory and evidence of the impact of the business cycle on productivity and its drivers

Economic theory does not provide a clear insight of the impact of the business cycle on productivity. The evidence on the impact of the business cycle on specific drivers is also mixed.

A. Impacts on productivity

Average Labour Productivity (ALP) is expected to behave procyclically, as productivity is likely to grow more rapidly when output is growing rapidly, and grow more slowly when output is growing slowly. This is because changes in employment tend to lag changes in output. Figure 1.1 in Chapter 1 shows that output per worker (ALP) is highly procyclical. This is why ALP productivity performance is measured over the economic cycle to remove short term cyclical distortions and to focus on changes in long run trends in productivity.26

While the estimation of trend productivity growth will tend to ‘wash out’ short run cyclical variations in ALP, it is possible for short run factors to affect trend productivity growth over a given business cycle.

Recessions can lead to positive improvements in underlying productivity through a number of routes. For example, less productive firms could be eliminated during recessions, increasing average productivity in the upturn.27 28 Second, firms may invest in productivity-enhancing

26 In theory a TFP measure would control for cyclical effects, but, as noted in Chapter 1, TFP is not an appropriate measure for policy purposes
27 This is the “cleaning up” effect pointed out by Caballero and Hammour (1994).
28 This effect may be offset by the fact that the rate of entry of new (efficient) firms is also lower during recessions, which in turn limits the extent of the phasing out of old (inefficient) firms.
corporate reorganisation or training during periods of slack when the opportunity cost in terms of forgone profits tends to be lower.29 Third, recessions increase the likelihood of bankruptcy for firms that do not prepare for the upturn by investing in this way.30

However, recessions (particularly if they are long lasting) may have negative long term effects on productivity, for example if the underlying drivers of productivity are damaged. These are considered in more detail below.

Chapter 1 discussed progress in reducing the UK’s productivity gaps with France and Germany and in keeping up with the US productivity performance in the most recent cycle. Past cycles do not appear to have slowed down progress in closing productivity gaps over the long term. For example, despite the UK experiencing a severe recession over 1990-1991,31 there has nonetheless been progress in narrowing the productivity gap with the US, France and Germany.

Whether cyclical effects will have a longer term impact on international productivity gaps will depend on: (i) whether there are any longer term effects; and if so, (ii) whether other countries have similar experiences.

B. Impacts on drivers

The business cycle can also have persistent effects on the drivers of productivity, which could lead to long lasting impacts on underlying productivity performance. Even though theory has strong implications for the Investment driver, this is not necessarily the case for the Innovation, Skills, Enterprise, and Competition drivers. For example, there are competing theories of the effects of the business cycle on innovation, with opposing predictions. Also, while some measures of innovation, skills and enterprise are procyclical (particularly where they involve investment), others are not.

a) Investment32

A decline in investment reduces the level of the capital stock, which in turn can have a significant impact on productivity.

Theory predicts that business investment is procyclical (i.e. it declines during recessions) as a result of weaker demand, increased risk, tighter monetary policy.33

30 This is the “disciplinary” effect highlighted by Aghion and Saint-Paul (1991). Increases in firm indebtedness could also reinforce the disciplinary effect of recessions; see Nickell, Wadhwani and Wall (1992).
31 This recession appears to have been caused by a collapse in over-optimistic business and consumer confidence (fuelled by strong growth and a relaxation of banking prudential standards), triggered by tight monetary policy.
32 Investment includes private and public sector additions to the domestic capital stock (physical capital such as plant and equipment, but also intangible investments such as software, intellectual property, branding). It is not only a production factor; it is also a component of final demand.
cash flow, the deteriorating quality of trade credit assets, and reduced lending by banks seeking to reduce their exposure to default. By contrast, public investment is expected to be countercyclical, (i.e. it rises during recessions) as governments seek to compensate for private sector investment weakness. Intangible investments, such as software, design, intellectual property, branding, and corporate reorganisation are likely to be procyclical, although not in all cases.

Historical evidence demonstrates that UK business investment is procyclical, and that government investment is countercyclical. Business investment (BI) growth and GDP growth share some (but not all) of their major turning points over the past 15 years. Business investment as a share of GDP (BI/GDP) is fairly stable and does not share any turning points with GDP, although BI/GDP appears to be positively correlated with GDP growth since the 1980s, a period of increased growth stability. By contrast, the intensity of government investment as a share of GDP (GI/GDP) appears to be countercyclical, falling when the trend growth of output is strong and rising when weak.

Looking ahead, the implication of the current economic slowdown for business investment is that it is highly likely to fall, although not necessarily as a share of GDP. Moreover, a prolonged recession is likely to have a more marked impact on the productive capacity of the economy as a result of capital scrapping.

- Recent data gives evidence of weakening cash flow in the manufacturing and services sectors, and declining business confidence particularly in sectors such as construction.
- July 2008 data show strongly negative trends, particularly in big ticket investments such as transport fleets and property (this is consistent with the Bank of England’s Agents Survey).
- British Chambers of Commerce (BCC) data suggests that SMEs are reducing investment in plant and machinery.
- At the same time, recent IFF data suggests that 36 per cent of respondents expected their budget for upgrading equipment to increase.

b) Innovation

Economic theory does not reach a strong conclusion regarding the impact of the business cycle on innovation.

On the one hand, it could be expected that innovation is procyclical to the extent that it is an investment. Strong demand should lead to increased investment, triggering demand for new processes leading to increased innovation activity, which is easier to finance when market conditions are favorable. However, the impact of innovation on business cycle is complex and depends on various factors such as the innovation driver (which can be interpreted as progress in technology, process and entrepreneurship).
growth is strong. The degree of cyclicalities of particular types of innovation depends upon the time horizon and the existence of adjustment costs.\textsuperscript{34}

On the other hand, some types of innovation could be countercyclical as their opportunity cost is lower when the return on production activities is lower as in a recession. Recessions could thus lead to greater involvement in innovation and reorganisation activities, particularly where these are not capital intensive\textsuperscript{35} as these yield higher returns over a shorter period of time.\textsuperscript{36} This development of new technologies, products and processes then could lead to investment in new plant, equipment and production capabilities.\textsuperscript{37}

The evidence regarding the impact of the business cycle on innovation is mixed. On balance, the evidence suggests that R&D is procyclical (particularly certain types such as smaller firm R&D programmes related to product and process innovation\textsuperscript{38}), but not strongly. It should be noted that cash-intensive but longer-term R&D investments (that yield returns over a longer period) are unlikely to be highly procyclical, but where programmes are less long-term, these could be more cyclical.

UK real business expenditure on R&D has been on an upward trend over the past 20 years, although falling as a percentage of GDP, but does not appear to track movements in GDP growth. At the same time, there is evidence to suggest that UK manufacturing investment in R&D (which accounts for the majority of measured R&D) exhibits some procyclicality, for example it stalled somewhat during the 1990-1991 recession.\textsuperscript{39} Additionally, there is evidence that tighter cash-flow in recessions has an impact on R&D undertaken by small firms, although this constitutes a small part of total business R&D. Results for other countries also provide a mixed picture.\textsuperscript{40}

There is a lack of good historical data on broader measures of innovation, which in the UK are based on relatively recent surveys of innovation behaviour. Research also does not give strong support to the proposition that broader innovation activities increase in recessions due to an opportunity cost effect.\textsuperscript{41} Recent work for ONS, HMT and BERR to

\textsuperscript{34} For instance, investment in R&D tends to have long horizons and high adjustment costs, although the greater importance of credit constraints and uncertainty in downturns do suggest some procyclicality.
\textsuperscript{35} For instance, advertising expenditures.
\textsuperscript{36} Aghion & Howitt (1998) \textit{Endogenous Growth Theory}
\textsuperscript{37} The observation of cyclicalities is complicated by feedback mechanisms, e.g. increased investment can lead to a virtuous circle of increased employment and demand, triggering further investment in innovation, i.e. procyclical innovation.
\textsuperscript{38} Investment in R&D tends to have long time horizons, so should not be affected by the business cycle, except that smaller firm R&D programmes are likely to be hit by cash flow problems in recessions.
\textsuperscript{39} BERR (2007) \textit{Intangible Investment In The UK market sector by industry}
\textsuperscript{40} See Saint-Paul (1993) and Guelles and Ioannides (1997)
\textsuperscript{41} Rafferty and Funk (2008).
estimate investment in intangibles shows strong historic growth for the UK, from 6 per cent of GDP in 1990 to 13 per cent in 2004, but their cyclicality cannot be inferred because in most cases the time series behaviour of the estimates is derived using industry turnover.

Some evidence from innovation event studies of major innovations and patents suggests that innovation is a ‘random walk’ (i.e. unpredictable), although there is some bunching during booms. As regards absorption of innovation, the evidence suggests that implementation varies procyclically with industrial growth rates.

Looking ahead, it is unlikely that there will be a drastic decline in R&D investment relative to GDP although there is considerable uncertainty owing to the specific combination of financial and economic conditions underpinning the current downturn:

- There is no reason to assume that the upward trend in R&D will be greatly affected by the slowdown since R&D investments tend to have longer horizons than a few years, and do not respond to changes in GDP growth or business sentiment, although a lengthy slowdown or expectations about one could begin to affect such plans.
- SME R&D is likely to be affected by cashflow problems while bank lending is restrictive, although this is not likely to have a big impact on total R&D unless large R&D-intensive firms also have cash problems. Recent evidence from the CBI suggests that the balance of small businesses (0-199 employees) expecting to increase expenditure associated with product and process innovation over the next 12 months has declined.
- The significant real growth in the science budget since 2002 suggests that UK science base outputs, such as its UK citation performance, should remain strong for the next few years.

c) Skills

The Skills driver focuses on the quality of labour inputs, an area where government has particular responsibilities. The multi-faceted nature of skills acquisition needs to be emphasised as individuals acquire skills through formal education, training, experience and other forms of informal learning.

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42 This category includes many innovation-relevant categories in addition to R&D (such as spend on computerised information, IP, design etc.) and therefore is more likely to capture innovation investments across a range of sectors.
44 Geroski and Walters (1995)
45 Davies (1979).
46 Skills include all individual capabilities relevant to production, including management.
Economic theory does not generate strong implications for investment in skills, as there are two counteracting effects. Investment in skills could rise since the opportunity cost of education and training (i.e. wages) tends to decline in recessions. However, it could also fall as the ability to pay for it declines (due to large direct costs and the inability of individuals to borrow to finance education using future earnings as collateral). Lengthy periods of unemployment could also lead to deterioration in the stock of human capital and the productive capacity of the economy, which could have persistent effects into the next business cycle.

There is limited data on skills acquisition over the business cycle, and much of the evidence comes from the US. The available empirical evidence suggests that college enrolments are countercyclical\(^{47, 48}\) and volatile, and that both on and off-the-job training are weakly countercyclical.

There is also evidence that the impact of the business cycle is symmetric, i.e. both expansions and contractions in output have a similar impact in terms of absolute magnitude.\(^{49}\) Evidence from other countries suggests that enrolment is countercyclical for OECD and procyclical for non-OECD countries.\(^{50}\)

There is evidence from the US that investment in both on and off-the-job training is weakly countercyclical, and can be volatile.\(^{51}\) UK data suggests that the rate of growth of business training expenditure only slowed marginally during the recession of 1990-1991.\(^{52}\)

There is evidence that supports the reverse causality between skills acquisition and the business cycle, i.e. that investment in skills can affect output growth and generate persistence in cyclical movements, and that skills shortages can make a recession deeper and longer.\(^{53}\) Over the 1970s and 1980s, skill shortages accelerated the pace of slowdown in the economy and acted as a drag on the recovery. Shortages pushed up wages, which contributed to employers shedding labour.\(^{54}\)

Looking ahead, the empirical evidence suggests that levels of education and training could be maintained over the downturn, but high levels of persistent unemployment could lead to the deterioration of skills (as

\(^{47}\) The results suggest that opportunity cost considerations outweigh ability-to-pay considerations.
\(^{48}\) Dellas and Sakellaris (1996); DeJong and Ingram (2001); Clark (2002)
\(^{49}\) Dellas and Sakellaris (1996)
\(^{50}\) Sakellaris and Spilimbergo (2000). The authors interpret this finding as suggesting that OECD countries have better functioning labour markets allowing young individuals to make easier transitions between work and education and so making the opportunity cost to education more cyclical. Also, it is likely that the ability-to-pay element is less cyclical in the OECD countries due to higher level and lower volatility of income per family and of national sources devoted to support study.
\(^{51}\) Sepulveda (2004) finds that it had a standard deviation more than ten times that of output.
\(^{52}\) Felstead and Green (1994)
\(^{53}\) Perli and Sakellaris (1998)
\(^{54}\) Blake et al (2000).
human capital deteriorates). It is also possible that firms will move towards short-term working, given weaker demand in the recession. Recent evidence provides a mixed picture as regards the impact of the downturn on training:

- CBI surveys of manufacturers show expected investment in skills holding up as in the coming year more firms expect to increase rather than reduce skills spending.
- BCC data suggest that SMEs in the manufacturing and services sectors are reducing investment in training.\(^{55}\)

**d) Enterprise\(^{56}\)**

Our analysis of the impact of the business cycle on the Enterprise driver focuses on new firm formation to take advantage of market opportunities.\(^{57}\)

Evidence on net firm formation and its determinants over the business cycle is limited\(^{58}\) and needs to be treated carefully.\(^{59}\) It can thus be difficult to predict the impact of recession on business formation and the number of enterprises.

The economic downturn is expected to lead to a decline in the number of business start-ups due to lower demand, increased financial constraints and increased risk. However, this could be offset if those who become unemployed increasingly use self-employment as a means to remain in the labour market – there is evidence that this happened during previous recessions.\(^{60}\)

Data from the previous UK recession (1990-1991) suggests that the stock of SMEs declined from about 3.8m in 1990 to 3.5m in 1992. There was then a gradual recovery, but between 1995 and 2002 the number of UK businesses remained relatively stable, with slower trend growth over the 1990s relative to the 1980s. More recently there has been significant growth. By the start of 2007 the number of enterprises had risen to 4.7 million, a rise of 880 thousand (23 per cent) in just five years.\(^{61}\)

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56 Enterprise can be defined as the seizing of new business opportunities, both by start-ups and existing firms. It can be viewed as a process of dynamic competition (“creative destruction”)\(^{56}\) whereby firms enter the market with new technology or work practices and compete with existing more mature firms.

57 Enterprise is more widely defined as the seizing of new business opportunities, both by start-ups and existing firms. It can be viewed as a process of dynamic competition (“creative destruction”)\(^{57}\) whereby firms enter the market with new technology or work practices and compete with existing more mature firms.

58 ONS data based on the Business Register is not available prior to 2000, but the VAT registration series is available for much longer.

59 For instance needs to take account of changes in the taxation regime.

60 Blanchflower and Shadforth (2007).

Looking ahead, the available evidence makes it difficult to make predictions regarding the impact of the business cycle on business formation and the stock of businesses:

- In September to November 2008, there were 3.812 million self-employed people in the UK; showing no change from the previous quarter but 13,000 (-0.3 per cent) lower than the same period last year.\(^{62}\) Self-employment is still high compared to past levels.
- There is always significant churn in the stock of SMEs, with both start-ups and closures remaining quite close to their 20 year mean between 1988 and 2008Q2 even during the last recession.\(^{63}\)

**e) Competition\(^{64}\)**

The competition driver captures the degree to which UK markets are competitive, flexible and open.

There are a number of issues regarding the analysis of the impact of the business cycle on competition. First, the degree of competition is difficult to measure, and traditional measures based on domestic industrial concentration ratios are increasingly irrelevant in an open economy. Moreover, measures based on mark-ups (capturing the intensity of competition) are imperfect because they cannot distinguish between market power and product quality effects. In addition, changes in the trade in goods and services over the business cycle do not necessarily represent evidence of the intensity of competition at a given stage of the business cycle, as these could be determined by other factors, such as changes in exchange rates.

Economic theory does not generate strong conclusions regarding the impact of the business cycle on competition. Competition could increase initially due to lower demand, but could then decline in specific markets due to firm exit.

Similarly, the theoretical implications of the business cycle on the business environment, which in turn influences market competitiveness, are not clear. Indicators of the business environment could improve in recessions, for example less congestion on roads, weaker upward pressure on wages and prices, and lower tax rates. At any rate, international differences in macroeconomic conditions could dominate changes in international measures of national competitiveness. The intensity of trade in both exports and imports will be affected, but there needn’t be any net impact on the degree of competition in the domestic

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\(^{62}\) Labour Force Survey, seasonally adjusted data.

\(^{63}\) Barclays Bank.

\(^{64}\) Competition can be interpreted broadly as all the factors which determine the business environment. Competitive and flexible product markets enable a more efficient allocation of resources, but the impact of competition on innovation can be complex, and there can be short term tradeoffs between labour market flexibility and productivity.
economy. As far as the regulatory environment is concerned, there is no reason why this should be affected. Moreover, the competition regime has in-built flexibilities enabling account to be taken of the present difficult circumstances. For example, the OFT has recently issued a restatement of its ability to allow a merger where the alternative would be for the target business to exit the market because any harm to competition could not be attributed to the merger.

The data suggests that the weakness of the UK’s macroeconomic climate was the primary factor in the UK falling from 9th to 12th in the WEF’s Global Competitiveness Report 2008-2009.65

Looking ahead, it is difficult to make any predictions on the impact of the downturn on competition. On the one hand, competition could increase as there is pressure on prices and margins, whilst, on the other, increased exit of firms can reduce the degree of competition. Furthermore, competition authorities may have to be more vigilant, as recession may increase the incentive for firms to engage in anti-competitive behaviour, as shorter-term considerations take on greater prominence in firms’ decision-making processes.

2.3 Conclusions

On the basis of the results presented above, this section puts forward some tentative conclusions about the likely effect of the business cycle on productivity and its drivers over the next few years, flagging potential concerns:

- **Productivity:** The weakening of productivity indicators in the short term does not imply that underlying productivity is affected. However, there are good reasons for fine tuning policies as the following points demonstrate.

- **Investment:** Problems with the availability and cost of finance during the downturn are likely to add an extra constraint to investment expenditure, particularly among SMEs. This could mean that business investment as a proportion of GDP declines more rapidly than output, and should therefore be closely monitored. Increased capital scrapping over the downturn is likely to fuel investment during the recovery.

- **Innovation:** There is unlikely to be a drastic decline in R&D investment as a proportion of GDP, but specific types of R&D in specific sectors by specific types of firms (e.g. SMEs) could be affected. To protect R&D budgets in the downturn, policy needs to target high-risk areas where capabilities could be irreversibly lost.

65 [http://www.weforum.org/pdf/GCR08/GCR08.pdf](http://www.weforum.org/pdf/GCR08/GCR08.pdf)
(such as R&D investments with strategic importance). Broader types of innovation activity could increase over the downturn as firms seek to develop the innovative new products and processes necessary for survival and growth in the recovery. There may be potential for policy to encourage firms to use their spare capacity to explore broader types of innovation activity during the slowdown, such as engaging with the workforce, suppliers and customers to identify potential new goods and services.

- **Skills:** There could be an increase in enrolment education (such as universities or Further Education) and on-the-job training by firms. Indicators such as highest qualification, training expenditure per capita and expenditure on educational institutions should be closely monitored. Policy could encourage firms moving to short-time working to use their spare capacity to offer short-term intensive training for employees, given that the relative return on non-production activities (in terms of return on production activities) including training is higher in recessions.

- **Enterprise:** While firm failure rates increase in a downturn, rates of new firm formation could hold up, for instance as those who have lost their jobs seek new opportunities. Given problems with availability and cost of finance (especially for SMEs), the relevant indicators (venture capital investments as a proportion of GDP and total term lending to businesses with turnover £1m or less) need to be closely monitored. Moreover, given the expected rise in transitions to self-employment in specific sectors, there may be a more pronounced role for government during the downturn to help with transitions.

References


3. Investment

3.1 Introduction

The Investment driver has, in the past, focused on physical capital investment by business and government. Investment in physical capital helps to raise productivity through two main routes: capital deepening and the incorporation of new technology. Business investment directly increases the amount of capital available per worker, usually with the aim of increasing output per worker. Government investment may also take the form of providing public goods such as transport infrastructure and securing natural capital (such as clean air and water).

While physical capital investment is important, business and government also make many intangible investments. For example, businesses invest in intangible assets such as intellectual property, branding, software, organisational and process improvements, whilst government invests in social infrastructure. There is evidence suggesting that intangible investments are now larger in scale and are as important to productivity growth as tangible investment.67

3.2 What drives investment?

The following section explores academic evidence on the impact of investment on productivity growth, and investigates the key variables that influence investment and their linkages with the drivers of productivity.

The contribution of investment to productivity has been investigated in growth models. Solow’s (1956) model68 argues that investment could only contribute to growth in the short run due to diminishing returns to capital. Later models69 argue that investment could affect the long term productivity growth rate (for example through human capital and R&D spillovers). Empirical investigations of the contribution of investment tend not to support increasing returns to capital, although there is evidence that spillovers operate.70

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67 See HMT (2007). This paper finds that treating expenditure on intangibles as investment rather than intermediate consumption would have increased the estimated growth in labour productivity and capital deepening.
Business investment

Business investment has historically been measured as physical capital such as plant, machinery, and ICT equipment. However, business investment in intangibles is increasingly important. This includes investments in intellectual property (e.g. R&D), software, branding, process improvements and human capital (e.g. training).

Over 2000-2004, the British economy experienced annual growth in labour productivity of 2.5 per cent. Of this, 1.2 per cent could be attributed to increases in the quantity of capital in use (capital deepening) while 0.3 per cent could be attributed to improvements in the quality of labour (human capital deepening). Preliminary work using intangible assets in a growth accounting framework suggests that intangible investment accounted for around 0.7 per cent of this growth in productivity.

The key factors determining business investment decisions are the expected return on the investment, the planning horizon, and the perceived risk of investment.

The scale and location of business investment depends on the business strategies adopted by firms, with ambitious firms that aim to grow strongly being more likely to invest. The level of business investment is also affected by the UK business environment, which is affected by the cost of doing business, the quality of infrastructure, the taxation system and macroeconomic, political and policy stability. Investment is also dependant on domestic and international competition and opportunities. Many of these factors can be influenced by government. However, it is not just the level of investment that is important; it is how that investment is integrated into economic activity (see Box A).

Box A: ICT and Productivity

Official statistics show that investment in Information and Communication Technology (ICT) in the UK has more than doubled between 1992 and 2004 from some £13.1bn to £28.8bn. ICT can contribute to productivity growth in two ways. First, investment in ICT raises the level of capital and technology which workers have available to them. This is referred to as capital deepening. Second, ICT enables firms to develop more efficient and profitable business models and practices. Investment in ICT has been found to have a greater impact

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21 http://www.hm-treasury.gov.uk/d/pbr_csr07_macroeconomic333.pdf
22 See footnote 13.
23 This includes telecommunication and computer services, office machinery and computers and other ICT.
24 Empirical studies showing the positive impact of ICT on productivity can be found in Raising UK Productivity: Unlocking the potential of information and communication technology (ICT), June 2007, DTI, Information Age Partnership.
on productivity when it complements investment in skills and changes in firm organisation structures.\textsuperscript{75}

Investment in digital technology and networks – and in particular first and next generation broadband networks – can also promote productivity.\textsuperscript{76} For example, broadband enables knowledge of new ideas and technologies to be diffused rapidly among firms and research institutions facilitating further innovation. Broadband can also encourage stronger competition since it reduces the costs to consumers of searching and obtaining information on different goods and services and allows them to purchase these on-line, often at prices cheaper than in the high-street.

Access to natural resources has implications for the level of business investment, and inefficiency in using (scarce) natural resources, raises costs for business. High prices for land and raw materials will tend to reduce the returns to investment. Hence, it is important to note the role of natural capital as a contributor to the economy and prosperity.

**Agglomeration**

Investment decisions can also be influenced by agglomeration benefits (the benefits from locating near competitors, customers and employees). These can arise due to economies gained from increased density such as input sharing,\textsuperscript{77} labour market pooling,\textsuperscript{78} and knowledge spillovers.\textsuperscript{79} Investment in infrastructure can improve the gains from agglomeration, for example, by providing greater connectivity and relieving congestion. The planning system plays a key role in facilitating agglomeration, such as through the development of clusters of economic activity.

**Inward investment**

An important contribution to investment in the UK is made by foreign investors (Foreign Direct Investment, FDI), either through the creation of new businesses or Mergers and Acquisitions (M&As). UK Trade and Investment (UKTI) has identified a number of factors which affect the attractiveness of the UK economy as an investment location.\textsuperscript{80} These include the general business environment, the availability of skilled

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\textsuperscript{75} CEP Discussion Paper no 788, April 2007, Americans do I.T Better: US Multinationals and the Productivity Miracle, Nick Bloom, Raffaella Sadun and John Van Reenen.

\textsuperscript{76} Some studies on the links between broadband and productivity can be found in *Pipe Dreams: Prospects for next generation broadband deployment in the UK*, April 2007, Broadband Stakeholder Group.

\textsuperscript{77} Romin and Albu (2002) discuss a case study of the IT and software industry in the Oxfordshire and Berkshire area which supply IT and software firms in the area with new ideas and innovations, their study also extends to other Marshallian factors.

\textsuperscript{78} Ciccone (2002) and Harris and Ioanides (2000) find evidence of a positive impact of employment or population density on productivity controlling for differences in human and physical capital.

\textsuperscript{79} Lucas (1988) and Romer (1990) find that workers learn form each other and become more productive when they work with skilled workers.

labour, the strength of the R&D base, the position of English as the international language of business (and the wide range of other languages spoken in the UK), the tax and regulatory regime, and ‘softer’ factors such as diversity of cultural mix, lifestyle and education system.

Hubert and Pain’s (2000) investigation of the impact of FDI on technical progress and labour productivity in the UK manufacturing sector gives evidence that there are both within and across industry spillover effects from FDI. There is a substantial literature suggesting that openness to inward investment is a significant factor in increasing aggregate productivity growth. The ability of innovative and technology-based firms to enter, grow and develop is a particularly important contributor to aggregate productivity growth. Recent research\(^{81}\) has shown that aggregate productivity growth comes not only from productivity improvements within incumbent firms, but also through “dynamic competition” effects from changing market shares, entry and exit (see also Chapter 7 on Competition).

**Infrastructure**

Infrastructure, like business investment, can take on physical and intangible forms. Physical infrastructure includes transport (such as roads, railways and airports), ICT systems, utilities (water, waste generating plants, distribution facilities) and other energy infrastructure. Intangible investment includes functions such as social infrastructure\(^{82}\) – for example, job matching people and employers.

Economic growth increases the demand for infrastructure, and the need for increased investment in infrastructure. Government has prime responsibility for investment in infrastructure such as schools, rail, roads, but private sector investment, for example, in airports and ports, is also important.

Government policy has a major impact on the level of infrastructure, either through its own expenditure or through environmental and planning regulations. For example, the planning system, which aims to manage the environmental impact of investment, could influence the types of investment made, and the costs of investing in new businesses. The impact of planning on productivity is explored further in Box B.

**Box B: Planning and Productivity**

The planning system has an impact on productivity through each of the five drivers, most directly through its influence on investment decisions.

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\(^{81}\) See DTI Economics Paper No. 18.
\(^{82}\) Social infrastructure refers to the institutions, networks and policies that are in place to support and facilitate economic activity. This can range from networks that facilitate economic activity (for example, the role of Job Centre plus in job matching) to protection of rights (for example law enforcement).
In addition, the planning system seeks to balance economic growth against wider sustainable development goals. Land is a scarce resource subject to competing demands. However, some uses of land impose externalities, involving significant differences between private and social interests in land development. If left unregulated, land tends to become overdeveloped, and free space undersupplied, a market failure which government addresses with planning regulation.

The planning system can increase productivity by providing certainty for investors and reducing planning and development costs. For instance, recent reforms set out in the Planning Act 2008 will facilitate large-scale investment by creating a faster and more certain regime for delivering critical infrastructure projects. However, inefficiencies in the system (e.g. lengthy and complex planning processes) can have a negative impact on investment, enterprise and productivity:

- Innovation may be restricted if the built environment does not facilitate new ways of working;
- Competition may be weakened if entry is limited as a result of the planning system;
- Incumbent firms may have an unfair advantage in dealing with overly complex rules and procedures.\(^83\)

The recent Killian Pretty Review\(^84\) sets out a set of recommendations to improve the operation of the planning system, including recommendations to address unnecessary complexity in the planning application process. For example, removing 40 per cent of minor commercial planning applications from the planning system altogether is estimated to result in savings of around £300m to the UK economy and help local authorities to focus their resources on the remaining, more complex applications.

Investment in infrastructure is unlikely on its own to raise productivity, but can play an important role in supporting and facilitating other economic activity. According to a survey of macroeconomic studies by the European Commission,\(^85\) the majority of studies found positive impacts of improved infrastructure on productivity (such as roads, harbours, railways and bridges), although in most studies the effect was not strong. The impact of transport infrastructure on productivity is explored further in Box C.

There is evidence to suggest that failure to invest in the maintenance of infrastructure has a significant negative impact on economic growth, compared to the smaller positive impact of increased investment.

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\(^{83}\) ECOTEC Research and Consulting Ltd and Roger Tym and Partners, Planning for Economic Development: A report for the Office of the Deputy Prime Minister (2004), pp 9, 81


According to Mattoon (2004), the rate of return on maintenance of US highways was as high as 35 per cent, while the return on new highway capital investments was just 5 per cent. This is consistent with the findings in the Eddington Transport Study. This found that in developed economies like the UK, where there are well-established networks and good connectivity between economic centres, there is less scope for big transport projects to contribute to productivity growth, but that the focus should be on maintaining the performance of the existing network. At the same time, the report notes that transport policies offer some remarkable economic returns with many schemes offering benefits several times their costs.

There appears to be a positive relationship between ICT infrastructure and ICT enablers (complementary factors such as skills development, innovation policy and business environment promoting ability to harness ICT for economic gain, which the UK performs well on). There are many examples of how ICT has improved firm performance, but productivity research indicates that it is most effective when used in conjunction with the enhancement of firm skills and firm organisation.

<table>
<thead>
<tr>
<th>Box C: Transport and Productivity</th>
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| Investment in transport infrastructure can improve productivity by reducing travel time, effectively increasing the size of an economic area. The Eddington Study identified that transport can influence productivity through seven mechanisms:

- Increasing business efficiency, through time savings and improved reliability for business travellers, freight and logistics operations.
- Increasing business investment and innovation by supporting economies of scale or new ways of working.
- Supporting clusters and agglomerations of economic activity. Transport improvements can expand labour market catchments, improve job matching, and facilitate business to business interactions. Transport’s contribution to such effects is most significant within large, high-productivity urban areas of the UK.
- Improving the efficient functioning of labour markets, increasing labour market flexibility and the accessibility of jobs. Transport can facilitate geographic and employment mobility in response to shifting economic activity, for example in response to the forces of globalisation, new technological opportunities, and rising part-time and female participation in the labour market.
- Increasing competition by opening up access to new markets. Transport improvements can allow businesses to trade over a wider area, increasing competitive pressure and providing

86 The Eddington Transport Study, December 2006
87 Economist Intelligence Unit (2004).
88 Taken from [http://www.dft.gov.uk/about/strategy/transportstrategy/hmtlsustaintransys?page=7](http://www.dft.gov.uk/about/strategy/transportstrategy/hmtlsustaintransys?page=7).
consumers with more choice.
- Increasing domestic and international trade by reducing the costs of trading.
- Attracting globally mobile activity to the UK by providing an attractive business environment and good quality of life.

3.3 Progress

The following section reports on progress on UK investment.

**The investment record**

Business investment has increased by 50 per cent since 1997. However, it has started to slow as output growth has fallen in the downturn. Business investment in physical capital tends to be procyclical, falling and rising with output.

Figure 3.1 illustrates that business investment as a percentage of GDP in current prices is historically low, but this, in part, reflects the fall in the relative price of investment goods over the last 10 years. This trend holds for other countries, particularly the US. However, on international comparisons, UK business investment is relatively low. This is a key contributing factor to the productivity gap with international competitors measured in terms of output per worker (see Chapter 1, Figure 1.2). However, this ignores many intangible investments, which will tend to be higher in economies such as the UK that are relatively service intensive.

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**Figure 3.1: Business investment**

*Comparison, 1992-2007*

*Per cent of GDP in current prices*

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89 http://www.hm-treasury.gov.uk/d/productivityintheuk7141207.pdf
There is also evidence that government investment has increased over recent years. Figure 3.2 demonstrates that the UK leads Germany in terms of government investment as a proportion of GDP but still lags behind the US and France.

**Figure 3.2: Government investment**
*Comparison, 1992-2007*
*Per cent of GDP in current prices*

There have been significant private and public investments in new infrastructure, such as Heathrow Terminal 5, five offshore windfarm projects with funding from the Offshore Wind Capital Grants Scheme have been completed,⁹⁰ and also in improving the use of infrastructure (for example the congestion charge in London) in recent years.

The UK’s attractiveness as a destination of FDI can be illustrated in Figure 3.3 which illustrates that the UK had a higher stock of inward investment as a proportion of GDP in 2007 relative to the US, France and Germany. As suggested in section 3.1, there is evidence that foreign direct investment and multinational enterprises – particularly those from the United States – have also contributed to productivity growth, by facilitating the transfer of new technologies

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The macroeconomic environment

Over 1997-2007, the UK enjoyed a period of unprecedented macroeconomic stability relative to its competitors, as demonstrated by lower volatility of GDP growth (See Figure 3.4). However, recent global economic difficulties, namely the credit crisis and the increase in commodity prices, have had a marked impact on the macroeconomic performance of a number of economies, including the UK.

Weak macroeconomic stability was identified in the 1980s and 1990s as a key barrier to investment growth. Whilst macroeconomic stability has
improved markedly since, recent uncertainty in the financial sector had a marked impact on the macroeconomic performance of a number of economies. Nevertheless, as illustrated in Figure 3.5, the volatility of interest rates in the UK has been lower than for international competitors.

Figure 3.5: Volatility of short-term interest rates
Comparison, 1992-2007

Coefficient of variation

The Government has put in place rules and institutions to enhance UK’s macroeconomic environment for business investment. In 1997 monetary policy was handed over to the Bank of England for independent setting of interest rates\(^{91}\) and in 1998 the Government’s fiscal framework (*Code for Fiscal Stability*) was approved by the House of Commons. The Code for Fiscal Stability requires the Government to set out its fiscal objectives and operating rules, providing flexibility for the Government to either change its rules or depart from them on a temporary basis to ensure that at all times they are appropriate to deliver the objectives, particularly in times when economic circumstances change significantly. PBR 2008 announced a temporary change to the fiscal operating rules to take account of the global shocks that are currently working their way through the economy.\(^{92}\)

The Government has committed to provide a stable policy environment, with the majority of new regulations affecting businesses being introduced on only two dates in the year, to allow for businesses to plan ahead. Figure 3.6 shows that on ease of paying taxes, the World Bank’s

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\(^{91}\) [http://www.hm-treasury.gov.uk/press_64_97.htm](http://www.hm-treasury.gov.uk/press_64_97.htm)

\(^{92}\) [http://www.hm-treasury.gov.uk/d/pbr08_chapter2_228.pdf](http://www.hm-treasury.gov.uk/d/pbr08_chapter2_228.pdf)
Doing Business 2009 report ranks the UK 16 out of 181 countries (compared to ranks of the US – 46, Germany - 80, and France – 66).93

Figure 3.6: Ease of Paying Taxes measure (1=greatest ease)

Budget 2007 announced a range of tax simplification measures.94 The Government has also recently been looking at simplification of the tax system through a number of reviews, including VAT, anti-avoidance legislation and corporation tax rules for related companies.95 These factors all contribute to a more stable environment and in turn could influence positively business investment.

Government infrastructural policy to improve the business environment

Section 3.2 suggested that the quality of infrastructure, including physical infrastructure, is important for productivity growth. As shown in Figure 3.7, although road congestion started to get worse in 2006, there has been an improvement in road congestion since autumn 2007.96 As regards congestion in major urban areas in England, there has been a reduction of 2.4 per cent in the person journey times (minutes per mile) from 3.85 to 3.75 between 2004/0597 and 2006/07.

94 See http://www.hm-treasury.gov.uk/d/pbr_csr07_chapter4_p68_9.pdf. These measures include: (1) modernising and simplifying both the personal and business tax systems; (2) publishing the implementation plan for the 2006 Review of HM Revenue & Customs’ (HMRC) Links With Large Business; and (3) delivering £300 million of administrative savings to business, helping HMRC towards achieving its administrative burden targets.
95 http://www.hm-treasury.gov.uk/4064.htm
96 Figures 3.7 and 3.8 present data being used to monitor the Department of Transport’s PSA target (PSA 5). These indicators monitor the journey time reliability on the strategic road network, as measured by the average delay experienced in the worst 10 per cent of journeys for each monitored route (91 routes in total). For a list of all four indicators used to measure progress against PSA 5 see, http://www.dft.gov.uk/about/publications/apr/ap/autumnperformance08.pdf
Figure 3.7: Congestion on inter-urban roads

![Graph showing congestion levels on inter-urban roads over time](image)

Source: Department for Transport

Figure 3.8 illustrates the improvements made in rail performance across all operators over the period 2002/03 and 2007/08. Almost 90 per cent of trains across all operators arrived on time in 2007/08 compared with almost 80 per cent in the former period.

![Graph showing rail performance over time](image)

Source: National Rail Trends - Office of Rail Regulation

The Government has introduced a range of measures to help ease congestion. These measures include better public transport, congestion charging schemes and improvements to infrastructure.\(^{98}\) There is evaluation evidence\(^ {99}\) to suggest that there have been improvements to


\(^{99}\) Note: the evaluation does not provide evidence that this is specific to the road improvements.
journey times, reliability and also, in some cases, evidence of economic development.

A specific example is the opening of the Newbury Bypass scheme in 1998. An evaluation of the scheme completed five years after its opening\textsuperscript{100} provides evidence of reduced journey times and improved reliability, particularly for the haulage industry, with reduced journey times to the ports on the south coast.\textsuperscript{101}

A second example is the Channel Tunnel Rail Link, the first high-speed railway constructed in the UK. European Cooperation in the field of Scientific and Technical Research (1996) suggests that there are a number of benefits from the operation of the high speed rail link including: (1) immediate effects arising from a cut in generalised transport costs and thus an improvement in productivity; (2) benefits of reorganisation, or secondary benefits, with economies of scale enabling a bigger market to be exploited by a drop in the cost of access to the market and integration of the markets; and, (3) stimulative effects which mean increased competition between regions, with firms obliged to stick to the "learning curve" and thus increase their productivity.

There is some evidence of the economic impacts of these transport improvements. As noted in the Eddington Transport Study, small, strategic projects can contribute more to the economy especially where there is already an established transport network, but there can also be additional benefits where transport improvements lead to a ‘tipping effect’ i.e. journeys that were not viable before the improvement became viable.\textsuperscript{102} According to the Department for Transport (2005),\textsuperscript{103} overall reliability (as measured by excess journey time) improved in 2001/02 by nearly 7 per cent over the previous year. Also, the number of peak trains cancelled because of operator non-availability reduced by 80 per cent in the period between December 2000 and March 2002.

There has also been progress in setting out infrastructure plans for other supporting infrastructure, such as energy infrastructure. Government has set out a clear strategy for energy policy including the Energy White 2007\textsuperscript{104} to encourage private sector investment (for example through approval of planning for the construction of a combined heat and power station at Seal Sands, Teesside) and supporting development of new technologies to accelerate the commercialisation of low carbon energy and energy efficiency technologies in the UK. Examples of projects in the latter category include: Bio-energy Capital Grants and Bio-energy Infrastructure Schemes; Offshore Wind Capital Grants programme;
Carbon Trust’s innovation programme, including research accelerators, technology accelerators, and incubators.

**Economic impacts of investment**

There is evidence to suggest that improving infrastructure is contributing to the increased use and integration of ICT by business, which is contributing to productivity growth. A recent review of the ICT literature by SQW for BERR\(^{105}\) suggests that the adoption of ICT has made a significant contribution to the growth of productivity over the last ten years or more, primarily through its impact on TFP from spillover and network effects. Nevertheless, the US appears to have secured a stronger contribution from ICT in this regard compared with the UK and other European countries, partly because of the greater propensity amongst US firms to carry out frequent reconfigurations of their business operations and organisation which could be explained by greater proximity to the technology frontier and more competitive product markets.

As previously discussed, there is evidence that investment in new infrastructure and in improving existing infrastructure contributes productivity growth. Transport investment can improve productivity,\(^{106}\) by decreasing transport costs, allowing increased specialisation and economies of scale. Venables’ (2007) assessment of the impact of transport improvements suggests that they are quantitatively important.

Environmental initiatives can encourage productivity in those industries that are innovating and developing new technologies and also supporting the whole economy through provision of basic infrastructure and utilities. The impact of environmental initiatives is explored further in Box D.

**Box D: Environment and Productivity**

The Stern Review on the Economics of Climate Change\(^{107}\) set out the importance of taking early action to reduce carbon emissions and mitigating the effects of climate change for long-term economic growth. The need to adapt to the irreversible impacts of climate change that have already occurred will put further pressure on already scarce resources such as clean air, increasing the importance of resource efficiency. A well-known approach being implemented to protect scarce natural resources is the EU Emissions Trading Scheme (EU ETS) that released tradable permits for carbon emissions. This approach addresses concerns with scarce resources and contributes to productivity by

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\(^{105}\) See BERR Occasional Paper No. 3, The Impact of Regulation on Productivity, Chapter 3.


\(^{107}\) [http://www.hm-treasury.gov.uk/stern_review_report.htm](http://www.hm-treasury.gov.uk/stern_review_report.htm)
avoiding the long-term detrimental impacts of climate change but also by allowing competition between sources for carbon abatement technologies.

Environmental objectives focus, to some extent, on using resources sustainably. This can mean that there are short term trade-offs between environmental and economic objectives. For example, strict environmental regulations intended to promote the sustainable use of resources could potentially have a negative impact upon productivity growth in the short-term.

Although there could be some short-term costs to environmental regulation, there is some evidence to suggest that there are potentially significant positive impacts on productivity. According to the Porter Hypothesis, strict environmental regulations can generate efficiency of production processes and encourage innovations that help improve commercial competitiveness, thus having a positive impact on productivity that outweighs any negative impact of compliance costs.

SQW (2006 and 2007) explores situations where ‘win-win’ outcomes could be achieved through environmental regulations (i.e. regulation generating positive income, output and productivity effects at the same time as securing the intended environmental outcomes). The study finds that such outcomes are possible but emphasises that these are not systematic but depend on the nature and design of the regulation and the conditions in which they are applied.

More specifically, SQW (2007) suggests that the impact of investment in environmental technologies on productivity growth depends on three factors: (1) the nature of the investment; (2) the form of environmental regulations; and, (3) the relative costs, returns and risks of environmental and competitive technologies at the point when capital replacement is considered. Regarding the first point, clean or cleaner technologies could provide the opportunity to change existing production/service delivery processes with the potential for radical improvements in productivity as conventionally measured. As regards the form of regulation, some regulations will tend to prompt adoption of end-of-pipe technologies (e.g. catalytic converters) whilst others may ‘force’ certain technological solutions or provide for more flexible responses (e.g. renewable fuels). Relative costs, returns and risks are an important consideration as firm decisions may be driven by their historic market, institutional and regulatory characteristics; hence this could make it difficult for some new technologies to compete.

As well as the ongoing development of the policy framework to protect the environment, the Government has committed to bring forward a Low Carbon Industrial Strategy in 2009. In light of the legal commitments that UK has made to reduce of carbon emissions by 80 per cent by 2050,
this strategy will set out the role that the Government has to play in making the transition to a low-carbon and more resource-efficient economy as smooth and as cost-effective as possible.

Summary assessment

The evidence presented in this chapter suggests that the UK continues to perform well in the investment area relative to comparator economies. The UK scores well in terms of macroeconomic stability relative to comparator countries as demonstrated by a lower volatility of GDP growth and a lower volatility of interest rates. Moreover, UK businesses enjoy a lower relative regulatory cost burden. The above factors have been instrumental in making the UK an attractive destination of inward investment. Furthermore, there is evidence to suggest that there has been progress in terms of improvements in the quality of infrastructure, for example, improvements in rail and road performance in terms of reliability and reduced congestion and journey times. At the same time, the evidence suggest that there is still scope for further improvement in some areas, such as business investment, which could be a key contributing factor explaining UK’s productivity gap with international competitors.

References


Department for Transport (2005), ‘Delivering better transport: progress report’.


Information Age Partnership (2007), ‘Raising UK Productivity: Unlocking the Potential of Information and Communication Technology (ICT)’.


The Economist Intelligence Unit (2004), ‘Reaping the benefits of ICT Europe’s productivity Challenge’.

4. Innovation

4.1 Introduction

Innovation is the successful exploitation of new ideas.\(^{108}\) As defined by the OECD and the European Commission,\(^{109}\) innovation can take place through the implementation of:

- new or significantly improved products (either goods or services);
- new processes (such as a production or delivery method);
- new marketing methods (involving product design or packaging, product placement, product promotion or pricing); or
- new organisational methods in business practices, workplace organisation or external relations.

Innovation involves the creation of new designs, concepts and ways of doing things, their commercial exploitation, and subsequent diffusion throughout the economy and society. Since long-term economic growth mainly derives from productivity growth, the exploitation of innovation is critical in ensuring that the volume and quality of goods and services produced in the economy can grow by more than just the volume of the resources used. This paves the way for sustained improvements in economic well being. According to the March 2008 Innovation Nation White Paper,\(^{110}\) the UK must excel at all types of innovation if it is to raise productivity, foster competitive businesses, meet the challenges of globalisation and live within its environmental and demographic limits.

The measurement of innovation has evolved significantly over time, both in recognition of its overall importance to society, but also in response to the need to reflect the wider range of innovative activities outside the traditional technological domain and the rapidly changing patterns of innovation. This increasing interest in innovation measurement is demonstrated by ongoing work by a range of innovation reporting initiatives by the likes of the US Department of Commerce,\(^{111}\) the European Commission,\(^{112}\) the OECD\(^{113}\) and the UK

\(^{108}\) “Competing in the global economy: The innovation challenge.” DTI, December 2003
\(^{111}\) The advisory Committee on Measuring Innovation in the 21st Century, 2008, Innovation Measurement; Tracking the State of Innovation in the American Economy; A Report to the Secretary of Commerce, p.7
\(^{112}\) As part of its European Innovation Scoreboard. See for example http://www.proinno-europe.eu/admin/uploaded_documents/European_Innovation_Scoreboard_2007.pdf
\(^{113}\) As part of its work for an Innovation Strategy.
National Endowment for Science, Technology and the Arts (NESTA), which is currently designing an “Innovation Index”.114

4.2 What drives innovation?

This section explores the evidence regarding how innovation can impact on productivity growth and investigates some of the most important factors that influence innovation.

**Innovation and productivity growth**

The performance of an innovation system – namely the set of actors (e.g. firms, individuals), institutions, markets and networks which jointly and individually contribute to the development and diffusion of innovations – can be assessed by its capacity to generate innovation and translate that innovation into economic growth.

There are several strands of economic theory that describe the relationship between innovation and productivity growth. One strand115 posits that long-term growth follows from independent innovations that raise the overall efficiency with which inputs such as labour and physical capital are used. This prevents the deceleration in productivity growth that would result from not being able to raise all inputs indefinitely, as decreasing returns to capital would limit growth in aggregate output. Another strand116 places a stronger emphasis on the role of profit-driven investment decisions in raising the stock of knowledge. These in turn increase the efficiency with which resources can be used, so that the economy enjoys constant returns to scale with respect to a wider notion of capital including knowledge, which can be accumulated and sustain constant growth over time. Despite their differences on what are the fundamental drivers of innovation, both strands coincide on the importance of new knowledge diffusion, from the original ideas or inventions, to the rest of the economy.

**Research & Development**

Empirical studies have traditionally focused on the analysis of R&D expenditures to quantify the effect of innovation on productivity. This largely owes to the fact that there is a well established framework for measuring R&D expenditures. This has been highly influential in providing the evidence on market failures in scientific and technological knowledge investment, as demonstrated by the pervasiveness of public support of R&D across developed countries. Other measures for

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114 In the 2008 DIUS White Paper on innovation, John Denham, the Secretary of State for Innovation, Universities and Skills, charged NESTA with producing an Innovation Index to measure the UK’s performance as an innovation nation.
115 See for example Solow, 1956.
116 See for example Aghion and Howitt, 1992.
innovation are probably not as well developed and not as uniformly used across countries or companies.\textsuperscript{117}

A number of studies have documented a robust positive relationship between R&D expenditure and productivity at various levels of aggregation, namely at the firm, sector or country level. Estimates of the private rate of return to R&D across a number of countries (including the US and UK\textsuperscript{118}), suggest that the elasticity of output with respect to R&D is around 0.07.\textsuperscript{119} This translates into a gross rate of return of around 27 per cent for R&D, a relatively large return but likely to be in proportion to the higher risks and obsolescence of knowledge relative to many other assets. Hall (1996) reports estimates of private rates of return to R&D around 10 to 15 per cent although, in some studies, estimates can be as high as 30 per cent. Griliches (1992) also finds the social rates of return to R&D substantially above private rates of return.

Following the early growth accounting literature, an increasing body of research aims to explicitly account for the role of knowledge accumulation in contributing to productivity growth as a way of providing further insights into the impact of innovation on productivity. The logic behind this is that knowledge accumulation can in principle be treated like any other form of capital formation. Expenditures like business R&D, which in turn are driven by expectations of future economic benefits to business, are currently captured in official statistics as operating expenses such as electricity or material inputs. These expenses, on a purely accounting basis, do not directly contribute to the measure of GDP as they are netted off from output when estimating value added.\textsuperscript{120}

Following the 2008 revision of the UN System of National Accounts, R&D is to be treated as capital formation of an intangible asset. The EU Commission is currently in the process of deciding how this methodological change will be implemented through a Satellite R&D account that will, in the interim, coexist with the existing reporting framework. A preliminary assessment\textsuperscript{121} of what the UK economy would look like if R&D were to be treated as capital formation suggests that capitalising R&D raises the level of UK GDP by approximately 1.5 per cent, but has hardly any visible impact on the estimates of recent GDP growth because of the subdued behaviour of R&D expenditures, particularly amongst businesses. The main shortcoming of this ‘accounting’ approach is that it still excludes the impact of R&D spillovers from an estimate of the contribution of R&D knowledge accumulation to economic growth.

\textsuperscript{117} For a review of innovation measures used by companies, see McKinsey (2008).
\textsuperscript{118} For example Griliches (1992) uses US firm-level data.
\textsuperscript{119} This implies that for a 10 per cent increase in R&D expenditure there will be a 0.7 per cent increase in output.
\textsuperscript{120} Conversely, expenses that qualify as fixed capital investments are not deducted from output, but are subject to depreciation which is then reflected in measures of net value added and national income.
\textsuperscript{121} Galindo-Rueda (2007)
**Broader investment in innovation**

For an innovation to be developed and implemented, businesses need a range of resources, not just R&D. As reported by Robson and Haigh (2008), in addition to R&D expenditure, companies undertake a wide range of innovation expenditures including the acquisition of machinery, equipment and software, access to external knowledge, training, design and expenditures aimed at introducing innovations to the market such as market research and advertising for new products.

Capital investment such as machinery, equipment and software is the most often cited element of the underlying structure which needs to be in place to support innovation. This confirms the importance of ICT investment, since this not only facilitates communication but also the development of new products, processes and services. Furthermore, agglomeration patterns for innovative firms suggest that public capital infrastructure can also be an important factor for facilitating firms’ ability to innovate, given its importance in enabling access to markets, skills and knowledge which will help firms to innovate (see Chapter 3 on Investment for more detail).

Data on innovation expenditures also highlights the importance of skills (see Chapter 5 on Skills for more detail). Innovation and skills acquisition are well known to be complementary activities, since knowledge, unlike mere information, needs to be embedded in people in order to be effectively utilised. Skills, particularly managerial skills, are critical for the development of new ideas that can be commercially exploited and also to be able to use the new creations effectively. The lack of qualified personnel has also been identified in the UK Innovation Survey as the sixth main barrier to innovation, emphasising the importance for firms of employing people with the necessary skills and ensuring their capabilities evolve in line with changing business needs.

Non-technological innovation is also a major factor of competitiveness and productivity growth in the economy. The profile of innovation investment (see Figure 4.1) demonstrates the difference in R&D intensity across broad sectors in the economy, with Engineering based Manufacturing and Knowledge Intensive Services recording relatively high R&D intensity, while Construction, Retail and Other services exhibit much lower shares of their innovation investment in R&D.

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122 Computer hardware and software.
124 Along with access to finance and the need to meet UK and EU regulations.
Analysts are paying increasing attention to the extent and likely impact of intangible investments other than R&D. Marrano et al (2007a,b) suggest that intangible investment in the UK market sector in 2004 was £123bn, 28 per cent higher than the equivalent figure for tangible investment. They also show that intangible investment as a proportion of business output more than doubled between 1970 and 2004. According to provisional estimates by Clayton et al (2008) for NESTA, the accumulation of new knowledge through intangibles by the UK business sector may directly account for almost half of labour productivity growth over 2000-2005, a measure which does not account for innovation spillovers outside business.

Their measure of intangible investment covers software, R&D, architectural and engineering design, various forms of product development costs as well as training costs and an estimate of investment in organisational change and managerial capability. This exhibits a substantial overlap with the expenditure categories captured in Figure 4.1, although not all intangible investment is necessarily related to innovation and vice versa.

Organisational change is a notoriously difficult form of innovation to quantify. It closely relates to the enterprise driver of productivity, in that it should capture how individuals and businesses develop the
capabilities that enable them to take calculated risks to develop new products and bring them to the market. The ambitions and plans underpinned by business strategies can be an important factor for driving innovation, and these will often depend on the level of competition and the level of skills within the firm. Implementing new business strategies will not only impact on the products and services provided by firms, but also the way organisations are structured, and the way they interact with their customers.

'Open innovation', collaborations and user-led innovation

Because of the nature of knowledge arising from innovation, companies have sought to minimise the potential loss of value through spillovers. One strategy has been to internalise these effects by undertaking most innovation processes under one single ‘roof’. This has led to innovation often being described as an internal process, also called the ‘closed innovation’ model. According to this model, an innovating firm conducts the whole innovation process in-house, from the ‘upstream’ in which inventions take place through experimental R&D, to the ‘downstream’ in which development, manufacturing and marketing take place. As a representation of reality, this model was never accurate but has become increasingly outdated and replaced by more open models, in line with what the evidence shows about how innovation is being pursued.

‘Open innovation’ means that not only the innovating firm is involved in the process but also external parties such as suppliers, other firms in the same sector or universities. Companies can no longer afford to rely entirely on their own research, and hence buy or license-in processes or inventions (e.g. patents) from other organisations. Collaborations enable firms to address spillover and coordination problems, enabling them to acquire certain knowledge that they might not otherwise possess and to spread the risk of the innovation among different partners. Collaboration enables increased specialisation, an increasingly important priority for firms given the rising sophistication and complexity of various fields of science and knowledge. Collaboration and knowledge exchange are also being facilitated by technological changes, particularly those in the domain of ICT.

According to the 2007 Innovation Survey, 10 per cent of all enterprises had cooperation arrangements on innovation activities. The distribution of cooperation partners is described in Figure 4.2 below.

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126 It is often difficult to exclude others from accessing and using a given piece of knowledge, and knowledge is not depleted as it is used.
127 See for example Chesbrough (2003).
Suppliers and clients or customers make up the largest external resources which firms draw upon to innovate cooperatively. Universities and government or public research institutes are the less ‘popular’ choices as cooperation partners. The Innovation Survey asks for ranking of information sources for the innovation process on a scale from ‘no relationship’ to ‘high importance’; Figure 4.3 below shows the sources of information ranked as of ‘high importance’.

**Figure 4.3: Sources of information for innovation**

<table>
<thead>
<tr>
<th>Sources of information ranked 'high', Percentage of all respondents</th>
<th>Size of enterprise; employees</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10-250</td>
</tr>
<tr>
<td><strong>Internal</strong></td>
<td></td>
</tr>
<tr>
<td>Within your enterprise group</td>
<td>18</td>
</tr>
<tr>
<td><strong>Market</strong></td>
<td></td>
</tr>
<tr>
<td>Clients or customers</td>
<td>27</td>
</tr>
<tr>
<td>Suppliers of equipment</td>
<td>14</td>
</tr>
<tr>
<td>Competitors or other enterprises within your industry</td>
<td>10</td>
</tr>
<tr>
<td><strong>Institutional</strong></td>
<td></td>
</tr>
<tr>
<td>Universities or other higher education institutes</td>
<td>1</td>
</tr>
<tr>
<td>Government or public research institutes</td>
<td>1</td>
</tr>
<tr>
<td><strong>Other sources</strong></td>
<td></td>
</tr>
<tr>
<td>Technical, industry or service standards</td>
<td>6</td>
</tr>
<tr>
<td>Conferences, trade fairs, exhibitions</td>
<td>4</td>
</tr>
</tbody>
</table>
The customer role is becoming increasingly important. The term ‘user-led innovation’ has been coined to refer to innovation which is driven by customers to meet their needs, whereas ‘collective innovation’ implies that development of an innovation is accomplished by several individuals/organisations. Although it is difficult to think of innovations which do not aim to meet customers’ needs and draw on the available evidence on how to achieve this, it is apparent that users are now playing a more proactive role in shaping innovation. Clear examples for this are the online encyclopaedia Wikipedia and the open source software movement.

These ‘new’ approaches to networking/knowledge exchange can generate considerable economic returns. Examples include Toyota’s networked approach to innovation, which has resulted in suppliers having 14 per cent higher output per worker, 25 per cent lower inventories and 50 per cent fewer defects. Procter & Gamble’s ‘Connect and Develop’ strategy now produces 35 per cent of the company’s innovations and billions of dollars in revenue. Significantly, since 2000, its own spend on formal R&D as a percentage of sales has declined from 5-6 per cent to 3-4 per cent.

**Globalisation**

International competition is an important factor affecting the level of innovation in the UK. It will impact on whether firms decide if they want to locate in the UK to carry out their innovation, and where different parts of the delivery chain are located. Globalisation has also contributed to the spread of knowledge tasks across boundaries.

In line with the rising importance of global value chains, companies are increasingly internationalising their R&D supply chains and customer bases and adopting “open innovation” models that span across countries. The OECD compiled data for a number of member countries and showed that R&D expenditure under foreign control has gone up from US$33.5bn in 1995 to $69.3bn in 2003. Industrial R&D is in fact becoming internationalised, and over the last ten years has become the most dynamic activity of multinational companies, just behind mergers/acquisitions and international investment.

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<table>
<thead>
<tr>
<th>Scientific journals and trade/technical publications</th>
<th>3</th>
<th>4</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional and industry associations</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Source: Robson and Haigh (2008)

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128 See Chapter 4: User Knowledge and Innovation in BERR Economics Paper No. 1
129 See NESTA (2007)
130 BERR, 2008a
131 The group of countries includes US, UK, Germany, Japan, France, Canada, Czech Republic, Finland, Hungary, Ireland, Poland and Sweden. Figures reported in http://ec.europa.eu/information_society/istevent/2006/cf/document.cfm?doc_id=2087
The globalisation of innovation also follows from the increased international mobility of highly qualified individuals and the emergence of networks. For example, in the UK, over 40 per cent of scientific output over the last five years involved international collaborations.\footnote{BERR, July 2007, UK Science and Innovation at the heart of the Global Knowledge Economy, quoted in NESTA, 2007, Five ways universities drive innovation, p.3; \url{http://www.nesta.org.uk/assets/Uploads/pdf/Policy-Briefing/universities_policy_briefing_NESTA.pdf}} This is also reflected in the university-based research processes where, for example, Imperial College London signed with Shanghai Jiao Tong University and Tsinghua University in Beijing a Memoranda of Understanding to encourage knowledge exchange across boundaries. Furthermore, it is not only their knowledge that researchers bring to a university but also skills to perform research, develop new ideas, and in using advanced instrumentation and techniques. The movement of researchers between universities also contributes to this.

**Regulation**

A recent BERR Economics Paper\footnote{BERR (2008), Regulation and innovation: evidence and policy implications, BERR Economics Paper No. 4} explores the different ways in which regulation can affect innovation and the particular circumstances under which regulation may promote or hamper innovation by business.

The available evidence suggests that the relationship between regulation and innovation is highly complex and dynamic. Regulation – either directly or indirectly – can affect the nature and direction of innovation as well as the ways in which businesses innovate. Over time, as new technologies, products and business models are developed, new markets emerge which require different regulatory solutions.

The extent to which regulation helps or hinders innovation by business is found to depend on the way in which it is designed, implemented and enforced. The evidence suggests that government is more likely to promote beneficial innovation if, for example, it clearly informs businesses of future changes in regulation well in advance so that they have sufficient time to comply or specifies desired outcomes which cannot be easily achieved using existing technologies and business practices.

**4.3 Progress**

This section explores the UK innovation record, what Government has done in the area, and economic impacts of innovation.
The innovation record

a) Innovation active firms

The proportion of innovation active firms\textsuperscript{134} can be considered a holistic measure of wider innovation (covering technological innovation, process, design, marketing etc) and, as suggested in Chapter 6 on Enterprise, it can be used to demonstrate the strength of business innovation. The 2007 UK Innovation Survey showed that 64 per cent of enterprises were innovation-active over 2004-2006, an increase of 57 per cent compared with 2002-2004. The 2007 survey also showed that 23 per cent of enterprises brought new products to market, down from 25 per cent in the 2005 survey, and 12 per cent of enterprises introduced new processes, down from 16 per cent in the 2005 survey.

The latest period for which a comprehensive comparison of innovation activity across EU countries is available is 2002-2004.\textsuperscript{135} The EU-wide definition of innovation-active firms excludes those with expenditure in areas linked to innovation activities. Figure 4.4 demonstrates that on this metric, the UK performs in line with the EU average, with Germany placed as the country with the highest share of innovation active firms. However, it is important to note that response rates to the survey vary across countries and to the extent that willingness to respond may be related to the innovation behaviour of the firm, this can potentially distort international comparisons.

Figure 4.4: Percentage of innovation active firms, 2002-2004

![Graph showing percentage of innovation active firms across EU countries](image)

Source: Eurostat

\textsuperscript{134} The UK Innovation Survey classifies a business as ‘innovation active’ if it is engaged in any of the following: (1) introduction of a new or significantly improved product (good or service) or process for making or supplying them; (2) innovation projects not yet complete, or abandoned; (3) expenditure in areas such as internal research and development, training, acquisition of external knowledge or machinery and equipment linked to innovation activities.

\textsuperscript{135} This corresponds to wave 4 of the Community Innovation Survey.
The following measures look to understand the type of innovation activity that is taking place and progress in these areas.

b) Investment in research & development

Differences in R&D investment have been used to explain the UK’s relatively poor productivity performance. R&D expenditure is, however, an imperfect measure of innovation as it only provides a measure of input to technological innovation processes and accounts for around just 40 per cent of all innovation-related expenditure.

Figure 4.5 shows that total gross expenditure on R&D (GERD) as a percentage of GDP in the UK remains low (1.78 per cent of GDP in 2006) compared to other leading industrialised nations. DIUS research (2008) suggests that this is largely due to the UK’s industrial mix (the UK is specialised in less R&D intensive industries). There has been a modest recovery in GERD since 2004 (the lowest point in the series since 1992); however, even on such trends, it would take a considerable number of years to catch up with the GERD levels of US and Germany.

Business enterprise R&D (BERD) is a component of GERD. With BERD accounting for 62 per cent of UK GERD, a proportion in line with several

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136 Differences in R&D accounted for a quarter of the UK’s productivity gap with the US and a sixth of the gap with France in 1999.

137 GERD provides one measure of the amount of resources an economy dedicates to the generation of new knowledge.

138 Available at [http://www.dius.gov.uk/publications/innovation_nation_docs/BusinessInnovationUK.pdf](http://www.dius.gov.uk/publications/innovation_nation_docs/BusinessInnovationUK.pdf) The Public Service Agreement for Science and Innovation reflects this by including as part of the set of indicators for measurement of performance for Business R&D expenditure, the average UK R&D intensity in the six most R&D intensive industries, relative to the US, Japan, France and Germany.

139 This is a measure of the extent to which businesses are developing new technology.
other countries, it is not surprising to see that BERD as a percentage of GDP is also lower in the UK than in its major competitors (see Figure 4.6). The BERD to GDP ratio declined in the UK during the 1990s but stabilised after 1997, before falling again in 2004 (lowest point in the series). Since 2004, levels of BERD relative to GDP have slightly increased from 1.07 per cent to 1.1 per cent in 2006.

**Figure 4.6: Business Expenditure on R&D (BERD)**

*Comparison, 1992-2006*

*Per cent of GDP*

Source: OECD except for the UK which is ONS. Break in series for France 1996/7 and 2000/1. US data excludes most or all capital expenditure.

c) Generation of intellectual property

Patents are a measure of intermediate output from the innovation process in some sectors, particularly those sectors that do formal R&D. To qualify for a patent, inventors need to demonstrate that they have produced something innovative. The number of patents granted to firms located in the UK therefore gives an indication of the success of UK firms in generating knowledge, which may subsequently prove to be commercially valuable.

The propensity to use patents as a means of protecting intellectual property varies by industry; whereas science-based industries such as pharmaceuticals, biotechnology and chemicals have a high propensity to patent, for other sectors, such as financial services, publishing and electronic media, patenting is not usually an appropriate means to protect intellectual property.

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140 Not all patents are directly valuable, and there are still significant hurdles between acquiring a patent and developing a commercially valuable product or process.
The number of patents granted by the US Patent and Trademark Office per head is a widely used indicator which, although likely to overstate the patenting performance of the US due to ‘home country bias,’ allows a broad comparison of the patenting performance of comparator economies, as reported in Figure 4.7. Broadly similar results are obtained when triadic patents are used.\textsuperscript{141} The UK’s number of US patents granted per head is similar to that of France, but below that of Germany.

Evidence suggests that UK patents are worth on average £10.1million, more than twice those in Germany (£4.45million), implying similar values for the total patent stock.\textsuperscript{142} The distribution of UK patent values in the UK is more skewed towards high value patents than in Germany or France. While these results are based on a sample of inventors and do not reflect actual market valuations, it is encouraging to see that the UK is effective at transforming R&D into valuable intellectual property even if the actual patent numbers appear to lag other countries’ performance.

Traditional data sources like patents do not provide a sufficiently comprehensive picture of the outcome of innovations, particularly when it comes to non-technological innovations. Innovation surveys collect mainly qualitative information\textsuperscript{143} and are not available for some major OECD countries. Information on the registration of other forms of intellectual property such as trademark\textsuperscript{144} and design data\textsuperscript{145} can usefully

\textsuperscript{141} These are patents taken at the US Patent and Trademark Office, Japanese Patent Office and European Patent Office.

\textsuperscript{142} Results from the PatVal EU project are based on inventors’ self-assessment of the value of their patents. Inventors are associated with a sample of European Patent Office’s (EPO) patents invented in Germany, France, UK, Italy, Netherlands and Spain \url{http://www.alfonsogambardella.it/patvaleu.htm}

\textsuperscript{143} For example: has the firm done such an innovation, yes/no

\textsuperscript{144} As defined by the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPs), a trademark can be “any sign [word, logo, phrase, etc.], or any combination of signs, capable of distinguishing the goods
contribute to the measurement of non technological innovation and of innovation, particularly in the service industries.

Firms register their trademarks at a trademark office, which grants them exclusive rights to use the trademark in their business in the country where it is registered for a certain period.\textsuperscript{146} While trademark and design data exhibit similar shortcomings to those displayed by patents, such as not providing information on their economic value or whether they are genuinely the result of innovation, they contribute towards documenting the extent of broader forms of innovation.

Figure 4.8: Community trademarks: registration intensity as percentage of 1,000 population

![Graph showing trademark registration intensity by country over time](image)

Source: EU OHIM, OECD

Figure 4.8 demonstrates that in terms of registered trademarks relative to population, the UK appears to be a lead country in terms of introducing new products, with 11 trademarks per 1,000 population, just below Germany that leads the ranking with approximately 15 trademarks per 1,000 population.

As regards designs, and in contrast with the country ranking on registered trademarks, the UK position is not as favourable. In 2006, Germany had the highest Registered Community design intensity, with 203 designs per million population. They are followed by France with 98

\textsuperscript{145} A trademark system enables consumers to distinguish between competitive products (goods or services). This enables firms to secure customer loyalty, as long as their satisfaction with the quality provided remains common knowledge, which makes it possible to charge higher prices for the products and to maintain higher margins.

\textsuperscript{146} Design protection covers the outward appearance of a product. New shapes or patterns for a product can be protected as a design. A registered design grants monopoly right for the look of a product, protecting both the shape and the pattern or decoration. A registered design will cover the lines, contours, colours, shape, texture and materials of the product or its ornamentation. To be registered, a design must be new and have individual character; meaning, it should not remind an informed person of an existing design. This provides production up to 25 years.

\textsuperscript{147} Generally 10 years renewable indefinitely.
and the UK with 75, well above the US with 22 which is more likely to register such designs in its own country.

d) Contribution of new products to business revenue

While the generation of intellectual property tells us something about progress on developing new ideas, new ideas alone are not sufficient for productivity improvements; ideas must be translated into new products and processes. Therefore, the capacity of firms to create productive value from their innovation activities is a useful indicator of innovation performance.

Figure 4.9 below shows the proportion of turnover due to product innovations. While the UK performs less strongly than other countries as measured by the proportion of firms introducing a product or process innovation, the UK’s innovation intensity (as measured by the share of turnover from product innovations) is rather high. It currently tops the list of countries that have so far made this information available.

![Figure 4.9: Share of turnover from product innovations 2004-2006 % of total turnover](image)

Source: EUROSTAT

e) Knowledge exchange with the research base

The primary output from the public research base is the volume of research articles published worldwide. The UK is second to the US in terms of number of publications, with around 9 per cent of the world total. The number of citations a publication receives is an indicator of its
influence and international visibility. The UK is again second to the US with around 12 per cent of world citations, and 13 per cent of the most highly cited papers. The UK’s citation performance is strong across disciplines, with the UK in the top three in seven of nine fields.

While academic outputs in the form of articles are good measures of the productivity of the research base, one also needs to look at how the knowledge created is effectively utilised in the rest of the economy and at the quality and quantity of interactions that make this possible.

In the UK, around a quarter of innovative enterprises source information from universities or other Higher Education Institutions (HEIs), and a quarter source information from government or public research institutes. The proportion of all firms sourcing information from government or public research establishments has been increasing over time (see Figure 4.10). There is also evidence to suggest that other important sources of information may depend on the research base for their own information (Swann 2005).

The proportion of firms who regard directly obtaining information from universities and public research institutes as being of ‘high’ importance is fairly small in the UK at around 2-3 per cent, but this is in line with other EU countries.

**Figure 4.10: Sources of information for UK firms, all respondents**

![Source: UK Innovation Survey](image)

HEIs and public sector research establishments regularly report on their interactions with business and other users. The Higher Education Business-Community Interaction Survey gathers data from HEIs on the nature and scale of exchanges. Table 4.1 shows positive trends in knowledge transfer activities reported by HEIs. Income from business for UK HEIs has risen to over a billion pounds in 2006-07.
Table 4.1: Key knowledge transfer indicators for UK HEIs

<table>
<thead>
<tr>
<th>Indicator</th>
<th>2000-01</th>
<th>2002-03</th>
<th>2004-05</th>
<th>2006-07</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of new patent applications filed by HEIs</td>
<td>896</td>
<td>1,222</td>
<td>1,648</td>
<td>1,913</td>
</tr>
<tr>
<td>Number of Patents granted</td>
<td>250</td>
<td>377</td>
<td>711</td>
<td>647</td>
</tr>
<tr>
<td>Number of licensing agreements</td>
<td>728</td>
<td>759</td>
<td>2,099</td>
<td>3,286</td>
</tr>
<tr>
<td>Income from licensing intellectual property (£ million)</td>
<td>18</td>
<td>37</td>
<td>57</td>
<td>58</td>
</tr>
<tr>
<td>Number of spin-outs</td>
<td>248</td>
<td>197</td>
<td>148</td>
<td>236</td>
</tr>
<tr>
<td>Income from business (value of consultancy contracts) (£ million)</td>
<td>104</td>
<td>168</td>
<td>219</td>
<td>288</td>
</tr>
<tr>
<td>Income from business (contract research and consultancy contracts £million)**</td>
<td>362</td>
<td>457</td>
<td>836</td>
<td>1,070</td>
</tr>
</tbody>
</table>

Source: Higher Education Business-Community Interaction Survey. The numbers in the table above reflect the latest Survey published on July 2008. Results for 2001/2, 2003/4 and 2005/06 have been suppressed to ease presentation. The full table can be obtained from the DIUS economic impacts report.

** 2000-2003 Income from business data does not include contract research with non-commercial organisations.

Public Sector Research Establishments (PSREs) also transfer knowledge through research collaboration and contract research on behalf of industry, licensing of technology to business users, and sales of services, data and software.147

f) Supply and demand for innovation skills

In order for innovation to contribute to productivity growth, it is important that there is a robust supply of, and demand for, innovation skills. Chapter 5 on Skills and Chapter 6 on Enterprise highlight the role of managerial skills in driving innovation; nevertheless, defining what the relevant skills for innovation are is no easy task. Traditionally this has been associated with the extent of science, technical, engineering and mathematics (STEM) skills, which are crucial in the generation of scientific and technological knowledge, and their deployment in R&D jobs. However, the skills required for wider forms of innovation are less well defined and by implication more difficult to capture. As a result, this is an area where metrics will have to be further developed.

The number of those obtaining first degrees in STEM remains strong. Table 4.2 demonstrates that, overall, the number of STEM first degree qualifiers from UK HEIs has increased by 11 per cent over the period 2002/03 to 2006/07 and the number of STEM graduates as a proportion of the total number of first degree qualifiers has remained broadly stable.

147 Further detail is available in the Economic Impacts report by DIUS.
Table 4.2: First degree qualifiers at UK HEIs, excluding the Open University

<table>
<thead>
<tr>
<th>Subject</th>
<th>2002/03</th>
<th>2003/04</th>
<th>2004/05</th>
<th>2005/06</th>
<th>2006/07</th>
<th>Growth 2002/03 to 2006/07</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medicine and Dentistry</td>
<td>6,175</td>
<td>7,005</td>
<td>7,445</td>
<td>7,700</td>
<td>8,260</td>
<td>34%</td>
</tr>
<tr>
<td>Subjects allied to medicine</td>
<td>23,665</td>
<td>24,705</td>
<td>27,865</td>
<td>29,775</td>
<td>30,460</td>
<td>29%</td>
</tr>
<tr>
<td>Biological Sciences</td>
<td>23,725</td>
<td>24,925</td>
<td>26,375</td>
<td>26,975</td>
<td>28,135</td>
<td>19%</td>
</tr>
<tr>
<td>Veterinary Science</td>
<td>560</td>
<td>660</td>
<td>690</td>
<td>680</td>
<td>645</td>
<td>15%</td>
</tr>
<tr>
<td>Agriculture and related subjects</td>
<td>2,150</td>
<td>2,415</td>
<td>2,225</td>
<td>2,140</td>
<td>2,185</td>
<td>2%</td>
</tr>
<tr>
<td>Physical Sciences</td>
<td>12,475</td>
<td>11,980</td>
<td>12,200</td>
<td>12,530</td>
<td>12,270</td>
<td>-2%</td>
</tr>
<tr>
<td>Mathematical Sciences</td>
<td>5,100</td>
<td>5,150</td>
<td>4,990</td>
<td>5,260</td>
<td>5,385</td>
<td>6%</td>
</tr>
<tr>
<td>Computer Science</td>
<td>18,240</td>
<td>20,010</td>
<td>19,775</td>
<td>18,495</td>
<td>16,255</td>
<td>-11%</td>
</tr>
<tr>
<td>Engineering and Technology</td>
<td>19,455</td>
<td>19,585</td>
<td>19,340</td>
<td>19,535</td>
<td>19,495</td>
<td>0%</td>
</tr>
<tr>
<td>Architecture, Building and Planning</td>
<td>6,555</td>
<td>6,735</td>
<td>6,565</td>
<td>7,365</td>
<td>7,615</td>
<td>16%</td>
</tr>
<tr>
<td>TOTAL STEM</td>
<td>118,105</td>
<td>123,165</td>
<td>127,475</td>
<td>130,450</td>
<td>130,705</td>
<td>11%</td>
</tr>
<tr>
<td>TOTAL NON-STEM</td>
<td>156,340</td>
<td>161,825</td>
<td>169,540</td>
<td>175,460</td>
<td>179,960</td>
<td>15%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>274,445</td>
<td>284,990</td>
<td>297,015</td>
<td>305,910</td>
<td>310,665</td>
<td>13%</td>
</tr>
<tr>
<td>% STEM</td>
<td>43%</td>
<td>43%</td>
<td>43%</td>
<td>43%</td>
<td>42%</td>
<td></td>
</tr>
</tbody>
</table>

Source: Higher Education Statistics Agency (HESA) Student Record.
Figures exclude those qualifying from the Open University due to inconsistencies in their method of recording subject of study over the time period.

The strength of the UK science base is reflected in the fact that the UK is ranked 2nd to Germany in the G7 on the number of PhD awards per head of population, and has maintained this position since the mid 1990s, though the gap with Germany has been narrowing. In 2006/07, of the 86,100 former postgraduate students\(^{148}\) whose destination was known, 77 per cent (66,275) were in employment, the same as in 2005/06, 11 per cent (9,150) were in a combination of work and study (10 per cent in 2005/06), 6 per cent (5,070) were involved in further study only (unchanged from 2005/06), and 3 per cent (2,635) were assumed to be unemployed (unchanged from 2005/06).

The number of researchers in the workforce can be considered a measure of the capacity of each country with regard to research and innovation. Figure 4.11 demonstrates that there has been little change in the UK’s performance over the last decade. It also performs less strongly relative to its main competitor economies (the US, Germany and France) and is sixth in the G7.

\(^{148}\) Including both UK and EU domiciled students, and both full-time and part-time.
Government policy to improve the innovation record

Some progress is being made on the level of investment in R&D and government continues to support business, for example through R&D tax credits and targeted grants. According to the Innovation Nation White Paper, about £600 million in the form of R&D tax credits is claimed annually by about 6,000 companies. An evaluation of the R&D tax credit\footnote{http://www.hmrc.gov.uk/randd/rand-taxcredits-final.pdf} scheme found that over half of recipients said that they had an impact on the level of their R&D spend or on the type of projects undertaken.\footnote{For example, making more risky projects more attractive to firms.} Other evidence predicts some success in R&D tax credits with Hall and van Reenen (2000) by suggesting that they are potentially effective in raising the level of R&D spend. OECD (2003) finds that tax incentives and direct government funding of R&D performed by firms has a positive effect on business financed R&D. The Government has strengthened further the R&D tax credit scheme by increasing the rates of relief from 125 to 130 per cent for large companies since April 2008 and from 150 to 175 per cent for SMEs as from August 2008.

As regards IPR, government has a role in providing a framework to encourage firm investments, for example, through an appropriate IPR regime that balances objectives of incentivising investment in innovation, ensuring competition in product markets and diffusion of knowledge for future innovation. The data presented in the previous sub-section suggests that the UK is making progress in developing new intellectual property, but that other countries continue to outperform the UK on generation of patents. There are a number of policies aimed at supporting further UK’s innovation infrastructure, including continuing work to increase awareness of IP, working towards mutual recognition
between IP offices internationally and progressing the establishment of a single European Patent Court to help companies protect their inventions in Europe and examining whether better reporting of intangible assets such as Intellectual Property by companies can help them secure finance.

The Government also helps by encouraging linkages and collaborations between different groups of people and firms to help them to share knowledge and exploit their ideas. Two key areas of Government support in this area are Knowledge Transfer Networks (KTNs) and Knowledge Transfer Partnerships (KTPs). KTNs have been set up in a number of sectors\(^{151}\) with the aim of providing a vehicle within that sector\(^ {152}\) to develop ideas, collaboration and knowledge transfer throughout relevant stakeholders, including the supply chain. KTNs also provide an important route for engaging with government about future technology needs of the sector. As regards KTPs, these match businesses with academics or researchers to undertake specific projects to improve business performance. Projects can include improving existing products or developing new products; developing new systems and frameworks to improve efficiencies in staff and processes. Case studies\(^ {153}\) show benefits cover a wide range of areas, including increased efficiency within parts of the business, access to new markets and new collaborative relationships. Regarding knowledge transfer and engagement between businesses and the academic community, the Government has strengthened the capacity in Higher Education Institutions in England and Wales to take part in such activities by establishing the Higher Education Innovation Fund (HEIF), with the Fund rising to £150m per year by 2010/11.

Chapter 5 outlines the progress that has been in the skills area, including on programmes in place to target skills development, such as the Train to Gain Programme, and progress on understanding the mix of skills that will raise UK productivity in the long term. This includes work by UKCES to carry out a strategic skills audit to identify where further demand for and supply of skills in the UK could be better aligned and work by DIUS, including piloting a revenue based FE Specialisation and Innovation Fund to build the capacity of the FE sector to support businesses to raise their innovation potential and establishing at least one National Skills Academy (NSA) in every major sector of the economy.

Finally, as mentioned in section 4.1, NESTA is currently developing a new Innovation Index, with the aim of identifying gaps in current innovation measures, embedding existing measures in a broader


\(^{152}\) With relevant players including business, academics and government.

\(^{153}\) [http://ktp.aesolutions.co.uk/casestudies/results](http://ktp.aesolutions.co.uk/casestudies/results)
portfolio of other indicators, improving our understanding of service sector, user-led and public sector innovation, and building on measures that innovative firms and their investors find useful. This will also aim to track progress in measuring the impact of the new demand-side focus to innovation policy, which was set out in the Innovation Nation White Paper.

**Economic impacts of innovation**

There is evidence that supports the view that business and public R&D have a positive impact on productivity. A 2001 OECD study of a group of 16 countries from 1980-1998, including the UK, finds that a 1 per cent increase in business R&D increases multi-factor productivity by 0.13 per cent and that a 1 per cent increase in public R&D increases multi-factor productivity by 0.17 per cent.\(^\text{154}\)

A number of studies have considered how design, an important part of the intellectual property framework, contributes to success at the firm level.\(^\text{155}\) In fact, surveys of UK firms carried out for the Design Council (2005) find that rapidly growing companies attach much greater weight to design than average growth companies. Gemser and Leenders (2001) study of Dutch firms found that integrating industrial design into new product development projects has a significant and positive influence on company performance (profit, turnover and export sales). Bruce et al. (1995) show that 60 per cent of 178 UK funded design projects could be defined as commercially successful (measured by positive financial returns on investment).\(^\text{156}\)

**Summary assessment**

The evidence presented in this chapter suggests that the UK performs well compared with other competitor economies in terms of the proportion of innovation active firms, the rate of introduction of new products and the value of its total patent stock. There is still scope for improvement in certain areas such as the level of public and business investment in R&D and the development of a robust supply of and demand for innovation skills. The strategic skills audit by UKCES will contribute in identifying where further demand and supply for skills (including innovation) in the UK could be better aligned.

**References**


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\(^\text{154}\) Note that results are averages over countries and time.


\(^\text{156}\) Around one-half of all projects for which export information was obtained saw some international trade benefit.


5. Skills

5.1 Introduction

A skill can be defined as an ability to perform a task and may relate to both specialist technical expertise in an area or to more generic abilities such as team working and communication. Individuals can develop their stock of skills through education, training and experience. Having more skills enables an individual to work more productively within the workplace and helps facilitate the introduction of new innovative ideas and practices within the production process.

In addition to helping deliver improvements in labour productivity, skills are also important for other economic and social objectives. Gaining new skills, particularly for those with little formal education or training, is a significant factor in helping individuals find employment, and opens up the opportunity for them to progress in the labour market. Building on the UK’s already strong record on employment, skills is an important factor that will help achieve the Government’s long term ambition for an “employment rate equivalent to 80 per cent of the working age population”. Increases in employment or hours worked raise the total output of the economy and contribute to growth. However, there is a limit to how much labour can be supplied, meaning that in the long run, the most significant improvements to economic growth and living standards are likely to come from productivity.

Although the set of skills that individuals hold is important for driving productivity, it is difficult to quantify many skills. The progress section of this chapter therefore aims to bring together a range of indicators and evidence to help understand what progress is being made on this driver.

5.2 What drives skills?

This section explores the evidence about how skills can impact on productivity growth, and investigates some of the most important factors that influence skills.

*Investment in skills and productivity growth*

The key theoretical explanation highlighting the positive relationship between skills and productivity is derived from models of economic growth which have evolved substantially since the initial contributions of

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the 1950s.158 These models were developed to answer two questions relating to why some countries are richer than others and why real incomes are observed to rise over time. Early models considered production as being determined by two factors – labour and physical capital. Technological change, which improves the effectiveness of labour within the production process, was assumed to occur exogenously. These models predicted that in the long run, the level of output per worker was determined by physical capital, but the growth of output per worker was driven only by the rate of technological progress.

Empirically, the early models were relatively unsatisfactory in the sense that very large differences in the amount of physical capital were required to explain the observed differences in income per capita between countries and over time. The models of economic growth then started to evolve to allow for capital to be comprised of both physical and human capital.159 In addition, a new strand of models emerged that enabled technological change to be endogenously determined by using a proportion of the economy’s physical and human capital to create additional knowledge.

Alongside the evolution of the theoretical models of economic growth, a substantial empirical literature also emerged to test some of the key predictions of the theory. One of the most significant contributions by Mankiw et al (1992) found that human capital, measured by years of schooling, had a positive impact on the growth in income per capita across a range of countries between 1960 and 1985. Coulombe et al (2004) provide a more recent study across 14 OECD countries and find that countries with a literacy score 1 per cent above the average are associated with 1.5 per cent higher GDP per capita and 2.5 per cent higher labour productivity in the long run steady state.

A number of factors drive the take-up of skills. These are identified as being an individual’s investment, government investment and firm’s investment in skills.

**Individual investment in skills**

For individuals, the decision to invest in skills is based on an assessment of the balance between the relevant costs and benefits of gaining skills which are provided by labour market signals, such as employment rates and wages. The costs consist of both the direct costs of the education or training, such as tuition fees, and indirect costs associated with any earnings foregone by choosing to participate in learning rather than employment, such as the opportunity cost of education or training. Benefits are received in the form of the increased probability of being in employment and in the future stream of wage earnings.

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158 See for instance Solow (1956); Cass (1965); Diamond (1965); Koopmans (1965).
159 See for instance Jones (1996).
Figures 5.1 and 5.2 show economic activity status by level of qualification for males and females respectively. The data shows how the employment rate is higher for individuals holding higher levels of qualifications, compared to those with fewer qualifications.\textsuperscript{160}

### Figure 5.1: Economic activity status by level of qualification, Males, UK 2007

There are other factors that could influence an individual’s decision about whether to invest in skills, including the availability of training (such as the number of available places at colleges or the courses on offer) and the mobility of individuals to access training, which may be influenced by factors such as public transport and information available about training opportunities and the potential benefits.

\textsuperscript{160} Measures are an average of the four quarters.
**Employer investment in skills**

There are firm benefits generated from skills beyond the private net returns to the individual. It is likely that workers with higher skill levels work more efficiently and effectively, and are also more adaptable to the changing economic environment. In addition, highly skilled individuals are more likely to generate innovative ideas and to handle innovations, enabling firms to engage in more sophisticated production processes. Moreover, there are complementarities between skills and investment in physical capital: firms’ decisions to invest in new capital can be affected by the availability of skilled employees. Deficiencies in workforce skills may therefore act as a constraint on both investment and the ability of firms to innovate, with implications for productivity growth.

Dearden et al (2006) explore how employer investment in training affects sectoral productivity. Their results suggest that a company benefits over and above the wage effect if it increases training availability. In particular, they find that a one percentage point increase in the proportion of individuals receiving training in an industry increases value added per hour worked by 0.6 per cent, but only a 0.3 per cent increase in wages.

The mobility of the workforce has an important impact on making skills accessible to firms, and potentially on the skills demanded by businesses. International migration impacts on the skills base through the net flow of relevant skills in the UK. Evidence on the magnitude of human capital spillovers suggests that plants located in cities where the fraction of college graduates grew faster experienced large increases in productivity than similar plants in cities where the fraction of college graduates grew more slowly, after controlling for a plant’s own level of human capital.\(^{161}\)

The demand for skills is derived from the business strategies that employers adopt. This influences the level and type of investment by firms in the skills of their workforce and is, at least partly, influenced by the level of skills already within the business. Management and leadership are important drivers of the ambition of business strategies and thus could influence employer investment in skills. Keep et al (1999) argue that employers initially decide which goods and services they wish to produce and the method of production before employing or training individuals with the appropriate skills. It is important, therefore, to consider skills within the wider business context and the market conditions that firms face. Globalisation for example is creating new competitive pressures, but also providing new opportunities, for UK firms to meet a growing global demand for high value added goods and services arising as a result of rising global incomes. Strategic decisions

\(^{161}\) Moretti (2004)
to enter these markets combined with the effects of technological change are likely to increase demand for higher skills and create more high skilled employment opportunities within the UK.\textsuperscript{162}

The ability to identify and exploit new market opportunities requires strong leadership and management skills within organisations. This is important across both the public and private sectors for setting the firm’s strategy and environment, and making key decisions regarding investment, innovation, skills development, service delivery and performance. Management can thus influence productivity outcomes directly and indirectly, through its role in determining innovation, workforce skills, investment and enterprise outcomes.

Research by the London School of Economics’ Centre for Economic Performance and McKinsey & Company (2007) suggests that higher levels of management capability within firms are positively associated with measures of performance such as sales, labour productivity and the return on capital employed. The ability to lead and manage fits into a wider issue relating to ensuring that all resources employed within an organisation are utilised in the most effective manner to deliver productivity improvements. Although the empirical literature has often failed to identify a causal link, studies have suggested that adoption of human resource practices designed to promote greater employee involvement and engagement are associated with some measures of business success.\textsuperscript{163}

\textbf{Government investment in skills}

As highlighted in the Leitch Review, there is a shared responsibility between individuals, employers and government in raising productivity through investment in skills.

Labour market data on employment and wage outcomes has informed policy development on the respective roles of government, individuals and employers in enhancing the skills of the current and future UK workforce. Labour market intelligence – for skills needs now and in the future - is important for ensuring that skills provision is timely and that we are investing in the skills and in the provision of training that can be utilised fully within the workplace to help deliver productivity gains. Government policy has focused on providing employability skills\textsuperscript{164} that are equally valuable to all employers, because this is where employers have a reduced incentive to invest in skills because of the fear of newly trained workers being poached by a competitor.\textsuperscript{165} Other factors may also lead to sub-optimal levels of investment in skills including

\begin{itemize}
\item \textsuperscript{162} New Opportunities: fair chances for the future, HMG (2009)
\item \textsuperscript{163} See for instance, Black and Lynch (2001)
\item \textsuperscript{164} Or general human capital in Becker (1964)
\item \textsuperscript{165} However, Kitching and Blackburn (2002) found that less than 1 per cent of employers reported that the fear of trained workers leaving or being poached was the most important barrier to training.
\end{itemize}
insufficient access to finance and imperfect information relating to the full returns from acquiring new skills.

It is important that information on the relevant skills needed by business feeds through to the labour market and is captured by signals such as employment rates and wages, and also to the provision of training. Such signals can influence individuals’ incentive to invest in skills as individuals use this information combined with the opportunity cost of training (in the form of the earnings sacrificed by not working) to estimate the return from acquiring new skills.

5.3 Progress

This section explores the record for skills, what Government has done and the impact of policies in the skills area.

The skills record

There are no measures that capture fully all of the skills individuals have acquired through formal education, training, experience and other forms of informal learning. The most commonly used proxy for skills is the highest level of formal qualifications held by the working age population.\(^{166}\) Figure 5.3 demonstrates that, since 1998, the proportion of individuals holding at least Level 2 qualifications\(^ {167}\) has risen from 62.2 per cent to 70.7 per cent, while the proportion with no formal qualifications has declined from 16.3 per cent to 11.4 per cent over the same period. For Level 4 and higher,\(^ {168}\) the percentage of individuals holding these qualifications has increased from 24.7 per cent in 1998 to 32.1 per cent in 2007.

\(^{166}\) The UK Labour Force Survey (LFS) provides information on the highest qualifications held by individuals of working age.

\(^{167}\) Equivalent to five or more passes at GCSE.

\(^{168}\) Equivalent to higher education first degrees.
Using data from the UK Labour Force Survey and equivalent sources from other countries, the OECD presents international comparisons of the qualifications of the working age population (25-64 year olds). Figure 5.4 shows that in 2006 the UK had a relatively high proportion of individuals holding the lowest level of educational attainment, but had an impressive performance in terms of the number of people holding a higher level qualification.

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169 Qualifications are grouped into three broad categories that are broadly, although not perfectly, comparable across countries – below upper secondary, upper secondary and tertiary.
Other evidence comes from surveys which assess particular types of skills, rather than formal qualifications. Evidence from the OECD’s Programme of International Student Assessment (PISA) suggests that for 2006, the UK’s performance in reading and mathematics was not significantly different to the OECD average, whilst the UK’s performance in science was above average.

As noted above, skills are about more than just the qualifications that we can measure. A second important aspect of the UK’s skills record is the level of investment that is being made in skills and training programmes by employers.

There is evidence that increases in the amount of workforce training may be associated with higher levels of productivity (see section 5.2). However, one of the problems with measuring the amount of training received by individuals is that such training may relate to a wide variety of activities, some of which may only be undertaken to meet legislative requirements (for example, health and safety) rather than a genuine investment in productivity-enhancing skills. It is thus important to distinguish between the incidence and intensity of training.

Table 5.1 provides information on the training activity of employers in England. The data shows that 67 per cent of employers provided some form of training to 63 per cent of the total workforce in the previous 12 months. These measures of the incidence of training represent small increases from the values reported in 2005. Moreover, evidence suggests that much of this training does not lead to individuals acquiring formal qualifications – only 18 per cent of trainees were being trained towards nationally recognised qualifications. This strengthens the view that skills is more than just formal qualifications and suggests that many employers recognise the importance of training to develop particular skills and competences outside of the formal qualifications system.

With regards the intensity of the training being provided by employers, Table 5.1 shows that across the workforce individuals received on average 9.8 days of training in the previous 12 months. The total amount spent on training by employers increased by just over £5 billion in nominal terms between 2005 and 2007 to £38.6bn. Part of this increase is explained by the greater incidence of training, but also increased expenditure per worker by 12 per cent from £1,550 to £1,725.
Table 5.1: Incidence and intensity of training activity in England

<table>
<thead>
<tr>
<th></th>
<th>2005</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Incidence</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage of employers providing training</td>
<td>65</td>
<td>67</td>
</tr>
<tr>
<td>Percentage of workforce receiving training</td>
<td>61</td>
<td>63</td>
</tr>
<tr>
<td><strong>Intensity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Training days per worker</td>
<td>7.5</td>
<td>9.8</td>
</tr>
<tr>
<td>Total training spend, £billion</td>
<td>33.3</td>
<td>38.6</td>
</tr>
<tr>
<td>Training spend per worker, £</td>
<td>1,550</td>
<td>1,725</td>
</tr>
</tbody>
</table>

Source: NESS 2007

A third important aspect of UK’s record in the skills area is the degree to which the skills obtained by the workforce match employers demand for skills.

Figure 5.5 shows the employment rate by educational attainment for 2006.\(^{170}\) The data suggests that for each level of attainment the UK has a relatively larger proportion of individuals in employment relative to the other three competitor countries. This evidence lends some support to the view that that the skills gained by achieving a certain level of education match the skills demanded by UK employers relatively better than in other countries. At the same time, it should be pointed out that this could simply be a reflection of other features of the UK labour market that result in a relatively strong employment performance.

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*Using the data from the UK Labour Force Survey and similar data sources from other countries, the OECD presents international comparisons of the qualifications of the working age population in employment.*
Figure 5.6 shows England’s performance on skills gaps. This can be seen to have improved over the period 2001 to 2007 as there has been a decline in the levels of skills shortage vacancies and skills gaps as a percentage of employment. This evidence also suggests that over time there has been a better matching of the supply of skills with the demand for skills as it seems to be the case that employers are experiencing fewer skills deficiencies or gaps amongst their existing staff.

The discussion so far has demonstrated that there has been more investment in skills and increased skills levels as well as better matching of the supply of and the demand for skills. Firms can also raise productivity when they make better use of the skills that they have at their disposal, deploying them more effectively across the different parts of their organisation. Central to this is strong leadership and management within firms which can ensure that all resources, including skills, are being used in the most effective manner to achieve business success. Thus, the utilisation of skills is a fourth important aspect of UK’s skills record.

A series of studies of medium-sized manufacturers undertaken by the London School of Economics’ Centre for Economic Performance and McKinsey & Company have shown that the UK appears to have a relative deficiency in terms of management. Based on the average score of these measures, figure 5.7 demonstrates that the UK is behind the US, Sweden, Germany and Japan.

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**Figure 5.6: Skills shortages vacancies and staff with skills shortage as % of staff employed**

The data for this indicator comes from the National Employers Skills Survey (NESS), which is published biennially. As the survey covers England only, international comparisons cannot be made.

http://cep.lse.ac.uk/_new/research/productivity/management.asp

A robust qualitative interview technique was used to derive a score of the quality of management across three broad areas: shop floor operations, performance management and talent management.
Much of the evidence relating to UK management capability is based on perceptions rather than robust quantitative measures drawn from surveys consistently undertaken over time. The Institute for Management Development (IMD) business executive opinion survey measures quality of management as the weighted average of three scores resulting from three questions asked. The latest survey from IMD provides some consistency with the CEP/McKinsey research and suggests that business perceptions of management quality are lower in the UK compared to Germany, France and the US. Nevertheless, it should be noted that relative to 2005 and 2006, the UK was the only country among the four presented in Figure 5.8 that exhibited an increase in business perceptions of quality of management in 2007 and 2008.

174 The three questions cover competence of senior management, international experience of management and priority of employee training.
Government policy to improve the skills record

In order to sustain and improve the UK’s position in the global economy, the Government remains committed to the ambition as set out in the Leitch Review of Skills of achieving a world-class skills profile for the UK by 2020. Progress has been monitored through cross-cutting Public Service Agreements for skills and employment.175 Government has also recently published the New Opportunities White Paper which sets out the approach Government will take to support individuals throughout their lives and improve their chances of securing some of the new job opportunities emerging in the global economy.

As regards basic numeracy and literacy skills, recent analysis by the NAO (2008) suggests that the Government has made good progress towards meeting the 2010 target for basic skills. Specifically, the Skills for Life Public Service Agreement launched in 2001 attempted to improve the basic literacy and numeracy skills of 2.25m adults by 2010; interim targets of 750,000 and 1.5m adults in 2004 and 2007 have been both exceeded.

Moreover, in order to help individuals progress and achieve their ambitions (especially those with low levels of skills and qualifications), the government will make £50m of funding available through the Adult Advancement and Careers Service in 2010-11. The success of this scheme would be determined in part by the extent to which the service is delivering improvements around better information for everyone (individuals and employers) relating to the skills that are valued within the economy and that the service is comprehensive for directing people to all areas of skills support and information.

The government also invests in skills through a number of programmes, including apprenticeships and investment in schools, Further Education (FE) and Higher Education (HE) Institutions.

There are programmes such as Train to Gain where Government works with business to provide training. Train to Gain aims to boost business performance by improving the skills of individual staff members.176 The Train to Gain programme has been strengthened via the Sector Compacts. These represent non-contractual agreements between the Department for Innovation Universities and Skills, the Learning and Skills Council and a Sector Skills Council (or sector body) to work collaboratively to drive up demand for skills across England through Train to Gain.

As regards investment in schools, it is useful to look at expenditure in educational institutions as a proportion of GDP, which shows how a

175 See footnote 156.
country chooses to prioritise education in relation to its overall allocation of resources. Figures 5.9 and 5.10 illustrate expenditure on primary, secondary and post-secondary non-tertiary education and expenditure on tertiary education as a proportion of GDP for France, Germany, the UK and the US. Figure 5.9 illustrates that the UK devotes a larger proportion of its total wealth towards investment in primary, secondary and post-secondary non-tertiary education relative to the other three comparator countries, reaching a figure of 4.6 per cent in 2005. By contrast, figure 5.10 illustrates that the UK falls behind the US in terms of investment in tertiary education, standing at 1.3 per cent of GDP in 2005. It should be noted that the US investment in tertiary education of 2.9 per cent is lower than the UK investment in primary, secondary and post-secondary non-tertiary education. Looking ahead, there could be further improvements in this area by ensuring that the funding for universities is lined up with business needs.

Figure 5.9: Expenditure on primary, secondary and post-secondary non tertiary education

Figure 5.10: Expenditure on tertiary education

177 It should be noted that this is an aggregate choice, made by government, enterprises, and students and their families, and is partially driven by the size of the country’s school-age population and enrolment in education
We need to understand the mix of skills that will raise UK productivity in the long term as it competes in a global economy and the most effective way of delivering those skills. The PBR 2008 recognised this and announced various steps to identify future skills needs and to help employers to work together with partners to support growth and employment. For instance, the Government has asked the UKCES\(^{178}\) to carry out a strategic skills audit to identify where further demand and supply for skills in the UK could be better aligned. This will also inform the appropriate policy response to meet future challenges. The UKCES will produce an annual audit of strategic skills priorities beginning in 2009. Also, the Government announced an additional 4 National Skills Academies (NSAs),\(^{179}\) bringing the total number of NSAs to 20. According to the Report, the Government is on course to meet its ambition to have at least one Academy in every major sector of the economy, resources permitting.

The Government recognises that strong leadership and management skills are important as the full benefits of a more skilled workforce will only be reaped if management deploys these skills effectively within organisations and links them to strategic goals. As a result, there are programmes in place to increase leadership and management skills.\(^{180}\) For instance, the Leadership and Management Programme, delivered through Train to Gain, provides flexible funding to enable SMEs to develop management and leadership skills.

**Economic impacts of investment in skills**

The available evidence suggests that once in employment, more highly educated individuals are associated with higher levels of productivity, which is often measured by wages. For academic qualifications, Dickerson (2005) shows that positive wage returns exist for qualifications at or above Level 2 (around 12-15 per cent), but for vocational qualifications, significantly positive wage returns are only observed for Level 4 qualifications and above (returns rise to more than 20 per cent for level 4 and level 5). It should be noted that the finding of negative or negligible returns, on average, to low level vocational qualifications arises due to issues surrounding the comparison group used.\(^{181}\) This finding has prompted further research which has indicated that positive wage effects do exist for specific types of qualifications and for those acquiring them at a younger age.\(^{182}\) For instance, De Coulon and

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\(^{178}\) The UKCES was established in April 2008 to strengthen the employer voice in advising the Government on how the skills system can achieve higher productivity.

\(^{179}\) These are employer-led centres of excellence: they deliver the skills required by key sectors and sub-sectors of the economy, contributing to world-class competitiveness through world-class skills.

\(^{180}\) See Chapter 3: Leadership and Management Skills in BERR Economics paper No. 1: BERR’s Role in Raising Productivity.

\(^{181}\) Low level vocational qualifications are usually linked to low paid occupations, and other labour market disadvantages, so comparing holders with non holders in cross-sectional data does not reveal a return due to uncontrollable factors

\(^{182}\) See Jenkins et al, 2007; De Coulon and Vignoles, 2008.
Vignoles (2008) show that acquiring a NVQ2 between the ages of 26 and 34 has, on average, a strong, positive effect on wages of around 20 per cent. McIntosh (2007) suggests that there were substantial wage returns in 2004/2005 to apprenticeships of around 18 per cent at Level 3 and 16 per cent at Level 2, compared with individuals whose highest qualification is at Level 2, or at Level 1 or 2 respectively. It should be noted that there is significant variation in the estimated wage returns to apprenticeships, depending on the sector in which the former apprentice works.

There is less evidence of a positive relationship between skills and measures of productivity derived from firm-level data sets, but this is at least partly due to a lack of suitable data sources. By linking the National Employers Skills Survey to the Annual Business Inquiry, Haskel and Galindo-Rueda (2005) present some tentative evidence that output per worker increases with the skills of the workforce although the effect is only significant for higher proportions of workers holding Level 4+ qualifications.

Government investment in skills does have a positive impact on productivity. Evaluation evidence on the Train to Gain scheme suggests that the benefits of the initiative are shared between individuals and employers.183 42 per cent of employers felt that Train to Gain had a beneficial impact on bottom-line or profitability of business. Also, employers were generally positive about the effect of training on staff productivity and product/service quality albeit there was no measurable difference in sales figures, turnover, or profit margins. The evaluation suggests that employees also benefit, with results showing that 43 per cent of learners got better pay and 30 per cent got promotion on completing Train to Gain courses. The latter result supports academic evidence, which suggest that for low skilled individuals the best improvements in earnings and productivity occurs when qualifications are gained in the workplace.

As regards management and leadership skills, academic evidence from recent studies has linked good management practices with stronger firm level productivity and high quality investment. For example, Haskel et al (2005) suggest that firms that are more productive use better managers. Moreover, the evidence from the recent LSE and McKinsey & Company study of management practices and productivity suggest that higher quality management is correlated with measures of firm performance such as labour productivity, sales and return on capital. The Government has programmes in place (such as the Leadership and Management Programme, delivered through Train to Gain discussed above) to enhance these skills further as it recognises that the role of management

183 See http://readingroom.lsc.gov.uk/lsc/National/nat-qttlearnevaluation-may08.PDF and http://readingroom.lsc.gov.uk/lsc/National/nat-ttgemployerevaluation-may08.PDF
is pivotal in ensuring that skills are effectively deployed across the business.

**Summary assessment**

The evidence suggests that the UK has made good progress in raising basic skills such as literacy and numeracy and that more individuals are attaining higher qualification levels. Moreover, there are a number of Government programmes that aim to increase investment in skills, such as the Train to Gain programme where Government works with business to provide training. There is preliminary evidence to suggest that such programmes may have been effective for raising productivity, however more research is needed to assess fully the quantitative impact. More investment in skills and increased skills levels have also contributed to better matching of supply of and demand for skills in the UK relative to comparator economies. Moreover, progress has been made in relation to leadership and management skills although this could be an area for further development.

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6. Enterprise

6.1 Introduction

Enterprise can be defined as the seizing of new business opportunities, both by start-ups and existing firms. It can be viewed as a process of dynamic competition ("creative destruction"\textsuperscript{184}) whereby firms enter the market with new technology or work practices and compete with existing more mature firms.

Through this process of dynamic competition, enterprise can increase productivity in two ways. First, as firms introduce new technology or working practices in order to compete more effectively, (for example, by employing more skilled labour or new and more innovative ideas), their productivity levels grow.\textsuperscript{185} Second, enterprise encourages the process of churn which raises the average productivity level of the economy by helping to drive inefficient firms out of the market.

Ahn (2002) suggests that up to 50 per cent of a country’s growth is derived solely from this firm-level churn in which the process of entry, exit and changing market shares increases economic growth.

Enterprising activity is important for churn. If churn is considered to reflect both innovative and competitive pressures in a market, cross-country comparisons of churn are a useful way of considering relative efficiency levels. However, Bartelsman et al. (2005) argue that simple cross-country comparisons of the process of entry and exit may be misleading as differences in market structures and institutions may indicate differences in the nature of the process of creative destruction,\textsuperscript{186} rather than the absolute magnitude.

In their review of UK manufacturing firms during 1980-1992, Disney et al. (2003) show that 80-90 per cent of TFP growth comes from entry and exit of establishments, with 30 per cent of TFP growth coming from highly productive new firms and 50 per cent coming from the exit of the least productive firms. Much of this effect comes from multi-establishment firms closing down poorly performing plants and opening high-performing ones. The authors compare their findings to similar US studies over 1982-87, although they are cautious on drawing strong

\textsuperscript{184} Schumpeter, 1942.

\textsuperscript{185} Integration of innovation and skills by businesses into their working practices to compete more effectively is covered in more detail in the skills, innovation and competition chapters. This chapter also covers some of this evidence specific to enterprise.

\textsuperscript{186} For instance the composition of entering and exiting firms.
conclusions. They find that the impact of entry was almost the same but that the within establishment effect in the US was larger.

Harris and Robinson (2001) show that entry and exit were important contributors to UK productivity over 1990-1998. Using a decomposition approach, they find that entry accounts for 12 per cent of the increase in labour productivity over 1990-1998 in UK manufacturing and exits account for 4.5 per cent of the labour productivity increase. Entry and exit together are responsible for over half of the 30 per cent increase in labour productivity over the 8-year period.

HM Government’s Enterprise Strategy has set a “renewed enterprise vision to make the UK the most enterprising economy in the world and the best place to start and grow a business”. A key element of this vision is to increase the ambition of, and opportunities for, everyone to use their abilities to start and grow a business.

The Strategy identified five key enablers of enterprise, which inform and structure the Government’s enterprise policy. These are: (1) culture of enterprise; (2) knowledge and skills; (3) access to finance; (4) business innovation; and, (5) the regulatory framework. In addition to being key factors impacting on enterprise, it should be noted that these enablers are interdependent.

6.2 What drives enterprise?

The following section explores academic evidence regarding how the enablers of enterprise can impact on productivity growth. It also investigates some of the most important factors that impact on these enablers and highlights linkages between enablers and drivers of productivity.

Culture

Individuals’ attitudes to, and experience of, enterprise are important drivers of an enterprising economy. Positive experiences of people with the initiative, skills, drive and confidence to start and run a successful business are important in encouraging entrepreneurial activity. In fostering an enterprise culture, it is important that individuals and society appreciate the returns from enterprise and do not overstate the likelihood or consequences of failure.

A positive enterprise culture increases willingness to develop entrepreneurial skills and impacts positively on the actual development of such skills. A positive culture also influences business innovation by

providing the environment where people want to take risks and advantage of potentially viable business opportunities. A positive culture also helps with access to finance, as lenders tend to be more supportive of entrepreneurial activity where there is potential for returns to be made and individuals have aspirations to establish and grow their business.

Robinson et al (2006)\textsuperscript{189} find that both environmental factors (such as the region – population levels, local government policy) and socio-economic factors (such as wealth, family background and education) have significant influences on whether individuals choose to start-up their own business.

**Knowledge and skills**

Successful entrepreneurship not only requires a broad knowledge of enterprise (for example from role models, mentors and enterprise education), but also the specific skills to turn these ideas into successful businesses.

Knowledge and skills are important for creating entrepreneurial ambition and driving entrepreneurial performance. Management and leadership skills are important in ensuring that entrepreneurs are willing and able to take risks, and to take advantage of business opportunities by exploiting new technologies and developing new products and processes. BERR research has shown that entrepreneurs who found high growth firms tend to hold significant management experience, with two thirds having previously held positions as company directors.\textsuperscript{190} Other factors, such as the effectiveness of enterprise education, are also important for driving investment in skills, with some suggesting that the earlier children are introduced to enterprise, the more receptive they are to the belief that they have the skills to be enterprising.\textsuperscript{191}

Knowledge and skills influence the other enablers of enterprise. They influence access to finance, as entrepreneurs need to demonstrate to potential investors that they have the skills to take their ideas forward to successful businesses. Knowledge and skills impact on entrepreneurial ambition affecting firms’ ability to identify new opportunities and grow and their ability to internationalise. They also influence the extent to which innovative ideas could be exploited in generating viable commercial products and processes. In this respect it is important that entrepreneurs possess a personal skill set that includes the management, financial, business and communication skills required to identify opportunities and succeed.

\textsuperscript{189} Robinson et al (2006), a report prepared for DTI’s Small Business Service.
\textsuperscript{190} BERR 2008c, \texttt{http://www.berr.gov.uk/files/file49042.pdf}
\textsuperscript{191} HMT and BERR, 2008.
Case studies of management training in small and medium-sized enterprises (SMEs) in Canada, Finland, Germany, Japan, the US and the UK by the OECD (2002) provide preliminary evidence to suggest that formal management training can reduce the failure rates of small firms.

**Access to finance**

Lack of, or limited, access to external finance\(^1\) is likely to act as a barrier to enterprise. Well-functioning capital markets facilitate business start-ups and ensure that existing businesses are able to obtain the capital necessary to expand. There are a number of recognised market failures that prevent or restrict viable businesses, especially SMEs, from accessing the funds they need. This will have economy-wide implications, as these firms will not be able to generate finance for new technologies or new ways of operating, even if they have technical knowledge to do so.\(^3\)

A number of factors could influence the degree of access to finance. Macroeconomic stability is a relevant factor, which influences firm profitability, and profitability in turn influences access to finance. Entrepreneurial activity is significantly easier to carry out in a stable macroeconomic environment with low inflation as it allows entrepreneurs to clearly interpret signals about demand and prices and to develop sensible business plans and strategies based on the fundamental strengths of their projects.\(^4\) Moreover, access to different types of finance, risk aversion and ease of access to international markets could impact on the relative ease of access to finance throughout the economic cycle.

Access to finance can influence the other enablers of enterprise, for example, the extent to which entrepreneurs can access the necessary capital influences the ability to turn innovative ideas into successful commercial products and processes.

There is little empirical evidence to back up the *direct* link between access to finance and productivity. Butler and Cornaggia (2008) examine the effect of access to finance on productivity in the US agricultural sector over 2000-2006 and identify state-level productivity responses in the presence of varying levels of access to finance. The authors find that production increases the most in states with relatively strong access to finance, even in comparison to production in the soybean sector used as a control group.\(^5\)

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\(^1\) Firms can raise finance internally (retained earnings) or externally (e.g. from banks).

\(^3\) DTI, 2003.

\(^4\) OECD, 1998.

\(^5\) The authors find no significant difference between the increases of soybean yields in states with high and low levels of bank deposits over the sample period. This result eliminates the concern that the authors are simply capturing overall growth in agricultural productivity.
Other studies take an indirect approach and look at the availability of finance on business start-ups and entry, which in turn increases productivity. For instance, Aghion et al. (2007) find that higher finance development enhances new firm entry in sectors which are heavily dependent upon external finance. The authors find that finance development is most important for the smallest size firms, but also enhances post-entry growth of firms in finance dependent sectors.

**Business innovation**

Business innovation is an enabler of enterprise and is a key motivation for many entrepreneurs. As discussed in Chapter 4 on Innovation, innovative businesses are more likely to achieve growth, and businesses which have experienced recent growth are more likely to introduce new or improved products and services or new ways of working. An innovative environment is crucial for creating and adopting new ideas that create the basis for new investments.

Chapter 4 explores the different strands of economic theory that describe the relationship between innovation and productivity growth. The rest of this sub-section focuses on the factors that influence business innovation.

Enterprise requires firms to be able to access new ideas, from scientific and applied research conducted within research institutions to new ideas already being employed by other firms. It is only through enterprise that new innovations are exploited as businesses look to develop a competitive advantage.

Michelacci (2003) suggests that entrepreneurial ability is important for business innovation as it is essential to fully exploit the potential of R&D expenditure. The competitive pressure caused by new entrants can also force incumbents to innovate, possibly driving successive investments.

Robinson et al (2006) find evidence supporting a U-shaped relationship between firm size and innovation, whereby it is the smallest and largest firms that are most likely to innovate. Hoffman et al (1998) identified the characteristics of SME innovators as being located in niche markets, largely product innovators and particularly innovators with collaborative linkages to private and public organisations such as higher education institutions.

The factors that influence innovation performance are either ‘internal’ to the firm (for example, educational background and prior experience of the founder/managers, professional qualifications of the workforce and

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196 According to the 2005 SBS Household Survey of Entrepreneurship, a key motivation for becoming an entrepreneur for around half of all entrepreneurs is ‘making an idea or innovation happen’.
197 HMT and BERR, 2008.
various kinds of technological capabilities such as formal/informal R&D or on the job training) or ‘external’ (for example, networking capabilities, geographical advantages or institutional support). Romijn and Albaladejo (2000) show that firms that use large corporations or academic institutions as a ‘breeding ground’ for innovation benefit from the external support and the opportunity to carry out “substantial pre-competitive research”. Firms also benefit from the training and internal learning opportunities that are available. Moreover, the authors find that high levels of science/engineering qualifications are positively associated with innovations. Similarly, Cosh et al (2005) find that in high-tech industries, knowledge-related factors play a crucial role on innovation performance, while in low/medium-tech industries managerial incentives and organisational flexibilities are more significant.

**Regulatory framework**

The regulatory framework can impact on market outcomes by influencing the decisions of firms and individuals and the way markets operate. Regulation has implications in relation to the availability of business opportunities, the costs of pursuing these opportunities and the returns from doing so. For instance, administrative burdens are likely to act as a barrier to enterprise.

There is a two-way link between the strength of the business environment and the regulatory framework. The strength of the business environment influences the particular policies that form part of the regulatory framework. The regulatory framework also influences the strength of the business environment, which in turn influences the level of enterprise. For instance, stability of the business environment and the size of the burden of regulation and tax are important aspects of the business environment and can directly influence the cost of setting up a business and the certainty with which businesses can invest.

The available evidence on the link between regulation and productivity suggests that regulation can positively or negatively affect productivity. Positively by, for example, protecting intellectual property, or negatively by diverting resources away from more productive uses and raising barriers to entry into industries.

Nicoletti and Scarpetta (2003) find that product market reforms are positively correlated with TFP growth, with the strongest correlation for reducing administrative burdens. Macroeconomic evidence suggests that by reducing administrative burdens on businesses, there could be a positive impact on UK growth. Gelauff and Lejour (2006) explore the implications of a cut in administrative burdens and find that a 25 per cent

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198 BERR, 2008b.
reduction in administrative burdens in the UK would lead to a 0.9 per cent increase in UK GDP by 2025.

On the other hand, there is evidence to suggest that some regulation can have a positive indirect impact on productivity. Chapter 7 on Competition emphasises the importance of an appropriate corporate governance framework as a pre-condition for enterprise and investment, and a key determinant of company performance (by reducing agency costs).\footnote{See also BERR 2008b.} As regards specific types of regulation, standards regulations provide a key enabling mechanism for the widespread diffusion of major technologies, and hence are productivity enhancing. Temple et al (2005) find that the growth in standards as measured by the BSI catalogue accounted for 13 per cent of labour productivity growth in the post-war period.

6.3. Progress

This section explores the record for enterprise, what government has done in the area and the impact of government policies on the enterprise driver.

**The enterprise environment**

Research by the OECD and World Bank shows that the UK has one of the best business environments to start and grow a business.

The UK regulatory framework is consistently recognised as being amongst the best in the world. The World Bank (2009)\footnote{See Doing Business in 2009 report, \url{http://www.doingbusiness.org/}; Rankings cover the period April 2007 to June 2008.} compares the impact of a wide range of regulations across 181 countries and ranks the UK fourth in the OECD and sixth across the world in terms of the ease of doing business.

Figure 6.1 illustrates international comparisons of the cost and time needed to start a business. In general, the lower the burden businesses face when complying with regulations, the greater the business ability to innovate and compete. The evidence suggests that the time to start a business is a weaker area in the UK relative to the US and France, but that the cost to start a business is relatively low.

\footnotetext[199]{See also BERR 2008b.}
\footnotetext[200]{See Doing Business in 2009 report, \url{http://www.doingbusiness.org/}; Rankings cover the period April 2007 to June 2008.}
Conway et al (2005) suggest that the UK has the lowest barriers to entrepreneurship of all OECD countries, taking account of such factors as the administrative burdens on businesses in the process of starting-up, and the degree to which administrative systems are difficult to understand (see Figure 7.2 in Chapter 7 on Competition).

This positive view on the UK business environment is not fully reflected when people’s attitudes to, and experience of, enterprise are measured on international indices such as the total entrepreneurial activity (TEA) index computed using data from the Global Entrepreneurship Monitor (GEM).\(^{201, 202}\) Figure 6.2 illustrates people’s attitudes to, and experience of, enterprise as measured by the total entrepreneurial activity (TEA) index,\(^{203}\) which shows that the UK leads Germany and France but that the US is still the clear leader.\(^{204}\)

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\(^{201}\) This is a *composite* index calculated form perceptions of entrepreneurs and entrepreneurship; suitability as a career choice; and coverage in the media.

\(^{202}\) Note that 2008 data for Germany is available but not 2007.

\(^{203}\) This is a *composite* index computed using data from the Global Entrepreneurship Monitor (GEM) and covers: perceptions of entrepreneurs and entrepreneurship; suitability as a career choice; and coverage in the media.

\(^{204}\) It should be noted that in 2008, the differences in the index between the UK and the US and Germany are statistically significant, whilst the difference in the index between the UK and France is not.
Figure 6.2: Business start-ups
Total Entrepreneurial Activity (TEA) Index, 2000-2008
Per cent of the labour force either (i) actively involved in starting a new business or (ii) owner or manager of a business that is less than 42

![Graph showing Business start-ups from 2000 to 2008 for US, UK, France, and Germany.]

Source: Global Entrepreneurship Monitor 2008 Report

On most individual measures of attitudes and perceptions towards entrepreneurship among G8 countries, the UK scores well on most measures in comparison to France and Germany but less in comparison to the US. Even though people in the UK have broadly similar perceptions of their skills to be entrepreneurs as the US, they are still less likely to have the aspiration or motivation to start a business.

The evidence above suggests that there are many attractive features for starting a business in the UK, but that the level of entrepreneurship does not fully match this. The Government is continuing to make progress in this area, particularly through the launch of the Enterprise Strategy in March 2008 and also building on previous support.

**Culture**

Figure 6.3 illustrates the proportion of all UK SMEs saying they were aiming to grow their business over the next 2-3 years.\(^{205}\) Data suggests that since 2005 there has been some improvement in the UK enterprise culture as there has been increase in the number of SMEs which aspired to grow their business\(^ {206} \).

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\(^{205}\) Data is collected from the BERR Annual Small Business Survey. Data for 2003 refer to calendar year, whereas data for 2004-2006 refer to financial year. Note that data for 2007 is not yet available.

Evidence from the Global Entrepreneurship Week\textsuperscript{207} launched in 2004 suggests that the initiative had a positive impact on the culture of entrepreneurial ambition; the proportion of 16-24 year olds thinking of starting a business has increased from 14.4 per cent in 2004 to 17.5 per cent in 2007.\textsuperscript{208}

The Enterprise Insight Tracker study (2006)\textsuperscript{209} found a significant increase in participation in enterprising activities in the previous 12 months (from 10 per cent to 15 per cent of all respondents). Those ‘engaged’ in an enterprising action were much more likely to have taken part than those who were thinking or not engaged at all demonstrating that the events are successful. It should be noted that it is difficult to comment whether they were ‘engaged’ before they attended the event, or as a result of attending.

Government has also addressed wider factors that impact on enterprise culture including insolvency rules on personal and corporate provisions of the Enterprise Act.\textsuperscript{210} Policy could influence enterprise culture through its impact on individuals’ perception of cost of failure and risk aversion. The evaluations of insolvency rules suggest that the changes in the Enterprise Act have yet to fully achieve its expected outcomes for changing enterprise culture and increasing start-up rates as it will take some time for these outcomes to emerge. Armour and Cumming (2005) develop an index of severity of personal bankruptcy laws\textsuperscript{211} to investigate the link between bankruptcy and entrepreneurship using data on self-employment over the period 1990-2002 on 15 countries in Europe and North America. Their analysis suggests that personal bankruptcy

\textsuperscript{207} This is a worldwide initiative which aims to inspire young people around the world, including the UK to embrace innovation, imagination and creativity.

\textsuperscript{208} Using the 2003 SBS household survey of entrepreneurship as a baseline for the UK.


\textsuperscript{210} \url{http://www.insolvency.gov.uk/insolvencyprofessionandlegislation/legislation/evaluation/finalreport/report.pdf}

\textsuperscript{211} Based on time required before of discharge of bankruptcy order.
law has a more statistically and economically significant effect on self-employment rates than GDP growth, stock market returns and a variety of other legal factors and economic factors.

There is evidence to suggest that there are differences in enterprise culture among men and women, with women being substantially less likely than men to expect to start a business (5.3 per cent compared to 10.4 per cent). Looking ahead, Government policy will aim to improve attitudes to enterprise across the UK, including among women. The Enterprise Strategy announced that the Government will fund a high level media campaign around women’s enterprise – ‘Spark an Idea’ – to be coordinated by Enterprise Insight and has also committed £12.5 million for a capital fund focussed primarily on investing in women-led businesses.

**Skills**

As noted in Chapter 5 on Skills, there are a number of programmes in place to target skills development and there has been progress in this area. Based on objectives presented in the Leitch Review of Skills (2006), the UK skills base has improved markedly in recent years. For example, there has been an increase in the proportion of individuals holding Level 4+ qualifications and a reduction in the proportion of individuals holding the lowest level of educational attainment (Level 2). At the same time, there is room for further improvement in areas such as leadership and management skills as suggested by survey evidence from the Institute for Management Development (IMD) and the National Employers Skills Survey (NESS).

There are a number of initiatives aimed at increasing individuals’ willingness to develop entrepreneurial skills such as the Make Your Mark Club, the National Enterprise Academy and the University Enterprise Networks (the latter being based on the Kauffman experience in the US). It is too early to measure the impact of these policies on productivity. Evidence from the 2007 Household Survey of Entrepreneurship suggests that of those who had experienced training or work experience, four per cent went on to become “Thinkers” or “Doers” and claimed that they would not have wanted to start a business had it not been for their training.

Government is also making progress on entrepreneurship education and training embedded within all levels of education system. Figures 6.4 and 6.5 illustrate the entrepreneurship index for the primary and secondary

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212 Aims to link student voice to business and enterprise activity in school.
213 The first in a network of enterprise academies forming part of a joint initiative between government and entrepreneur Peter Jones aimed at fostering the entrepreneurial talents of the country’s teenagers.
214 Both the primary and secondary and the post-secondary index are composite indicators, each derived from the results of three questions asked the GEM national experts survey: the primary and secondary entrepreneurship education index relates to how far teaching at these levels of education a) encourages
education system and for post-secondary system respectively across the US, the UK, Germany, and Italy. These indicators aim to capture the degree to which the education system develops entrepreneurial skills and knowledge.

Figure 6.4 shows that the US is still the clear lead but the UK has been closing this gap, and still leads Italy. Figure 6.5 shows the UK lagging behind US and Italy for post-secondary education, but since 2005 there has been some progress in closing the gap with the US. Note that care needs to be taken in interpreting apparent trends, as year-on-year changes may reflect greater awareness of gaps in entrepreneurship education rather than actual changes.

Figure 6.4: Primary and secondary entrepreneurship education index

Source: Global Entrepreneurship Monitor (GEM) Note: Data not available for some countries in some years

creativity, self-sufficiency and personal initiative, b) provides adequate instruction in market economic principles and c) provides adequate attention to entrepreneurship and new firm creation. The post-secondary entrepreneurship education index relates to how far adequate preparation for starting-up and growing new firms is provided by a) colleges and universities, b) business and management education and c) vocational, professional and continuing education.

215 Data for France are only available for 2002-2003 and are not reported.
216 Note that these indicators do not overlap with the skills driver indicators.
Business Link provides support to businesses that can help them to develop their entrepreneurial skills; this includes, advice on accessing finance, starting up, and growing their business.²¹⁷ Evidence suggests that services provided by Business Link have a small but statistically significant productivity effect²¹⁸ and a positive and significant impact on employment growth, with the latter increasing by 2.2 percentage points. The evaluation evidence of Business Link suggests that it can take 36 months for the full benefits of this advice to emerge.

Access to finance

As highlighted in section 6.2, there may be a number of reasons why businesses may not be able to access finance. Moreover, and as noted in Chapter 2, any problems with access to finance may be made worse in a recession, with the recent credit crunch being the main driver of the current recession.

Prior to recent economic events, surveys show that many businesses that initially fail to obtain finance from one source go on to obtain it from another. Survey evidence from 2006 suggests that only around one in eight businesses needing new finance failed to obtain any external finance.²¹⁹ Whilst the general financing situation might be good, difficulties remain for a minority of viable businesses.

There is also evidence to suggest that the skills and confidence levels of UK entrepreneurs can be part of the problem for accessing external finance. A possible explanation is that many smaller businesses do not have their finances managed by a qualified individual; and confidence in dealing with finance is not high compared to other aspects of running a

²¹⁸ See 2001 Business Link Operators Tracker study.
²¹⁹ Annual Survey of Small Businesses’ Opinions 2006/07
More generally survey evidence reveals a lack of knowledge amongst businesses considering equity funding. Only one third considered themselves knowledgeable about the processes for securing equity finance, another third had some knowledge, whilst the rest considered themselves not to be knowledgeable.\(^{221}\) As noted above in the skills section, more is being done to support enterprise skills, and this includes how to access finance – examples of support include Business Link services and investment readiness support.

Figures 6.6 and 6.7 show that the UK performs well in comparison to France, Germany and the US on levels of venture capital investment as a proportion of GDP, suggesting that UK firms have less difficulty accessing this kind of finance relative to firms in comparator economies. Regarding venture capital for early stage investment, 2007 data illustrates that the US has overtaken the UK by a small margin, but the UK still leads France and Germany. As regards venture capital for expansion and replacement, 2007 data shows that the UK still leads the US, France and Germany.\(^{222}\)

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220 Fraser, 2005.
222 The 2006 figure both for early stages and expansion and replacement appears to be an outlier as there is anecdotal evidence to suggest this was due to a fund raising spree which allowed more investments to be made.
Other evidence on accessibility of finance comes from data on the total stock of term lending, the latter being more likely to be used for investment or development than funding utilised via overdraft facilities. Figure 6.8 shows term lending to businesses with turnover of £1 million or less (this measure covers the majority of SME financing\(^{223}\)), and demonstrates that even in light of current economic conditions there has been an overall upward trend since 1996.\(^{224}\)

\(^{223}\) This measure differs to the BERR definition of SMEs that are based on employee size.

\(^{224}\) Variations in the level of term lending are due to inconsistencies in the way the BBA data is collected over time. For instance, certain banks were included in 2000, clubs, societies and charities were excluded from 2002, and better identification of small business accounts occurred in 1998 and 2004.
The Government provides a range of support to businesses to ease problems with access to finance, ranging from providing loans and grants, to loans guarantees and support for developing skills to better access finance (for example through Business Link – as discussed above).

Selective Finance for Investment in England (SFIE),225 the successor to the Regional Selective Assistance scheme, is a discretionary grant scheme. Evidence on the support provided by SFIE is that it achieves real business benefits in terms of productivity and that this is also associated with increasing skills and technical capability. It should be noted that applications to SFIE must pass a productivity test to ensure that the projected growth in gross value added (GVA) that a project expects exceeds GVA growth elsewhere in the same sector.

Moreover, evidence from the 1999 evaluation of the Small Firms Loan Guarantee Scheme (SFLG)226 suggests that 70 per cent of firms received finance that was fully or partially additional. There is also evidence that SFLG led to additional turnover per firm of between £16,000 and £29,500 in the eighteen months following the loan, and created between 5,400 and 9,500 additional jobs to the economy as a whole. In addition, the evaluation suggested that 53 per cent of firms used finance to develop into a new market, 64 per cent to open a new market and 32 per cent to introduce leading edge technology.

**Business innovation**

We are able to track progress in this area through looking at the proportion of SMEs that are innovation active, and see how well the UK performs over time and relative to comparator economies.227

According to the UK CIS survey, the proportion of SMEs that are innovation active increased from 48 per cent in 2001 to 68 per cent in 2007. It is still the case that larger businesses in the UK (and other countries) are significantly more likely to engage in innovation than smaller businesses.228 Focussing on Eurostat figures, Table 6.1 illustrates that the UK has made some progress as it overtook France in 2005 and has narrowed the gap with Germany over the period 2001 to 2005.

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225 See BERR Occasional Paper No. 2, [http://www.berr.gov.uk/files/file45548.pdf](http://www.berr.gov.uk/files/file45548.pdf). The Regional Selective Assistance (RSA) Scheme has been in operation over the period 2000-2004 and was replaced by the Selective Finance for Investment in England (SFIE) Scheme since April 2004. RSA and SFIE are slightly different versions of the same scheme.

226 A new impact evaluation of the SFLG is due to be published in 2009.

227 Data is reported by the UK Community Innovation Survey (CIS) and Eurostat. Eurostat publish figures for a far more restricted sectoral coverage than that used for the UK CIS survey, so the figures provided for the former do not match those published for the latter. Focussing on the Eurostat data, these figures are broadly comparable across the countries as Eurostat ensure that the sectoral coverage is the same for all the data that countries submit. Nevertheless, it should be noted that comparability is limited by the differing national systems, institutions and economic histories of each country, and economic histories of each country.

228 This pattern in innovation activity by size is also confirmed in other large scale surveys. See for example Cosh, A. and Hughes, 2003.
According to the Sainsbury Review (2007), SMEs are often best placed to provide the most innovative solutions to problems due to their ability to focus narrowly, pursue new and different ideas, take quick decisions and respond to changing circumstances. The same report notes that in the US, SMEs have driven the growth of the high-technology economy.\textsuperscript{230}

The Government has taken steps in a number of areas to improve the enterprise environment and achieve further progress in the enterprise area.

The Small Business Research Initiative (SBRI) launched in 2001 is designed to help early stage, high technology SMEs gain greater access to R&D opportunities supporting the future procurement needs of Government Departments.\textsuperscript{231} SBRI aimed to reproduce, as far as possible, the highly regarded US Small Business Innovation Research (SBIR) programme launched in 1982. According to Lerner (1999), there is a strong positive relationship between the US SBIR awards and growth of high-technology firms.

As noted in Chapter 4 on Innovation, there are a number of programmes other than SBRI to target business innovation. These include the establishment of university enterprise networks through the National Council for Graduate Entrepreneurship. The Government will also investigate the role of innovation vouchers in encouraging firms to innovate in liaison with universities.

\textbf{Regulatory framework}

As part of the better regulation agenda, the Government has committed to a programme of simplification with a 25 percent reduction by 2010 in the administrative burdens that regulations place on business. In addition, the Government has consulted\textsuperscript{232} on the introduction of a new system of regulatory budgets for Departments that would set out the maximum cost of new regulation that can be introduced within a given period.

\begin{table}[h]
\centering
\begin{tabular}{|c|c|c|c|}
\hline
Year & Source: UK Community Innovation Survey & Source: Eurostat & \\
\hline
2001 & UK & Germany & France & UK \\
2005 & 48 & 59 & 38 & 35 \\
2007 & 61 & N/A & N/A & N/A \\
\hline
\end{tabular}
\caption{Proportion of Innovation Active SMEs, \%}
\end{table}

\textsuperscript{230} \textit{Entrepreneurial Dynamism and the Success of US High-Tech}, United States Congress, Joint Economic Committee Staff Report, October 1999.
\textsuperscript{231} The UK SBRI programme is currently being reformed to increase its future performance and impact.
\textsuperscript{232} \url{http://www.berr.gov.uk/whatwedo/bre/policy/scrnignew-regulations/consultation/page47006.html}
As noted in Chapter 7 on Competition, the Government is continuing to make good progress in reducing the annual administrative burden, with an estimated £1.9 billion of savings being delivered to date.

**Summary assessment**

The evidence presented in this chapter suggests that there has been progress in the enterprise area. At the same time there is scope for further improvement and there is a continuing role for the Government in providing support to increase confidence, provide skills and finance.

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7. Competition

7.1. Introduction

Competition can be defined as a process of rivalry between suppliers that takes place either in the market or for the market.\textsuperscript{235} Sellers compete with one another for buyers by offering lower prices, a wider range or a higher quality of products or services.\textsuperscript{236} Firms can have several objectives for winning customers, such as increased profitability, sales or market share.

Competition impacts on productivity through several routes.

First, higher levels of competition tend to reduce market prices, increasing the pressure on firms to increase efficiency and reduce costs. There is some empirical support for this link, for instance Bloom and Van Reenen (2006) suggest that poor management practices are more prevalent when competition is weak.

Second, increased competition raises the efficiency with which resources are allocated between competing firms as more productive firms gain and less efficient firms lose market share. Haskell’s (2003) study of UK manufacturing plants over 1980-1992 gives evidence that such market ‘churn’ is responsible for about half of gains in industrial productivity, with 70 per cent of the plants in the lowest productivity quintile exiting less than a decade later, whereas 45 per cent of plants in the top productivity quintile remain in either of the top two quintiles a decade later. This is discussed in more detail in Chapter 5 on Enterprise.

Third, increased competition can raise productivity by increasing the incentive to innovate, which will help firms gain a competitive advantage on their competitors. Empirical studies generally find a positive link between increased competition and innovation, such as Geroski (1990). However, there is some evidence of an inverted U-shaped relationship between competition and innovation.\textsuperscript{237} Thus, at medium levels of competition, innovation is high as firms compete by innovating, but at both high and low levels of competition innovation is low as there is little profit to be gained from innovating.\textsuperscript{238}

\textsuperscript{235} Competition in the market describes how firms in a particular market compete on a day to day basis against each other. Competition for the market describes how firms initially compete to supply a market.

\textsuperscript{236} Productivity and Competition: An OFT perspective on the productivity debate: January 2007, Office of Fair Trading.

\textsuperscript{237} Eg Aghion, Bloom, Blundell, Griffith and Howitt (2005), Aghion, Harris, Howitt, and Vickers (2000).

\textsuperscript{238} If levels of competition are low, firms are under less pressure to compete through innovation, and if they are high the gains from innovation could be quickly competed away through imitation by rivals.
7.2 What drives competition?

The following section explores the factors which lead to greater competition and therefore increased productivity, and their determinants.

**Barriers to entry and exit**

Barriers to entry and exit limit the competitive pressures on incumbent firms and dampen the positive effects on productivity from inefficient firms leaving an industry.

Poschke (2006) finds that small increases in the administrative costs of entry in product markets explained between 10 and 20 per cent of the differences in TFP\(^{239}\) between Europe and the US.

Barriers to entry and exit can be caused by structural factors such as economies of scale, absolute cost advantages, sunk costs, access to resources, transaction costs and regulation, or firm behaviour designed to limit entry such as strategic investment, limit pricing or predatory pricing. The strength of these barriers, among other things, will impact on the likelihood of entry, the speed of entry and how effective new entrants can be.

Regulation and barriers to international competition (such as quotas and tariffs) can act as barriers to entry and exit, and are directly influenced by government policy. Brandt (2004) finds that overly-complicated licence and permit systems discourage entry, and that excessively long periods over which creditors have claims on the assets of bankrupt firms discourages entry. To illustrate the potential magnitude of barriers to international trade, we can cite a recent study which estimates that costs incurred by firm in 2006 to meet different national regulatory requirements across the European Union amounted to around €40bn (around 2 per cent of EU25 GDP in 2006).\(^{240}\)

Restrictions on foreign direct investment (FDI) can impact on competition and productivity. As outlined in Chapter 3 on Investment, there is evidence\(^{241}\) that multinational firms are generally more productive than domestically-owned firms, who will face increased pressure to improve, but who can potentially also benefit from knowledge spillovers from the inward investment.

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\(^{239}\) See Chapter 1, Box A for a definition.


\(^{241}\) HMT and DTI 2006: Productivity in the UK 6: Progress and new evidence.
Competitive framework

Government can play a role in increasing competition by ensuring that the competition framework allows businesses to compete fairly. This includes competition policies which have a direct impact on the competitiveness of markets, and less direct policies such as corporate governance.

Competition policy

Competition policy and its enforcement can raise competition and thus productivity, by preventing anti-competitive behaviour such as cartels, or by liberalising markets.

There is evidence that cartelisation is associated with low productivity growth, such as Symeonidis (2003). Many other studies, such as a recent report by the OFT, provide evidence that anti-competitive restrictions lead to higher prices, and lower quality. The OFT study into the taxi market finds that restrictions on taxi licenses significantly lower the quality of service. Also, Maher and Wise (2005) estimate that the liberalisation and regulatory reforms of the UK electricity, gas, and water industries in the 1990s resulted in average rates of productivity growth in excess of 10 per cent a year.

Corporate law and governance

An efficient and credible corporate law and governance regime helps firms compete on a level playing field by preventing unscrupulous practices. Improvements in corporate governance improve the market for corporate control and can help reduce the cost of capital. There is evidence that GDP growth, levels and growth of TFP and the ratio of investment to GDP vary positively and significantly with the quality of corporate governance.

Increased activism of consumers

Competition in markets can also be increased by improving the ability of consumers to switch to more efficient suppliers, for example, by increasing the transparency of complex products such as financial services. This can help ensure efficiency as suppliers respond to consumer needs and preferences.

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242 Symeonidis, 2008.
245 The recent OFT market study into personal current accounts (published in July 2008) found that the UK has one of the lowest rates of customer switching in Europe – only 6 per cent of customers had switched in the last 12 months. See http://www.of.og.gov.uk/advice_and_resources/resource_base/market-studies/current/personal/pca/
Consumers may be unnecessarily unwilling to switch if they attach an artificially high estimate to the cost of switching suppliers. An Abbey Banking Report in 2005 found that the biggest barrier to switching current accounts was the *perception* of administration costs, with 73 per cent of respondents thinking that these made switching too difficult, when 89 per cent of those surveyed who had switched accounts found it easy to do so.\(^2^{46}\)

### 7.3 Progress

The government plays a key role in providing frameworks, rules and institutions for supporting competitive markets. This section considers progress under the competition driver.

**The competition record**

The degree to which businesses are exposed to international competition through trade and FDI is an important determinant of the strength of competitive pressures prevailing in product markets. Figure 7.1 demonstrates that the UK has a relatively open economy, with exports and imports of goods and services representing around 55 per cent of GDP in 2007. This is almost double the level in the US and slightly ahead of France.

The UK is also relatively open to FDI, with a higher stock of inward investment as a percentage of GDP relative to the US, France and Germany. UK’s stock of inward investment as a proportion of GDP rose to 49 per cent in 2007 in contrast to 40 per cent for France, 19 per cent for Germany and 15 per cent for the US\(^2^{47}\) (see Figure 3.3 in Chapter 3 on Investment).

\(^2^{46}\)http://www.aboutabbey.com/csgs/Satellite?c=GSNoticia&cid=1127562869631&idInfArchive=1077211222403 &pagename=AboutAbbey/GSNoticia/PAAI_newComplet

The above evidence suggests that the UK remains a relatively open economy and is in a position to reap the benefits of international trade. The relatively high stock of inward investment as a proportion of GDP demonstrates that the UK remains an attractive location for foreign investors.

Another important determinant of the intensity of product market competition is the effectiveness of the regulatory framework. OECD assessments of the restrictiveness of product market regulation\(^{248}\) suggests that product market regulation in the UK – already considered to be relatively ‘light-touch’ – has become even less restrictive since 1998 and is now the lowest in the OECD (see Figure 7.2). Other evidence confirms that the UK is considered amongst the least regulated economies in the world (Card and Freeman, 2001; Nicoletti and Scarpetta, 2005).

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\(^{248}\) The OECD’s assessments on the restrictiveness of product market regulation are the most respected international assessments.
Government policy to improve the competitive environment

The Government recognises that regulation is an important tool for achieving social and economic aims, but also that with benefits come costs. Thus, regulation needs to be implemented effectively, efficiently and fairly, and to be appropriately targeted in addressing genuine market failures. The Government’s Better Regulation programme of reforms seeks to ensure that regulation is delivered according to five principles: proportionality, accountability, consistency, transparency and targeting. The key drivers of the better regulation agenda stem from the Government’s acceptance of the Hampton report and the ‘Less is More’ report of the Better Regulation Task Force (BRTF) in 2005.

The Government also committed in December 2006 to reduce the overall level of administrative burdens by 25 per cent by 2010 for businesses and the third sector, with associated targets for individual departments. This is accompanied by annual simplification plans which identify regulations that have or can be simplified (or simply repealed), where administrative burdens can be removed or reduced. The latest simplification plans were published in December 2008 and show Government continues to make good progress in reducing the annual administrative burden of regulation by 25 per cent. An estimated £1.9 billion or 15 percent of annual net administrative burdens savings

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249 These five principles of good regulation were set out by the Better Regulation Task Force in 2003.

250 These reports emphasised the importance that regulation was properly targeted e.g. focusing on areas where the risk to society was greatest.

251 This means net savings worth an estimated £3.4 billion per annum by 2010.

have now been delivered. Reducing the burden of compliance will ensure that businesses are better able to innovate and compete, hence contributing to the long-term policy objective of improving the UK’s productivity performance.

As regards the economy’s competition regime, this is an important determinant of the overall level of competition. KPMG’s latest peer review of the perceived effectiveness of the UK’s competition regime\textsuperscript{254} concluded that the UK competition regime continues to be perceived as one of the best in the world, pointing out that the UK has narrowed the gap with the US and has almost drawn level with Germany.\textsuperscript{255}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure7.3.png}
\caption{Ranking of competition regime - peer review}
Index (scale 0 - 10) - EU result is set equal to 6 in each year
\end{figure}

Note: Sample size for France in 2001 was too small for reliable results to be produced.

The latest Global Competition Review of individual competition enforcement agencies continues to rank both UK agencies (the Office of Fair Trading, OFT, and the Competition Commission, CC) very highly. The CC is ranked in the ‘elite’ group for 2007 alongside the European Commission’s DG Competition and the US Federal Trade Commission, and the OFT is ranked in the top 10 (‘very good’). The powers of these two agencies have been strengthened considerably via the Competition Act 1998 and the Enterprise Act 2002.

\begin{itemize}
\item \textsuperscript{253} http://www.berr.gov.uk/files/file49273.pdf
\item \textsuperscript{254} DTI (2007), http://www.berr.gov.uk/files/file39863.pdf
\item \textsuperscript{255} The methodology comprised of pulling together survey responses by economists and lawyers across major OECD countries in relation to how effective they perceive the UK regime to be.
\end{itemize}
The strength of enforcement powers and the degree of political independence given to competition authorities helps determine the effectiveness of the authorities in deterring anti-competitive behaviour. The Enterprise Act 2002 formally removed political considerations from competition decisions (for all but a minority of cases) through establishing the OFT as an independent statutory body, and the introduction of the wider ‘substantial lessening of competition’ test to replace the more widely-defined ‘public interest’ test. As shown in Figure 7.4, around 47 per cent of the respondents to the 2007 KPMG peer review study consider that the Enterprise Act 2002 has enhanced or significantly enhanced the UK competition regime.

Figure 7.4: Impact of Enterprise Act 2002 on the UK competition regime (all respondents)

At the same time, the 2007 peer review report identified areas where there is scope for further improvement, such as improving the speed of decision-making under the Enterprise Act (2002) and Competition Act (1998), working towards making the regime appear less complex to users, and improving the use of resources in the competition regime.

**Economic impacts of competition**

Evidence suggests that, over one year, OFT and CC work on merger control and market studies or investigations has led to consumer detriment of £336 million being avoided.\(^{256}\)

The Competition Act (1998) works as a good complement to the Enterprise Act and was set up to prevent firms abusing market power and pursuing agreements that prevent, restrict or distort competition to

\(^{256}\) Competition Commission (2008), Estimated costs to consumers of mergers and market outcomes against which the CC took action between April 2007 and March 2008, p.5; http://www.competition-commission.org.uk/our_role/analysis/estimated_costs_07_08.pdf
the detriment of consumers. The OFT estimates that for the financial
period 2005-2008, the enforcement of the Act led to direct consumer
savings of £77m per year (with annual enforcement cost of £18m in
07/08).

There is also evidence of the positive impact on productivity of
ending agreements that distorted competition, for instance resale price
maintenance. The entry of supermarkets and internet sellers into the
market for books made a positive contribution to industry productivity of
about 20 per cent over 2001-2005.

In addition to the direct benefits generated by the enforcement of the
Competition Act (1998), there may be indirect benefits. Deloitte found
many examples of agreements and initiatives that were abandoned or
modified because of the threat of OFT enforcement action, and that for
every reference made by the OFT, at least five mergers were
deterred.

Summary assessment

The evidence suggests that the UK remains a relatively open economy in
terms of international trade and inward investment. Its regulatory regime
remains light-touch as measured by the restrictiveness of its product
market regulations and there has been good progress in reducing the
administrative burdens on businesses and the third sector. In addition,
the UK performs well in terms of its competition regime, with the
increased powers to the competition authorities determined through
continuing to have a positive impact.

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260 This measure does not take into account the potential negative effect on productivity due to possible
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Annex A: Productivity and Competitiveness Indicators

Investment

- **Macroeconomic stability** – measures of the volatility of GDP growth and short-term interest rates in the UK against its competitors;
- **Business investment** – overall business investments and stock of inward FDI as a percentage of GDP against competitor economies;
- **Government investment** – public sector investment as a percentage of GDP against competitors;
- **Infrastructure investment** – congestion on inter-urban roads in England (being used to assess the productivity element in the transport PSA) and rail performance in Great Britain over time; and
- **Cost of doing business** – ease of paying taxes aiming to capture the regulatory costs to businesses relative to competitor economies.

Innovation

- **Wider innovation** - proportion of innovation-active firms reporting innovation cooperation arrangements with other organisations;
- **R&D expenditure** – business enterprise R&D (BERD) and gross expenditure on R&D (GERD) both as a percentage of GDP;
- **Exploitation of Intellectual Property** - the number of patents granted by the US Patent and Trademark Office (USPTO) and EU trademarks and designs both as percentage of 1,000 population;
- **Knowledge exchange with the research base** – income from businesses (consultancy, contract research and IP licensing) received by Higher Education Institutions (HEIs) and Public Sector Research Establishments (PSREs);
- **Contribution of new products to business revenue** – share of firms’ turnover attributed to product innovations; and
- **Supply and demand for innovation skills**: number of STEM first degree qualifiers.
Skills

- **Level of Skills** – highest level of formal qualifications held by the working age population;
- **Investment in skills** – incidence and intensity of training in England and expenditure on primary, secondary, post-secondary non-tertiary education and tertiary education as a percentage of GDP;
- **Match of supply of skills to skills demanded** – employment rate by educational attainment and skills shortages, vacancies and staff with skills shortage as % of staff employed; and
- **Utilisation of skills** – IMD survey evidence on the perceptions of business executives of management skills in the UK and its competitors.

Enterprise

- **Enterprise culture** – GEM total entrepreneurial activity index and proportion of SMEs with ambition to grow aiming to capture individuals’ attitudes to, and experience of, enterprise;
- **Knowledge and skills** – entrepreneurship education embedded within all levels of the education system aiming to provide an assessment of how far the education system at all levels develops entrepreneurial skills and knowledge.
- **Access to finance** – venture capital investments as a proportion of GDP and total stock of term lending to SMEs;
- **Business innovation** – proportion of innovation active SMEs; and
- **Regulatory framework** – cost and time to start-up a business relative to competitor economies.

Competition

- **Openness to international trade and investment** – the percentage of GDP which is traded as imports and exports;
- **Effectiveness of regulatory framework** – restrictiveness of product market regulation.
- **Effectiveness of competition regime** – peer review of the effectiveness of competition regimes.