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Closing the UK's productivity gap:

the latest research evidence

The UK's productivity gap – how big and in what sectors?
Productivity in the services sector
ICT and productivity
Management practices and productivity
Science, innovation and technology transfer
Globalisation, outsourcing and productivity

EPSRC
Engineering and Physical Sciences Research Council

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About AIM

The Advanced Institute of Management Research (AIM) develops UK-based world-class management research. AIM seeks to identify ways to enhance the competitiveness of the UK economy and its infrastructure through research into management and organisational performance in both the private and public sectors.

AIM consists of:

- Over 250 AIM Fellows and Scholars – all leading academics in their fields…
- Working in cooperation with leading international academics and specialists as well as UK policymakers and business leaders…
- Undertaking a wide range of collaborative research projects on management…
- Disseminating ideas and shared learning through publications, reports, workshops and events…
- Fostering new ways of working more effectively with managers and policymakers…
- To enhance UK competitiveness and productivity.

AIM's Objectives

Our mission is to significantly increase the contribution of and future capacity for world class UK management research.

Our more specific objectives are to:

- Conduct research that will identify actions to enhance the UK's international competitiveness
- Raise the quality and international standing of UK research on management
- Expand the size and capacity of the active UK research base on management
- Engage with practitioners and other users of research within and beyond the UK as co-producers of knowledge about management.

Current AIM research projects focus on:

UK productivity and performance for the 21st century

How can UK policymakers evaluate and address concerns surrounding the UK's performance in relation to other countries?

National productivity has been the concern of economists, government policymakers, and corporate decision-makers for some time. Further research by scholars from a range of disciplines is bringing new voices to the debates about how the productivity gap can be measured, and what the UK can do to improve the effectiveness of UK industry and its supporting public services.

Sustaining innovation to achieve competitive advantage and high quality public services

How can UK managers capture the benefits of innovation while meeting other demands of a competitive and social environment?

Innovation is a key source of competitive advantage and public value through new strategies, products, services and organisational processes. The UK has outstanding exemplars of innovative private and public sector organisations and is investing significantly in its science and skills base to underpin future innovative capacity.

Adapting promising practices to enhance performance across varied organisational contexts

How can UK managers disseminate their experience whilst learning from others?

Improved management practices are identified as important for enhancing productivity and performance. The main focus is on how evidence behind good or promising practices can be systematically assessed, creatively adapted, successfully implemented and knowledge diffused to other organisations that will benefit.

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1 Introduction and summary

"Productivity isn't everything, but in the long run it is almost everything"

Paul Krugman, economics professor, *New York Times* columnist and Nobel laureate 2008

For economists, labour productivity is the key indicator of economic health. Over the long haul, the growth of real income and hence living standards must follow the growth of labour productivity. But there is a notorious and longstanding productivity gap between the UK economy and the other big western economies – notably the United States but also with France and Germany. And while there has been an acceleration of US productivity since 1995, this has not yet happened in the UK or continental Europe.

Achieving higher productivity growth and closing the productivity gap with these countries has been one of the central targets of the government's policy agenda since it came to power more than a decade ago. It is a challenging ambition: there are many different factors influencing productivity growth across the economy and policy effects may take a long time to materialise. But research is providing a series of valuable insights into the nature and causes of the gap and what policies might be effective in helping to close it.

In 2004, the ESRC published a report summarising what research has revealed about the size and composition of the UK's productivity gap and the roles played by competition, investment, innovation and skills in explaining that gap (ESRC, 2004).

Drawing on work in progress at some of the ESRC's biggest investments – notably the Centre for Economic Performance (CEP) at the London School of Economics and the Centre for the Microeconomic Analysis of Public Policy at the Institute for Fiscal Studies (IFS), and by fellows of the Advanced Institute of Management Research (AIM) – that report went on to outline the research agenda for UK productivity. It was launched at a seminar at the Treasury, bringing together researchers and policy-makers to explore the current state of knowledge and lay out the big questions.

This new report provides an overview of the evidence that has been produced since then in six key areas of productivity research, much of it funded by AIM: the size and sectoral breakdown of the gap; productivity in services, notably the retailing and business services sectors; the diffusion of information and communication technology (ICT); the importance of management practices; science, innovation and technology transfer; and the relationship between globalisation and productivity.

Of course, these issues are all interlinked. For example, while there has been considerable growth in UK firms sourcing business services offshore, there has also been growth in foreign firms sourcing business services in the UK and the sector has become an increasingly significant and high-productivity part of the economy. Similarly, ICT clearly plays a key role in raising productivity, but it seems to be most effective in conjunction with organisational change and improved management practices, which in turn seem to be driven by greater competition.

The issues explored in this report are not the only important factors at work. For example, it seems clear that macroeconomic stability is beneficial for reducing uncertainty and encouraging investment and innovation. Education and training play a vital role in the accumulation of skills or 'human capital' (the focus of the Leitch Review, 2006), benefiting productivity directly as a key input.

Physical infrastructure, notably transport (the focus of the Eddington Transport Study, 2006), is also critical. And public sector productivity is likely to have a large impact on aggregate productivity, not only directly but also indirectly given the importance for private sector productivity of having a well-educated and healthy population that can conduct business free of the fear of crime (O'Mahony et al, 2007).

Recent research has evaluated the UK's productivity performance on a number of levels – from comparing different countries right down to looking inside individual firms. The latest research has managed to take advantage of better quality data than has been used in the past, as well as benefiting from advances in theoretical understanding of what determines productivity.

For example, the new dataset collected by CEP in collaboration with McKinsey, which quantifies the effectiveness of management techniques over a wide range of firms across many countries, provides opportunities to

research more directly the impact of various management practices on performance (Bloom and Van Reenen, 2007). And new data on intangibles, collected by Jonathan Haskel and colleagues at the Treasury (Marrano et al, 2007), make it possible to measure the importance of the knowledge economy and innovation for the first time.

This report provides an overview of the latest results, as well as indicating the future direction of research and the implications for public policy.

The productivity gap

There have been improvements in UK labour productivity both in terms of output per worker and output per hour. But a large gap remains, especially with the United States. Overall efficiency growth – 'total factor productivity' growth – has been less impressive.

The evidence suggests that deficits in innovation, skills and management practices all help to explain the UK's productivity gap, alongside burdensome regulation in some sectors.

Productivity in the services sector

The service sector accounts for a disproportionate share of the productivity gap. In part this may be due to the difficulty of measuring productivity in services – in some sectors, such as financial services, it is difficult to measure output accurately.

The retail sector has experienced sluggish productivity growth since the mid-1990s. There is evidence that regulation may be in part behind poor productivity growth in retailing.

ICT and productivity

ICT appears to have a strong and positive effect on productivity according to firm-level studies. But simply investing in ICT is not enough: organisational change is needed to benefit fully from the opportunities of ICT.

Skilled workers are able to make much better use of ICT than unskilled workers.

Management practices and productivity

Some UK firms use world-class management practices while others are among the worst. Well-managed firms perform significantly better than poorly managed firms, with higher levels of productivity, profitability, growth rates and market values.

Competition and light regulation create a strong emphasis on competitiveness, and this appears to be a key driver of promising management practices.

Science, innovation and productivity

Research and development (R&D) is a key driver of innovation. The UK has been good at the creation of new technology but poor at applying it in a commercial setting.

Investment in university research helps both in creating new technology and applying it commercially. Competition is a key driver of private sector productivity.

Investment in knowledge – 'intangible' assets – has now overtaken investment in 'tangible' assets. Incorporating such investment into GDP raises GDP and GDP per head growth in the late 1990s.

Globalisation, outsourcing and productivity

Globalisation offers new opportunities to take advantage of foreign technology and foreign firms to improve domestic productivity.

UK firms are increasingly conducting R&D abroad and importing the results back to the UK. Outsourcing allows firms to focus on fewer tasks and increases productivity.

2 The UK's productivity gap – how big and in what sectors?

"The industrial age began in 1712 when an Englishman named Thomas Newcomen invented a steam driven pump to pump water out of the English coal mine, so the English coal miners could get more coal to mine, rather than hauling buckets of water out of the mine. It was all about productivity, more coal per man-hour… And then it became more steel per man-hour, more textiles per man-hour, more automobiles per man-hour, and today, it's more chips per man-hour, more gizmos per man-hour. The system is basically the same, producing more sophisticated products today."

Ray Anderson, entrepreneur and environmentalist

In the age of Thomas Newcomen, UK productivity led the world. In recent times, however, the UK's productivity performance has been persistently weaker than that of the overwhelming majority of international comparators. On some measures, this gap has narrowed slightly over the last decade, but it remains substantial.

There have been many studies carried out spanning around 50 years, involving both government agencies and independent researchers. All paint the same broad picture of the UK lagging behind other countries. The disputes tend to be about how far comparators such as Germany are ahead rather than whether the UK leads Germany.

Cross-country 'growth accounting' comparisons reveal a persistent gap in the UK's labour productivity performance compared with France, Germany and the United States. But the latest analysis finds some grounds for optimism in the newly constructed European Union KLEMS productivity and growth accounts database (O'Mahony and Robinson, 2007).

From 1970 to 1995, UK productivity fell further behind that of both France and Germany. But from 1995, UK productivity growth rates accelerated and the gap began to narrow. The remarkable productivity performance of the United States outstripped that of France, Germany and the UK from the mid-1990s.

But while the UK outperforms France and Germany on labour productivity growth rates, levels of labour productivity lag those of France, Germany and the United States. Despite recent improvements, there remains a sizeable gap between the UK and its major rivals.

Underlying these numbers are some significant developments in the growth of employment. Over the period 1970-95, the UK saw low growth rates of employment compared with the United States, and actually saw a fall in the number of hours worked. From 1995, this reversed, with the UK seeing faster growth rates of both the number of people in work and the number of hours worked than in the United States.

"There have been many studies carried out spanning around 50 years, involving both government agencies and independent researchers. All paint the same broad picture of the UK lagging behind other countries."

The rise in UK employment hides a large drop in manufacturing employment, but this has been compensated by significant increases in employment in services. So the UK's performance in the last decade is one of high growth rates of both labour productivity and employment.

Much of the contribution of the European Union KLEMS project is in its estimates of output growth and its sources on a sector-by-sector basis. These suggest very different sources of growth across countries. The United States has a large advantage in services, although the UK's service sector is improving, mainly due to an acceleration in the performance of the financial and business services sectors. France and Germany perform relatively better than the UK in both traditional manufacturing and industries that produce ICT.

Early AIM research showed the changing contribution of different sectors to the UK's productivity gap with the United States (Griffith et al, 2003). During the 1990s, the gap widened in key services, including wholesale and retailing, hotels and restaurants and financial services. At the same time, the gap narrowed in network industries (electricity, gas, water, post and telecommunications) and business services (services provided to other businesses rather than directly to the public).

Subsequent research shows that business services have become an increasingly significant part of the UK economy (in terms of value-added, more than twice as large as they were two decades ago) and that the productivity gap with the United States in the sector has almost been eliminated (Abramovsky et al, 2004). The improvement in productivity performance is notable in two high-skilled sectors: computer services and professional services, which include accountancy, advertising and law.

Further research on productivity in retailing shows that this sector of the economy accounts for a large part of the UK's productivity gap with the United States (Griffith and Harmgart, 2005). Susanto Basu and colleagues (2003) also find that retailing is an important sector in explaining the UK's poor relative performance.

More detailed survey work on the UK retailing suggests that management in the sector is relatively poor in the areas of human resources and, to a lesser extent, reward and incentive systems. It also appears that there are clear correlations between the level of managerial capability and productivity (Siebers et al, 2008). Further evidence on retail productivity is discussed in the next section.

What is productivity?

Productivity is the amount of output produced for inputs used. Output could be cars, steel sheets, insurance policies or haircuts; inputs could be workers, computers, other machinery and equipment, and energy. Calculating productivity requires measures of inputs and outputs.

The most commonly cited measure of productivity is labour productivity: output per hour worked. This is simple to measure and the most highly correlated with increases in living standards. The Treasury often cites numbers on output per worker. Looking at output per worker puts the UK in a better light than output per hour, with insignificant differences relative to Germany and smaller gaps relative to France.

Productivity can be broken down into two parts: the quantity of the inputs; and how they are used. Giving workers more and better equipment (physical capital) to use should enable them to produce more output from every hour at work. Such 'capital deepening' means that more capital per worker will lead to higher output per worker. More and better education and training can improve the 'human capital' of workers and should also raise labour productivity.

But inputs do not explain the whole story. After deducting the contributions of capital and skills from output per hour, there is a remainder that cannot be attributed to any input: this is 'total factor productivity' (TFP). Differences in TFP relate to different ways of working, for example, through better ways of organising firms or using better technology. They explain what is done with the physical and human capital.

Measuring output requires a way of ensuring that changes in price do not affect the calculations – a price 'deflator'. Constructing such a deflator is especially problematic for services, as outlined in the next section.

3 Productivity in the services sector

The sectoral composition of the UK's productivity gap indicates the importance of studying what drives productivity in different sectors. The service sector is especially important: services make up over two-thirds of the UK's economy. This section of the report outlines some of the measurement issues regarding productivity in the service sector as well investment in the 'knowledge economy'. It goes on to focus on the retail sector, which has seen particularly poor productivity growth since the mid-1990s.

Measuring productivity in services

Output and employment figures for the UK service sector are published regularly. A study published in AIM's productivity issue of the *Oxford Review of Economic Policy* reviews market sector data, showing how they are collected and how they can be used (Crespi et al, 2006a).

Few official productivity measures for the service sector are available, even though there are extensive estimates of output for the sector (to compile GDP). The bulk of the problems surround the banking sector and the business services sector.

The main problem in the banking sector is that the major source of a bank's income is interest earned from lending. Yet interest payments are not regarded as payments for productive services. To deal with this, the Office for National Statistics (ONS) subtracts the difference between interest received and paid out. This is not a perfect adjustment, and so the figures for the output of financial services must be used with caution.

In the business services sector, many of the output measures are employment. This means that an efficiency measure that requires fewer staff would be shown up as a loss in output, when in fact it might be exactly the reverse. What's more, it is harder to track how the prices of business services should change over time. Better price 'deflators' (which isolate the real price change, that is the price change relative to all other price changes in the economy) are improving this position.

Intangible investment and UK productivity

The 'knowledge economy' is all around us. Digital cameras, iPods and satellite navigation systems for cars are commonplace. Downloaded mobile phone ring tones are now part of the basket of goods used to measure the retail prices index. At the same time, new software has revolutionised firms' supply chains, customer analysis and staff rostering arrangements. And there are dozens of new occupations such as 'search engine programmers'.

But these changes have barely shown up in the macroeconomic indicators that measure the UK's economic performance. For example, judging from existing measures, it appears that the UK's productivity performance deteriorated after 1995 even with major investment in ICT and despite acceleration in US productivity growth.

Research by Jonathan Haskel and colleagues (Marrano et al, 2007) has examined whether the impact of the knowledge economy might be hidden by measurement problems. Spending on most knowledge assets – including software, R&D, design, training and branding – is, in accounting terms, spending on 'intangible' assets. With a very few exceptions, such spending is treated as intermediate expenditure and does not appear in GDP data.

When the economy was composed mostly of investment in 'tangible' assets like machines, this convention did not seem so bad. But if the economy is increasingly moving towards investment in intangibles, this might miss some very substantial parts of economic activity.

The research finds that investment in intangible assets has now overtaken investment in tangible assets. Incorporating such investment into GDP raises GDP and GDP per head growth in the late 1990s.

Retail productivity

The retail sector accounts for the same amount of economic activity as manufacturing. It also accounts for about a fifth of the UK's total productivity gap with the United States (Griffith, Haskel and Neely, 2006). Understanding why retail productivity has slowed so much since the mid-1990s is crucial to understanding the wider productivity gap.

Retailing is an 'intermediation' activity: taking goods from the factory to a shop. An approach to valuing the services that retailing provides is to argue that consumers must be willing to pay for this service. In a well-functioning market, this is measured by the margin between the retail price of the goods and the wholesale price.

So the value of the bundle of services provided by a shoe retailer is revealed not by the sales of the shoes, but the gap between the sales to final consumers of the shoes and the costs of buying the shoes in from the manufacturer. Similarly, an internet travel agent, where the customer does much of the work, typically sells a holiday for less than a high street travel agent, where the customer uses the agent to do much of the work.

Land use regulation

In 1996, there was a major change in retailing planning regulations in the UK. This change made it much harder for retailers to build large out-of-town supermarkets. Instead, to try to support inner-town development, planning permission would only be given for development within cities in the first instance and for out-of-town developments only under special circumstances.

Following this change, there was a marked change in the strategy of UK supermarket chain stores. Before 1996, large UK chains were opening 'big box' stores on the outskirts of towns. Afterwards, UK supermarkets developed and took over inner-town small shops. The median size of a store within a large supermarket chain has fallen from 75 employees to 56 employees. Some supermarkets, such as ASDA/Wal-Mart, simply stopped expanding altogether.

Recent research has investigated the role of land use regulation in explaining the poor productivity performance of UK retailing since the mid-1990s (Sadun, 2008; Griffith and Harmgart, 2007). Smaller stores may be less productive than larger stores as they are unable to take advantage of as many cost savings, such as allowing workers to concentrate on a few tasks. What's more, some firms may have built up expertise in running large stores – and regulation that forces them to open small stores means that this expertise is wasted.

The fall in shop sizes after 1996 lowered productivity growth by 0.18% a year, which accounts for about a fifth of the slowdown in UK retailing productivity from the mid-nineties (Haskel and Sadun, 2008). By these estimates, the change in retail planning regulation accounts for about 6% of the entire slowdown in UK productivity since 1995.

There is some evidence that other factors – such as the ageing of the population – have driven the trend towards smaller stores (Griffith and Harmgart, 2007). For example, Tesco started the expansion of the Metro and Express (smaller store) formats before 1996. Nevertheless, it is clear that changes in land use regulation were important in explaining the trend towards smaller retail outlets, and that this has hindered productivity growth.

International comparisons of retailing

Comparing the UK, the United States and Japan makes it possible to put the UK's retail productivity performance in context. Productivity levels in the UK and Japan are 56% and 46% of US levels respectively, and the Japanese retail sector experienced a decline in productivity in the late 1990s even as it accelerated in the United States.

Recent research documents the differences in the structure and dynamics of the retail sectors of these three countries by using confidential data on retail firms (Haskel et al, 2008). It finds that:

- There is a much greater density of Japanese retail establishments than in the United States. The UK lies somewhere between the two.
- Japanese establishments and firms are very much smaller than their US counterparts, again with the UK in the middle.
- The United States has a much greater market 'churn' than the other countries. New companies in the United States seem to be able to win the largest market share, a phenomenon not seen in the UK. Similarly, poor US firms fail much more quickly than poor UK firms.

Policy implications

Smaller stores are less productive than larger stores. This implies that regulation, such as that enacted in the UK in 1996, may be retarding productivity growth. Although some of the trend to smaller stores has been explained by other factors, regulation still appears to be important.

Figures from the Better Regulation Executive show that after corporation tax, planning regulation has the highest administrative and compliance costs of any regulation. But as some of the changes in store size may be due to demographic trends, it should not necessarily be expected that removing these regulations will lead to rapid productivity growth in the retail sector.

There are two additional caveats to such a single factor explanation. First, there is some evidence to suggest that the impact of demographic differences is such that the retail market in the UK would not actually support the scale of store development necessary to achieve productivity gains on a par with those seen in the United States (Griffith and Harmgart, 2007).

Second, and possibly related, there is some evidence from customer surveys that there is a strong preference for a portfolio of stores offering choice rather than a large single provider (Clarke, 2006).

The research agenda

IFS researchers are documenting differences in the price of foods in the UK and United States, and investigating what role differences in the efficiency of firms supplying foods play relative to other explanations, such as differences in consumer purchasing patterns and shopping behaviours.

Jonathan Haskel's findings on the significance of including intangible investment in GDP suggest the need to revisit both the conventions of economic measurements and the conventional view of the UK's economic performance. The next step is to extend measurement of intangibles to the other major economies of the European Union so as to start making proper comparisons between countries.

4 ICT and productivity

Since 1995, US productivity growth has surged ahead of Europe's. This means that the productivity gap, which narrowed consistently after the Second World War, has stopped converging. At first, only 'new economy' cheerleaders thought anything fundamental had changed. But even sceptics have been surprised by continuing strong growth into the twenty-first century: despite stock market crashes and the 9/11 terrorist attacks, US productivity growth has continued.

One key explanation for this productivity acceleration is the growing importance of ICT. Technological advances in these sectors have been very rapid and productivity growth has been spectacular.

But careful analysis shows that productivity growth in the industries that produce these high-tech gadgets has been just about as fast in Europe as in the United States. The big difference is in the industries that are big users of ICT, such as finance, retail and wholesale. In these sectors, US productivity growth really jumped from the mid-1990s whereas productivity growth in Europe's equivalent sectors stayed the same.

This is a puzzle as computers are available on both sides of the Atlantic at roughly similar prices and qualities. One explanation is that the real driver of productivity increases is the way ICT is used rather than simply the amount spent. ICT often requires firms to change radically the way they are organised and do business.

For example, the job of a bank clerk has completely changed with the arrival of cash machines. Instead of collecting and handing out money, front-office bank staff are now more involved in selling financial products and advising customers. This has required changing job roles, extensive retraining and reduced numbers of less skilled bank clerks. All such change is hard, but it is particularly hard in Europe where working arrangements are in general more heavily regulated than in the United States.

Measuring the impact of ICT

Disentangling the effect of ICT from that of other factors is challenging. It is important to allow for a wide variety of other factors, including the quantity and quality of other machinery, the state of buildings and the quality of the workforce and any material inputs among other factors (Draca et al, 2006).

The best studies follow the same firms over time. This allows researchers to see if a burst of ICT investment is followed by a burst of productivity growth, while holding the effect of other complicating factors constant.

Several findings have emerged from this research programme:

- ICT does appear to be significantly associated with higher firm-level productivity. This stands in contrast with some of the earlier industry and economy-wide studies that did not find any effect of ICT on productivity. This may have been because industry averages disguise large differences between firms within industries.
- The magnitude of the association between ICT and company productivity is substantial. Most studies find that the effect of ICT investment on productivity is much greater than the effect of investment in other types of capital. The analysis of 20 studies reported by Kevin Stiroh (2002) finds that a 1% increase of the ICT stock increases productivity by as much as 5%.
- There is a huge variation around the average impact of ICT on firm productivity between different studies. Stiroh (2002) reports estimates of the average impact of ICT on productivity ranging from over 25% to ICT reducing productivity by 5%. Some of this variation is due to methodological differences between studies. But a large amount of this variation is likely to be due to genuine differences in the impact of ICT across firms and this is reflected in the different results from different datasets.

Understanding this heterogeneity requires moving beyond looking only at technology and investigating other features of the firm.

The role of complementary factors

It seems clear that it is not simply the level of spending on ICT itself that is important. It is also the level of investment in other factors that allow firms to take advantage of ICT fully. This can include spending on consultants or on developing the skills of workers as well as changing the management structure of the firm.

Skills are important. There is a great deal of evidence that educated workers tend to be much better at coping with new ICT systems than less skilled workers. Ensuring that workers are able to use the ICT available to them fully is crucial in maximising its effectiveness.

Other organisational factors such as decentralisation of decision-making and the steepness of the managerial hierarchy have been found to be important. Old-style organisations with rigid centralised hierarchies have, on average, produced lower returns to ICT than more 'organic' flexible firms.

Whether firms make these investments in complementary organisational capital seems to be very important. Timothy Bresnahan and colleagues (2002) examined the impact of ICT on productivity in over 300 large US companies. A 1% increase in the ICT stock was associated with an increase in productivity of 3.6%, but this increased to 5.8% if a firm became more decentralised (in their study, a one unit increase on a decentralisation index based around teamwork and autonomy of workers).

Americans do IT better

US firms use ICT to enhance the productivity of their workers more than firms based in other countries. Looking at over 7,500 establishments located in the UK, a CEP study (Bloom et al, 2007) compared the labour productivity of workers in the UK plants of US multinationals, non-US multinationals and plants owned by domestic firms.

Workers in plants owned by US firms were over a fifth (21.5%) more productive than employees of domestic firms. They were even more productive than workers in plants owned by non-US multinationals, which were 'only' over a sixth (17.5%) more productive than domestic-firm workers. Although it is to be expected that multinationals will be more productive than domestic firms (they have to be more productive to operate successfully in many countries), there is no reason why US multinationals should be any more productive than non-US multinationals.

The US productivity advantage is partially due to greater use of inputs: US establishments use about 10% more materials and 4% more non-ICT capital than non-US multinationals. But the most striking figure is that US firms use 40% more ICT capital per worker than average whereas non-US multinationals use only 20% more. But even after accounting for greater input use, US establishments are 7.5% more productive than domestic firms.

What matters is the way that US firms use ICT. A 1% increase of the ICT stock is associated with an increase in productivity of 5% for a US firm but only of 4% for a non-US firm. US firms appear simply to get more productivity out of the same amount of ICT (and this does not seem true of non-ICT capital).

What's more, the bigger returns to ICT usage for US firms are only found in certain sectors of the economy. These are exactly the same ICT-using sectors of wholesale and retail that account for the US productivity miracle.

Why are the returns so much higher for US firms? While it is possible that US firms had more skilled workers or better software, it is unlikely that this explains the full gap. The main reason probably lies in the managerial structure of US firms.

Abramovsky and Griffith (2009) find evidence consistent with the idea that corporate restructuring in the form of outsourcing business services is complementary to ICT in production.

Policy implications

Why do European firms not adopt more US-style forms of business organisation? There is some evidence that they are doing so. For example, the Wal-Mart model has been explicitly copied by Tesco, the UK's largest supermarket. It has also been transplanted directly as Wal-Mart has acquired ASDA, which is now the UK's second largest supermarket.

But organisational changes are large and costly events so change is often slow and difficult. Furthermore, there are regulatory and cultural constraints to adopting US business practices in Europe though these should not be overstated as US multinationals like Starbucks and McDonald's appear to be able to do as well in their European outlets as they do back home.

A deeper question is whether European firms really should change so radically. The older organisational forms served Europe well during the catching-up period and it may be that as the technology beds down, they will again prove themselves reliable. On the other hand, if the world of work has genuinely entered a new phase of development where individual performance, flexibility, decentralisation and general education are needed, then such complacency could be fatal.

The research agenda

A key element for further work is to build on the existing data and research on relationships between skills, management practices, organisational arrangements and performance to provide a better-informed input to key policy questions.

CEP researchers have assembled a large cross-country dataset – on over 28,000 European establishments – and are using it to assess the impact of the growth of Chinese imports on innovation and ICT diffusion.

“A key element for further work is to build on the existing data and research on relationships between skills, management practices, organisational arrangements and performance to provide a better-informed input to key policy questions.”

5 Management practices and productivity

Business schools and popular discussions of the corporate world tend to place huge stress on the importance of good management in top performing companies. Economists, meanwhile, have had relatively little to say about the role of management in driving productivity and other key performance indicators. This is largely because until now, there has been an absence of good quality data on management practices measured in a systematic way across countries and firms.

Research by CEP's Nick Bloom and John Van Reenen, and Stephen Dorgan, John Dowdy and Tom Rippin, all consultants at McKinsey, attempted to fill this void, using an innovative survey approach to measure management practices in more than 730 manufacturing firms in France, Germany, the UK and the United States (Bloom et al, 2005). The work matched these data with information from firm accounts. This allowed the researchers to explore in detail the relationship between management practices and company performance.

In 2007, the research was extended in terms of both numbers of firms evaluated – more than 4,000 – and country coverage – firms in eight more countries: China, Greece, India, Italy, Japan, Poland, Portugal and Sweden (Bloom and Van Reenen, 2007).

Overall, the research finds compelling evidence that better management practices are significantly associated with higher productivity and other indicators of corporate performance, including return on capital employed, sales per employee, sales growth and growth in market share. This is true in both the Anglo-Saxon and the continental European countries, suggesting that the researchers' characterisation of good management practice is not intrinsically biased towards UK and US approaches.

Across the whole sample, a conservative estimate indicates that differences in management practices account for a significant proportion – up to a third – of the differences in productivity between firms and countries. This figure may actually be substantially greater, which raises the question of why there is such variation in the management practices and productivity of competing companies – and, in particular, how badly managed firms are able to survive, often for years.

Some researchers see limitations to these studies. First, the set of management practices measured is in reality a sub-set: Siebers et al (2008) use a wider set. Second, the method used to measure incidence and degree of a particular practice based on the expert rating of open-ended questions is open to some further questioning: given the research design, it is not possible to compare such assessments with the more common self-rating approach. Finally, given the increasing importance of services businesses, the sample is primarily medium-sized manufacturing companies.

Measuring management practices

Measuring management requires codifying the concept of good and bad management into a measure applicable to different firms within the manufacturing sector. McKinsey have developed an interview-based management practice evaluation tool that defines and scores from 1 (worst practice) to 5 (best practice) across 18 of the key management practices that appear to matter to industrials firms based on their expertise in working with thousands of companies across several decades. The 18 practices fall into four broad areas:

- Shopfloor operations: have companies adopted both the letter and the spirit of lean manufacturing?
- Performance monitoring: how well do companies track what goes on inside their firms?
- Target setting: do companies set the right targets, track the right outcomes and take appropriate action if the two don't tally?
- Incentive setting: are companies hiring, developing and keeping the right people and providing them with incentives to succeed?

For each company in the studies, researchers interviewed one or two senior plant-level managers, who knew only that they were taking part in a 'research' project and not that their management practices were being appraised. These managers were selected because they are senior enough to have a reasonable perspective on what happens in a company but not so senior that they might be out of touch with the shopfloor.

The interviews relied on open questions and the interviewers were trained to probe for details of practices on the ground. As a final question in the interview, managers were asked to assess the overall management performance of their firm. To avoid false modesty, they were asked to exclude their personal performance from the calculation.

To ensure impartiality, only companies that had no relationship with McKinsey were included in the study. And medium-sized firms, which tend to rely on local management, were selected in preference to large firms whose multinational operations might obscure differences between countries.

Management practices across countries and firms

Analysis of the survey data confirms a range of anecdotal evidence that US companies are better managed than companies elsewhere in the world. US firms are better managed than continental European or UK firms. The researchers estimate that differences in management practices between the UK and the United States account for 10-15% of the productivity gap between the two countries.

US companies also excel even when their operations are located overseas. The research finds that US multinational subsidiaries based in the UK, France and Germany are better managed than either domestic firms or other non-US multinational subsidiaries operating in these countries. This suggests that barriers to foreign ownership and cross-border deals are likely to be damaging to the spread of good management.

The data also suggest that countries have distinct management 'cultures'. For example, Germans firms excel at operations management – shopfloor and process management – while US firms excel at people management – targets and particularly incentives management.

On top of the clear national differences, there is also a huge spread of management practices across firms in every country. For example, some UK firms use world-class management practices while others are among the worst in the whole sample.

Around half of this variation is explained by the industry and country where the firm is based, with the remainder due to differences in management practices among firms in the same country and industry. Most notably, the data indicate that a large number of firms are extremely badly managed in the sense that they have ineffective monitoring, targets and incentives.

Well-managed firms perform significantly better than poorly managed firms, with higher levels of productivity, profitability, growth rates and market values. So why do these variations in management practices persist? The researchers present three reasons:

- Competition in product markets appears to be a primary driver of good management practices. This appears to be because of a 'selection effect' – badly performing firms are driven out of competitive markets.

- Older firms have the lowest average management scores. This is particularly true in uncompetitive industries where competition does not weed out underperformers. This is consistent with the idea that young firms find it easier than their established rivals to adopt the best management practices.
- Stronger labour market regulation significantly impedes good management practice, particularly in firms with longer tenured employees.

These factors also play a role in the national differences in management practices and productivity performance. For example, countries with lower levels of competition and tougher labour market regulation – France and Germany – are worse managed on average than countries with weak regulation, such as the United States.

The UK is something of an anomaly: while it has moderately high levels of competition and low levels of regulation, UK firms have poor management records on average. This may be due to other factors, such as a skills shortage in the UK.

Overall, superior US management seems to be driven by lower levels of labour regulation and a greater degree of product market competition. Compared with the UK, the country's firms also seem to benefit from higher levels of management skills.

Policy implications

If good management practices improve productivity, the need is to create the conditions for firms to adopt such practices. In many cases, this simply underlines the importance of policy objectives already accepted by the government, such as ensuring that markets are competitive and that regulation is light.

But the UK tends to have fairly competitive markets and light regulation compared with many other countries, particularly other European countries (but not the United States). This suggests that the factor limiting the adoption of promising management techniques may be the poor skill sets of managers. Addressing any such shortfall may allow UK firms to be managed more effectively in the future.

The research agenda

CEP researchers are using their measurement methodology to examine management practices in public and private hospitals in the UK and their impact on clinical outcomes, such as survival rates from heart attacks, and general operational and financial outcomes.

It is still not clear why firms with poor management practices and poor productivity continue to survive in competitive markets. One study has looked at branches within a single UK building and plumbing wholesaler (Griffith and Neely, 2006) and while some poor performing branches improve over time, most remain in the same relative position for many years.

Persistent poor performance might be explained by differences in management. The research finds a strong association between the firm's own data on individual managerial ability and productivity (although this could be because the most able managers are attracted to the best branches). This helps illustrate the fact that management practices matter. But it still does not explain why inefficient firms can survive, since presumably inefficient branches could survive through cross-subsidy.

One of the other major themes in AIM research has been promising managerial practices and the results indicate a number of further questions to be resolved. First, while the CEP research provides promising indications, it is important to recognise that a systematic review (Siebers et al, 2008) concludes:

> 'Some studies have found a positive relationship between the adoption of management practices and productivity, some negative and some no association whatsoever. We believe that the lack of universal consensus on the effect of the adoption of complementary management practices might be driven either by measurement issues or by the level of analysis. Consequently, there is a need for further research. In particular, for a multi-level approach from the lowest possible level of aggregation up to the firm-level of analysis in order to assess the impact of management practices upon the productivity of firms.'

It is also clear that the factors that go to make a particular practice in a particular firm such that it enhances performance and productivity are strongly linked to both the detailed context of the firm itself and indeed the history and culture of the organisation.

Second, at a policy level, it is clear that the notion of any universal approach is unrealistic. Policy needs to involve a better balance between a supply-side emphasis (the 'push' of skills and 'best practice' models) with practices that meet individual firm needs. Finally, policy interventions at the workplace need to develop support for firm-level 'adaptive learning' and find ways to promote this (Delbridge et al, 2006).

6 Science, innovation and technology transfer

A number of studies suggest that the roots of the UK's productivity problem might lie in the inability of UK firms to adopt and deploy innovations efficiently. This section of the report discusses the factors that contribute to the size and the effectiveness of UK R&D. The next section of the report goes on to discuss the important, and growing, influence of importing knowledge from abroad.

Several studies have highlighted the almost continuous decline in UK R&D as a proportion of national income from the early 1980s (for example, Baily and Funk Kirkegaard, 2004). In 2004, the UK spent just 1.1% of GDP on business R&D activities compared with an average of 1.7% for France, Germany and the United States. In 1981, this figure was 1.8%. This weakness is also seen when looking at measures of patents per head, where the UK now lags most major OECD countries.

The government has sought to address this by improving tax credits for R&D, especially for smaller firms. These are now generous by international standards: they cost £580 million in 2005 and were set to have risen to £730 million by 2009. Although these subsidies have yet to feed through into increased R&D, this is to be expected as typically such subsidies take time to have an effect.

While in theory firms can take advantage of innovations discovered overseas, in practice higher R&D spending has been shown to help firms adopt foreign innovations more easily (Griffith, Redding and Van Reenen, 2004). UK firms also benefit from conducting R&D abroad, as shown by Griffith, Harrison and Van Reenen (2006). This is discussed in the next section.

Basic science

A large body of empirical research in economics shows convincingly that university R&D generates real contributions to productivity. These operate through several channels:

- University research increases the productivity of R&D by private firms. Research from the United States by Adam Jaffe estimates that a 10% increase in university R&D increases corporate patenting by 1-4%. Since university research is only about one-sixth of industry R&D, this is a potent effect.
- University research induces firms to do more R&D because it raises the productivity of private sector R&D. A 10% increase in university research increases the amount of private R&D by 7%.
- University research leads to 'technology transfer' – the development of innovations that are licensed to private firms or which form the basis of new start-up companies.

It is also important to have 'absorptive capacity'. Scientists cannot effectively exploit the cutting-edge research of others unless they are themselves active in research. A strategy that relies on importing ideas may work for a while, but it cannot be the source of sustained productivity growth.

In terms of basic research, the UK ranks very highly: second only to the United States in terms of academic citations, accounting for an impressive 11.9% share of total world citations (compared with around 1% of the world's population). The country ranks fifth in the world for the number of PhDs produced per unit of higher education R&D spending. And UK scientists consistently win a high share of the world's major scientific prizes.

Technology transfer

Technology transfer has been particularly intense in the United States since the Bayh-Dole Act in 1980, which gave universities intellectual property control of their inventions that were the outcome of publicly funded research.

CEP research illustrates just how important this legislation was in stimulating technology transfer. What's more, it finds that universities that give greater royalty incentives to their researchers generate much more licensing income than those that don't (Lach and Schankerman, 2007).

For example, between 1991 and 2000, the number of licenses on university inventions in the United States increased from 1,278 to 4,362, and licensing income rose from $186 million to $1.3 billion. Licensing and start-ups based on university innovations are beginning to increase in Europe too, with the UK taking the lead, but the level is still quite low.

Private sector R&D

Anecdotal evidence suggests that while the UK is good at invention, UK businesses are rather poor at the commercial exploitation of new ideas. Furthermore, businesses do relatively less R&D in the UK than in the other major industrialised countries.

Business expenditure on R&D as a share of GDP for the UK has declined substantially over the past two decades. This contrasts with the United States, where the share of expenditure on R&D has remained persistently higher, or France, where it grew over the 1980s and has remained higher as the UK has declined.

Multinationals and foreign firms carry out a large share of R&D in the UK. Foreign multinationals perform more than 40% of R&D in the UK, with US multinationals alone accounting for 25% of the total.

Foreign firms' R&D in the UK

Private sector R&D labs in the UK are disproportionately clustered around highly rated university research departments (Abramovsky et al, 2007). This phenomenon is not driven just by university 'spin-outs': in some industries, foreign-owned firms are choosing to locate in close proximity to high quality research. This implies that multinational firms may be sourcing cutting-edge technologies from universities in the UK.

"Anecdotal evidence suggests that while the UK is good at invention, UK businesses are rather poor at the commercial exploitation of new ideas."

There is evidence that R&D facilities 'cluster' near university departments, particularly in the pharmaceuticals and chemicals sectors. A postcode area (for example, 'OX' for Oxford) with a chemistry department rated 5 or 5* by the 2001 research assessment exercise (RAE) is likely to have around twice as many labs doing R&D in pharmaceuticals and around three times as many foreign-owned pharmaceuticals R&D labs compared with a postcode area with no 5 or 5* rated chemistry departments.

In some sectors, clustering is not limited only to the most highly rated research departments. The research finds evidence that foreign-owned labs in the machinery and aerospace sectors are likely to be located near to materials science and electrical engineering departments rated 4 or below by the RAE. This suggests that firms may also benefit from proximity to more applied, commercially oriented research activity.

Competition and innovation

Conventional wisdom suggests that the prospect of monopoly power and higher profit provides the incentive necessary for firms to innovate. Indeed, prominent business leaders, such as Bill Gates, have argued for this view.

Yet it is possible that competition, not monopoly, acts as a spur to innovation – as firms seek to innovate to avoid being driven out of the market. Indeed, the evidence seems to support this latter view that competition is good for innovation – and therefore good for productivity. This is part of the argument espoused by Terence Kealey (2008), although he extends it to argue that state-sponsored R&D is itself dysfunctional.

A recent line of research published in top academic journals analyses the effect of market liberalisation and other pro-competitive reforms on competition. The key results are that:

- More competition encourages firms that are technologically advanced to innovate through increased incentives to 'escape competition'. Having said this, it does appear to discourage technologically backward firms from innovating.
- There is a strong positive relationship between institutions that promote competition and innovation.
- There are large differences in the impact of foreign competition over a range of industries. Incumbents in technologically advanced industries react positively to foreign firm entry, but not in laggard industries (Aghion and Griffith, 2005).

Researchers have looked at evidence from the introduction of the European single market, which suggests that reforms increasing competition led to an increase in innovation and productivity in the manufacturing sector (Griffith, Harrison and Simpson, 2006). This analysis was influential in helping European Union policy-makers think about what sorts of reforms should be implemented as part of the Lisbon and Barcelona Agendas.

Policy implications

The UK remains a world leader in science and technology. But this is not translated into success in applying this research in a commercial environment. The right set of policies needs to facilitate technology transfer while ensuring that the UK's excellent record in research is maintained.

The transfer of new technology between academia and the commercial sector is crucial. University research induces commercial firms to engage in more R&D, and makes that R&D more effective.

The research agenda

Why are UK firms going abroad, why are foreign firms locating in the UK and what impact does this have on UK productivity? There is limited systematic evidence on these issues.

Establishing the relationship between competition and innovation requires a method for gauging the importance of collaborative research between competitors. Firms claim that such collaboration is driven by ever-greater technical complexity. But in theory it could be a way for firms to get around existing competition laws.

This is a thorny issue for competition authorities, and one that is currently being debated in the United States and the European Union. Future work planned by AIM and the Social Science Research Centre (ZEW) in Berlin attempts to assess these two alternatives.

The researchers plan to use the reforms undertaken as part of the European Union's single market programme. The research will compare industries affected to a different extent by the reforms, as well as comparing the same industries before and after the reforms happened.

Preliminary results indicate that there is a bigger increase in collaborative patenting in the industries that experienced a bigger increase in competition. This is of course only suggestive, and there could be many other explanations for this pattern in the data. The researchers are working on developing a more formal test of these ideas to bring to the data.

7 Globalisation, outsourcing and productivity

In an increasingly globalised world, interactions between countries are important in explaining productivity growth in any country. This section of the report outlines the importance of the UK's interaction with other countries in facilitating knowledge flows between countries, as well as in refining the production process to increase productivity through outsourcing.

Outsourcing

New technologies mean that transactions that previously had to be conducted face-to-face within the firm can now be effectively conducted at arms length. It is thus now feasible for firms to outsource a host of activities that in the past it was too expensive to do.

There has been a large increase in trade in previously 'untradeable' activities such as many services, including call centres. New technologies therefore may have changed the optimal boundaries of the firm, and it is worth asking whether and how these changes may have fed through into productivity.

Outsourcing can affect productivity in three main ways:

- Outsourcing can allow companies that sub-contract work from many international clients to benefit from cost savings as they grow.
- If companies that win outsourcing contracts are able to benefit from innovation they introduce, they have an incentive to innovate.
- Companies that outsource their non-core activities are more able to focus on their central function.

In the case of the UK, research has found evidence that both the second and third channel are important in creating a link between outsourcing and productivity (Aghion et al, 2005; Abramovsky and Griffith, 2009).

Developments in ICT have been particularly relevant for outsourcing business processes such as finance and accounting, human resource management and sales and marketing. This is where there have been some of the biggest structural changes in the UK and US economies (Abramovsky and Griffith, 2006).

There is evidence from the UK to suggest that the productivity benefits of ICT increase with the amount of outsourcing undertaken (Abramovsky and Griffith, 2009).

Knowledge flows and learning

Research evidence from CEP suggests that multinational companies help to transfer knowledge across borders (Crespi et al, 2007), although the relationship between the presence of multinationals and productivity is weaker than it first appears due to hidden factors that contribute to both the presence of multinationals and productivity growth.

Suppliers, clients and universities all contribute to the 'flow' of knowledge to a particular firm. There even appear to be 'free' information flow spillovers from competitors – presumably firms can copy the good practice of their rivals. Multinational companies can take the best practice from their best performing offices and spread it around the world – from where companies that interact with it, whether suppliers, competitors or clients, can copy it.

There is some evidence to suggest that firms 'catch up' to the best levels of technology (the so-called 'technological frontier'). But research indicates that while a few world-leading firms do catch up to the global technological frontier, the national technological frontier is more relevant for most firms (Bartelsman et al, 2008).

There is some evidence that firms that export are more likely to experience faster productivity growth – firms undertake 'learning by exporting'. Evidence from UK firms suggests that 'learning by exporting' does exist – firms that export are more likely to learn from their clients than other firms (Crespi et al, 2006b). But it is not clear whether firms deserve a subsidy for exporting, as they capture most of the gains of any increase in productivity themselves.

UK firms' R&D overseas

The US innovation boom since 1990 has had major benefits for the UK economy. Without the massive growth in US spending on R&D in the 1990s, UK productivity would have been about 5% lower in 2000, which is roughly equivalent to £7 billion (Griffith, Harrison and Van Reenen, 2006).

R&D is important not just for expanding knowledge but also making it possible for firms to learn about and absorb innovations from elsewhere. Foreign direct investment can play a significant role in this technology transfer, and so can outsourcing R&D to overseas locations.

The 'special relationship' between the UK and the United States exists not only in politics but also in economics. UK firms that have placed a large number of their researchers in the United States have been able to tap into the new ideas of US scientists. Bringing these ideas from places like Silicon Valley back to the UK helps boost the UK's productivity.

This 'technology sourcing' from the United States was evaluated by looking at nearly 200 UK firms and over 550 US firms from 1990 to 2000. The results show that UK firms that had established a high proportion of US-based inventors by 1990 benefited disproportionately from the growth of the US R&D stock over the next ten years. What's more, the benefits of such technology sourcing were larger in industries where the productivity gap with the United States was largest.

But US firms that have set up research facilities in the UK have not benefited to the same extent. Just as with particular industries, it turns out that technology sourcing is more important for countries that have 'most to learn'. So when it comes to the special relationship, the UK benefits much more from US R&D than vice versa.

Policy implications

The trend towards UK firms taking advantage of research clusters abroad, especially in the United States, should not be stopped. There is significant evidence that technology imported to the UK is increasingly important in raising productivity.

As noted in the previous section, the UK remains a leader in science and technology, and this helps not just with the development of new ideas but also with their application commercially. So technology sourcing should not be seen as a rationale to cut research funding. In fact, quite the reverse: for firms to continue to import technology to the UK, good university departments may be needed to attract firms worldwide.

There is also evidence that the growth in international trade may enhance productivity. Firms can locate across national boundaries and spread technology and good practice. In addition, they can outsource their non-core functions and concentrate on a few tasks.

The research agenda

IFS research is using new micro level data to look at trends in offshoring inventive activity by European firms (Abramovsky et al, 2008).

"The 'special relationship' between the UK and the United States exists not only in politics but also in economics. UK firms that have placed a large number of their researchers in the United States have been able to tap into the new ideas of US scientists."

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