# Productivity in the UK: The Evidence and the Government's Approach

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The Public Enquiry Unit
HM Treasury
Parliament Street
London SW1P 3AG
Tel: 020 7270 4558

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# SUMMARY

The Government's central economic objective is to achieve high and stable levels of growth and employment[1]. Recent papers by the Treasury[2] have discussed the Government's policies and record on employment and labour market reform. This paper analyses the issue of productivity and sets out the Government's strategy for raising productivity through promoting economic stability and its microeconomic reform agenda. By increasing productivity, the Government aims to raise the UK's trend growth rate.

UK productivity, however measured, lags that of other major industrialised countries. The labour productivity gap with the US was 45 per cent in 1999, that with France was 18 per cent and that with Germany 11 per cent.[3] If the UK were to match the productivity performance of the US, for example, output per head would be over £6,000 higher. The challenge for the Government is to achieve its long-term economic ambition to have a faster rise in productivity than its main competitors as it closes that gap. **Chapter One** sets out this challenge.

The next section of the paper looks in further detail at the components of the productivity gap, focusing on two dimensions of the problem:

- At the national level, the environment in which firms operate determines access to critical resources needed for growth, such as physical and human capital and technology. **Chapter Two** looks at these issues for the UK and draws conclusions about the weaknesses that explain its poor productivity performance in comparison with other major economies.
- At the firm level, there are wide variations in the productivity performance of different enterprises, which are masked by the national-level data. To understand fully the productivity gap it is necessary to examine the factors that contribute to productivity growth at the firm level. **Chapter Three** analyses these and concludes that the key to increasing UK productivity growth lies in improving firms' access to inputs of physical and human capital, technology and innovation as well as creating a competitive environment in which they can operate.

The framework for Government policy to promote productivity follows this dual analysis and is set out in **Chapter Four.** This framework has at its heart the aim of creating the right environment for firms to maximize their productivity potential. It has two pillars:

- First, providing macroeconomic stability to allow firms and individuals to invest for the future; and
- Secondly, making microeconomic reforms to ensure that markets function efficiently and to tackle barriers to productivity growth.

[1] Statement by the Chancellor of the Exchequer to the Bank of England on 6 May 1997. Available at www.hm-treasury.gov.uk.

[2] See HM Treasury: The Goal of Full Employment: Employment Opportunity for all Throughout Britain, February 2000. Also important are the six HM Treasury publications that make up the Modernising the Tax and Benefit System series. All are available at www.hm-treasury.gov.uk.

[3] Source OECD and DTI. Labour productivity is measured as output per worker. Due to the introduction of the System of National Accounts (and the European System of National Accounts) there have been revisions of country GDP estimates. These changes and recent updates for the UK and US have been incorporated in the estimates, and for this reason differ from those cited in Budget 2000 in March. The labour productivity gap with the former West Germany is around 20 per cent.

The productivity challenge does not fall solely to the Government. All participants in the economy – businesses, employees, investors and others – have an important role to play in raising aggregate economic growth. The Chancellor of the Exchequer has asked the TUC and the CBI to look at how they can help to address the key priorities for increasing UK productivity.[4]

**Chapter Five** draws the main conclusions from the paper and sets out briefly how the Government will take the productivity agenda forward.

[4] The letter sent by the Chancellor of the Exchequer to the Confederation of British Industry and the Trades Union Congress is reprinted as an appendix to this paper.

# 1 UK PRODUCTIVITY PERFORMANCE

## INTRODUCTION

**1.1** The Government's central objective is to achieve high and stable levels of growth and employment. Even small increases in the rate of growth can have large positive effects on total output if they are sustained over a period of years. Increasing trend growth in the UK will enable sustainable increases in income per head and is therefore central to raising the prosperity of the country. For this reason, the Government aims to raise the economy's trend growth rate – the long-term rate at which the economy can grow without causing inflationary pressures[1].

## THE DETERMINANTS OF GROWTH

**1.2** An economy's output depends on two things: how many people are working; and how much they produce, that is how productive they are[2].

**1.3** The mid-point of the Government's GDP forecast ranges are anchored on a neutral assumption of 2½ per cent a year trend output growth[3] (see Table 1.1). This assumes trend productivity growth of 2 per cent in underlying terms, as estimated for the pre-1997 cycle, and only a very modest trend increase in the employment rate compared to the recent past. Revised projections from the Government Actuary's Department now show 0.5 per cent a year medium-term growth in the population of working age, 0.1 percentage points higher than previously expected. This small revision has not changed the neutral assumption for trend output growth itself. Projections for the public finances continue to be based on the cautious 2¼ per cent a year trend growth assumption, as they will be in Budget 2001. Downside risks to trend output growth are at least balanced by the possibility of continued underlying improvements in supply performance illustrated by the upper ends of the Government's forecast ranges.

### Table 1.1: Contributions to trend output growth

| | Estimated trend rates of growth[1], per cent per annum | | | | |
|---|---|---|---|---|---|
| | Trend labour productivity[2] | | Trend employment rate[4] | Population of working age[5] | Trend output |
| | Underlying[3] (1) | Actual (2) | (3) | (4) | (5) |
| 1990Q4 to 1997H1 | 2.0[6] | 2.1 | –0.2 | 0.3 | 2¼ |
| 1997H1 to mid-1999 | 1.9 | 1.6 | 0.5 | 0.5 | 2½ |
| Forecast[7] | 2.0 | 1.9 | 0.1 | 0.5 | 2½ |

[1] *Treasury analysis based on the judgement that 1990Q4, 1997H1 and mid-1999 were on-trend points of the output cycle, and allowing for employment lagging output in order to estimate trend growth rates for employment and labour productivity. Figures independently rounded. Columns (2) + (3) + (4) = (5)*

[2] *Output per workforce job.*

[3] *Adjusted for effect of changes in employment rate, i.e. assuming the employment rate had remained constant. Column (1) – column (2) = (1–a). column (3), where a is the ratio of new to average worker productivity levels. The figuring is consistent with this ratio being of the order of 50 per cent, as suggested by data on relative entry wages.*

[4] *Ratio of workforce jobs to working-age household population.*

[5] *UK household basis.*

[6] *Estimated from a regression of productivity growth on employment rate growth and the output gap over a complete output cycle from 1986Q2 to 1997H1.*

[7] *Neutral case assumptions underlying the mid-points of the GDP growth ranges from 2001Q1.*

[1] HM Treasury and the Department of Trade and Industry have a joint target to "improve UK competitiveness by narrowing the productivity gap with the US, France, Germany and Japan over the economic cycle." See HM Treasury: Spending Review 2000: Public Service Agreements 2001-2004, July 1998.

[2] For a full exposition of this see HM Treasury: Trend Growth: Prospects and Implications for policy November 1999.

[3] This is the same in HM Treasury: Budget 2000 (HC346), (March 2000)

Box 1.1: What is productivity?

Productivity is the main determinant of national living standards. It refers to how well an economy uses the resources it has available by relating the quantity of inputs to outputs. There are several measures of this relationship, and their main characteristics, as well as the differences between them, are set out below.

Labour productivity looks at the output produced per unit of labour input. The most common indicators are output per worker and output per hour worked.

Output per worker has the advantage of being easy to calculate because the data, namely total output and employment, are readily available. It can also be related directly to total output growth, which is equal to growth in output per worker multiplied by the growth in employment.

Output per hour measures the productivity of an hour of labour inputs. Its main advantage is that it is not influenced by the number of hours worked over a given period, and consequently takes account of part-time work and time not spent working.

Both productivity per hour and productivity per worker are denominated by only one factor of production, namely labour. Capital is also an input into the economy, and some other measures of productivity take this into account.

In particular, total factor productivity (TFP) attempts to measure output per unit of inputs, where inputs are generally labour and capital. While TFP has the advantage of taking account of other inputs aside from labour, it also has a number of disadvantages. First, it is a residual left over after accounting for the contribution of labour and capital inputs and so is often described as a measure of what cannot be explained; and secondly, it requires measures of the capital stock, which are often problematic in terms of data availability and reliability.

Each of the three main measures above have advantages and disadvantages, and all give different insights into the nature of productivity. In order to establish a precise objective for policy, the Government uses output per worker as the central measure for assessing the productivity gap. This is for two reasons: first, it is the most straightforward to measure and therefore the least ambiguous; and secondly, it can be immediately linked to the overall objective of raising trend growth.

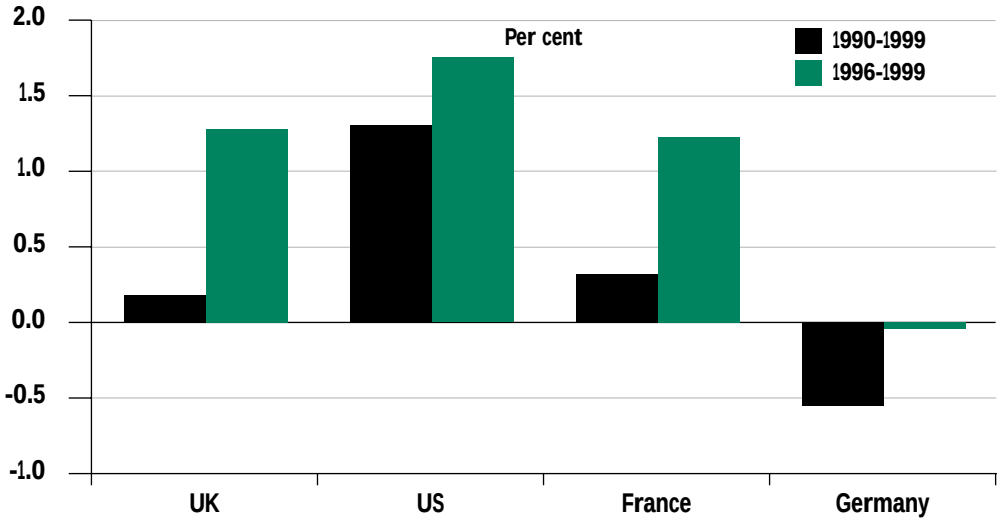
## First determinant of growth: employment

**1.4** UK employment has performed well over recent years. Employment growth has averaged 1.4 per cent in the last four years and the UK employment rate is now higher than almost every other OECD country[4]. Chart 1.1 shows how UK employment growth since 1990 compares with the US, France and Germany. Only the US and France have experienced comparable rates of employment growth between 1996 and 1999.

**1.5** As a result, the ILO measure of the rate of unemployment is at 5.3 per cent, its lowest level since the series began in 1984, and the claimant count is 1.04 million, its lowest level for over 20 years. In total, over 1 million extra people are now in work compared to spring 1997.

[4] HM Treasury: The Goal of Full Employment: Employment Opportunity for all Throughout Britain February 2000.

## Chart 1.1: Average annual employment growth 1990-1999 and 1996-1999




*Source: OECD.*

**1.6** There is, however, further to go to make a reality of the Government's goal of employment opportunity for all - the modern definition of full employment Research has shown that work is the best route out of poverty and the Government's ambition is that by the end of the decade there will be a higher percentage of people in employment than ever before.[5]

## Second determinant of growth: productivity

**1.7** UK productivity, on the other hand, has not fared as well. In comparative terms, the UK's labour productivity performance has been poor throughout the post-war years. Table 1.2 shows that labour productivity growth has been faster in France and Germany than in the UK for most of the post-war period, allowing those countries to catch up and surpass the UK's labour productivity levels. The UK has, until recent years, generally seen faster productivity growth than the US, although the US has maintained a much higher level of labour productivity.

### Table 1.2: Labour productivity growth rates (per cent per annum)

| | 1950–73 | 1973–96 |
|---|---|---|
| UK | 2.99 | 2.22 |
| France | 4.62 | 2.78 |
| Germany[1] | 5.18 | 2.56 |
| US | 2.34 | 0.77 |

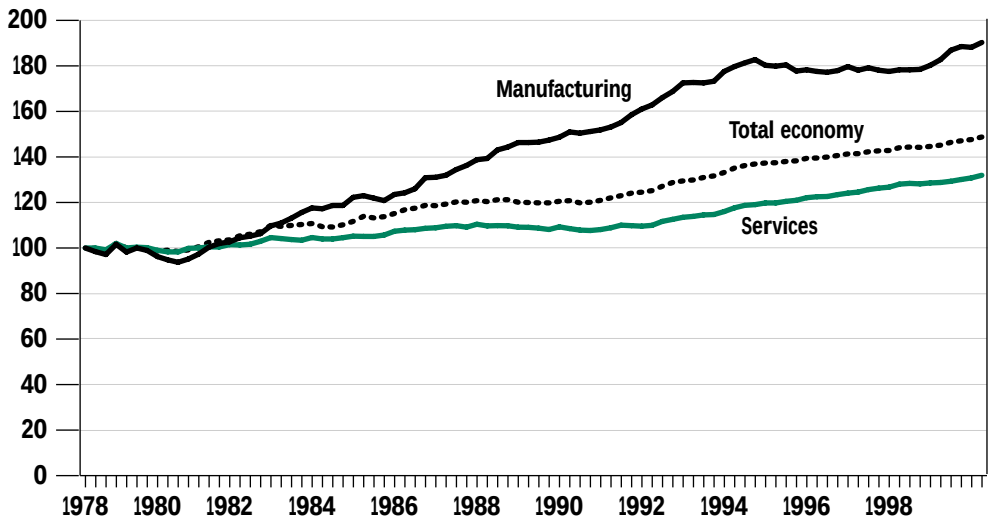
[1] *Figures refer to former West Germany.*

*Source: O'Mahony (1999)*

**1.8** Chart 1.2 shows the UK's productivity in terms of output per worker across the whole economy since 1978. Productivity growth, especially in the manufacturing sector, has improved during the last year. It is too early to know whether this will be sustained, but there is a real opportunity for the UK to achieve sustained higher productivity growth than in the past.

[5] HM Treasury: Pre-Budget Report 1999 (Cm 4479), November 1999.

## Chart 1.2: UK productivity index[1] by sector (1978 Q3 to 2000 Q2)




[1]Productivity is measured as output per worker.

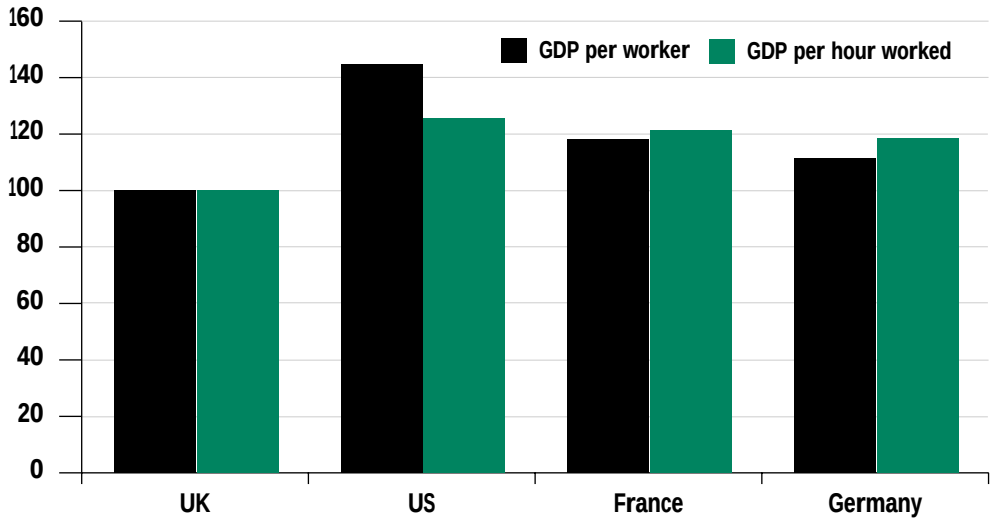
Source: ONS, 1978Q3 = 100

## THE PRODUCTIVITY GAP

**1.9** Whichever measure of productivity is used (see Box 1.1 above), the UK has a sizeable gap compared with other major industrialised economies. Chart 1.3 shows that output per worker is highest in the US, with France and Germany just behind. The UK trails by some distance.

**1.10** A similar picture exists for output per hour worked. The UK is again behind the US, France and Germany, but the latter two countries' performances are much closer to that of the US. The differences between countries' relative performances according to the two measures of labour productivity can be explained by the fact that workers in the US and the UK tend to work longer hours than in the Continental European countries.

## Chart 1.3: The productivity gap (1999)




Source: OECD, UK = 100.

### Box 1.2: Measurement issues

International comparisons of productivity have always been complicated by measurement difficulties, which introduce considerable margins of error. In recent years these have been compounded by developments associated with the 'new economy'.

Information and communications technology (ICT) has become an important driver of economic growth. Its importance has risen, not just because more ICT equipment is available, but also because the quality of ICT has improved substantially. Different countries' national statistical agencies have adopted different approaches to adjusting prices of ICT products and services for quality change. In particular, the method adopted in the US, known as "hedonic price adjustment", has a significant effect on the measurement of output. Applying the same method to the UK would affect the size of the productivity gap.

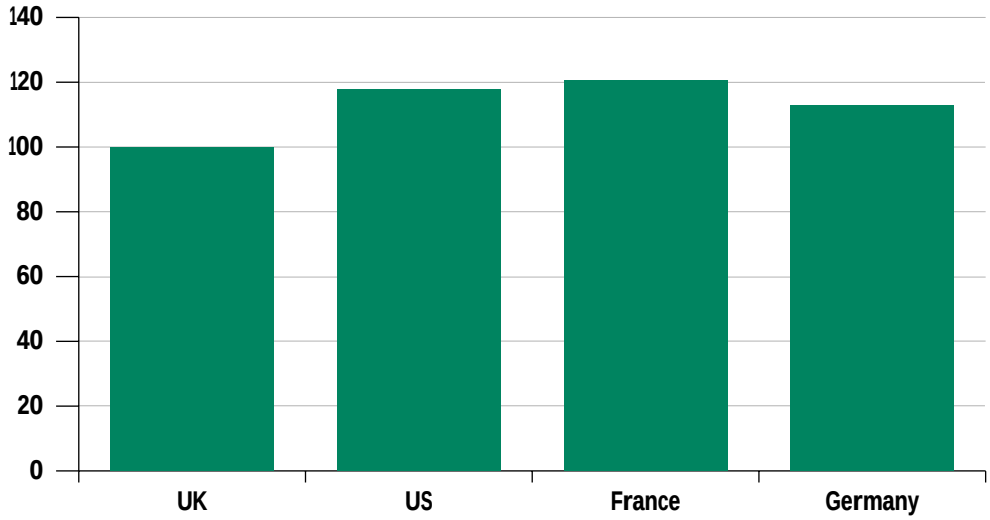
Specifically, although both UK and US national accounts allow for changes in ICT quality, the hedonic price adjustment approach carried out in the US implies a much faster rate of decline in computer prices. This means that any given change in nominal sales or spending on computers will show up as a much larger real change in the US accounts than in the UK accounts. So there has been a growing perception that recently GDP (and hence productivity) growth in the UK may have been understated relative to that in the US.

Quantifying such effects, however, is less straightforward than it appears at first sight. For example, applying US computer price indices in the UK accounts would raise measured GDP growth by less than the effect on real investment and consumer spending on computers, to the extent that they are imported rather than domestically produced. In other words, and more generally, the effects on measured GDP growth differentials of harmonising the measurement of ICT prices between countries would depend on the relative size of their ICT sectors as well as their spending on ICT.

Nonetheless, it should be recognised that the US/UK productivity gap cannot be explained away by statistical treatment - the gap is too large and has persisted for too long to be a statistical artifact. Technical Annex A looks at these issues in more detail.

**1.11** Chart 1.4 shows the productivity gap for the UK expressed in terms of total factor productivity (TFP). Again the UK is below all its major competitors, although its shortfall is reduced. The UK's relatively less poor comparative performance in terms of TFP is explained by its low capital stock (see Box 1.1). This is discussed in more detail in chapter 2.

**Chart 1.4: The total factor productivity gap (1999)**




*Source: NIESR (O'Mahony, 2000), UK = 100.*

## CONCLUSIONS

1.12 The productivity challenge for the UK is to have a faster rise in productivity than its main competitors as it closes the productivity gap. This challenge is increasing as major economies, especially the US, continue to have stronger productivity growth than the UK and to widen the productivity gap.

1.13 To meet the challenge, the Government must continue to improve the environment for firms to achieve their productive potential. The changes it has already made – promoting macroeconomic stability, reforming the labour market and improving the microeconomic environment – have begun to achieve this. The rest of this paper looks at the evidence in more detail for the wider economy and outlines the Government's ongoing strategy for meeting the productivity challenge. In addition, the Government will publish a further paper in due course looking at the productivity of the public sector itself.

# 2 UNDERSTANDING THE PRODUCTIVITY GAP AT THE NATIONAL LEVEL

**2.1** Although there are some recent signs that labour productivity in the UK is beginning to improve, it is too early to conclude that this marks a new upward trend in productivity growth. The UK's productivity gap with the US, Germany and France is still considerable. Indeed the recent strong performance of the US has increased the gap still further.

**2.2** This chapter examines the productivity gap in more depth, dividing it into its various components, and assessing the UK's comparative performance in each[1]. The components are:

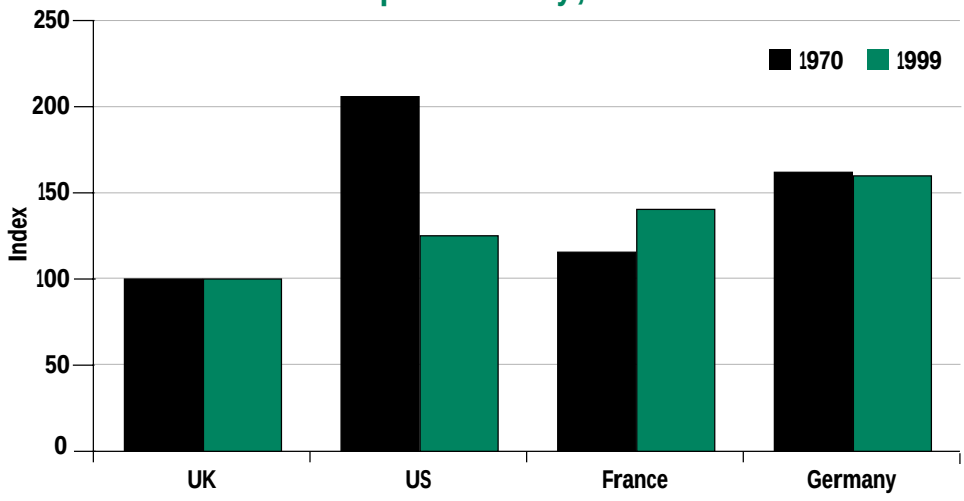
(i) Physical capital;
(ii) Human capital; and
(iii) Innovation and technological progress.

## (1) PHYSICAL CAPITAL

**2.3** Growth in an economy relies heavily on investment in physical capital to augment the productivity of labour[2]. In the past, the capital stock of firms and the stock of public infrastructure in the UK has been well below that of its main competitors. This shortfall has been a major part of the explanation for relatively poor UK labour productivity, and reflects years of low investment in both the public and private sectors.

**2.4** Chart 2.1 sets out estimates of the UK's capital to labour ratio relative to the US, France and Germany[3]. The diagram shows that the UK's weak position on capital per worker dates back a considerable time. In 1970, it had lower capital per worker than each of the other

**Chart 2.1: Relative capital intensity[1], 1970 and 1999**




[1]*Measured as capital per hour worked*

*Source: NIESR, (O'Mahony, 2000) UK=100.*

[1] For a systematic review of the UK's comparative record in various dimensions of economic performance see Department of Trade and Industry (1999).

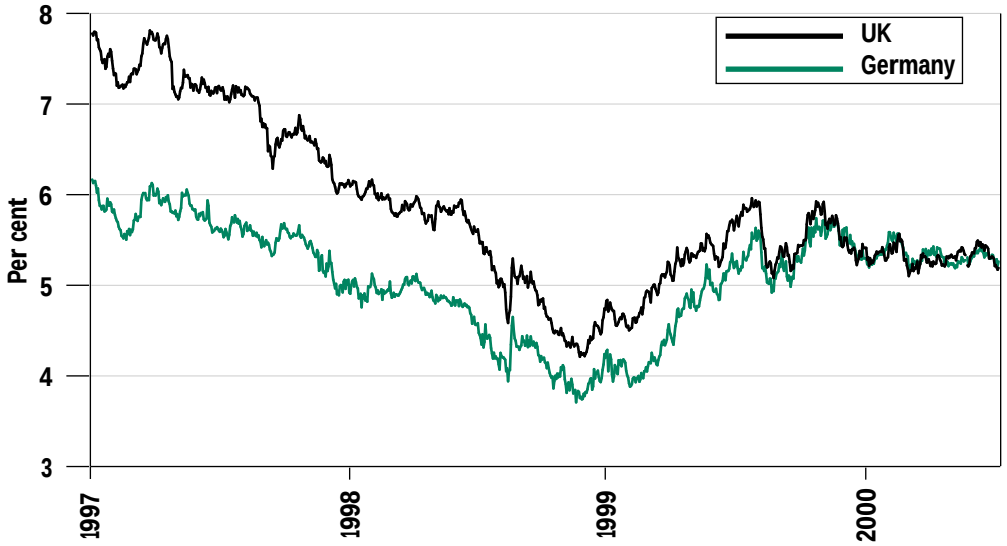
[2] Physical capital has been regarded as an essential ingredient to growth since the development of the Solow-Swan growth model. Numerous empirical studies have looked at the relationship between physical capital and growth, one influential, albeit controversial, one being by DeLong and Summers (1991). See also Rowthorn (1999) on the role of physical capital in growth.

[3] Measuring the capital physical stock is difficult. The current capital stock consists of a large number of different vintages run at different utilisation rates. The recent boom in computer investment (see Box 2.1) has made the task even harder, with computers rapidly depreciating and computer power increasing greatly. Nonetheless using similar methods across different countries allows comparison.

countries and in 1999 its position remained unchanged. The US now has 25 per cent more capital stock per worker than the UK, France has 40 per cent more, and Germany 60 per cent more.

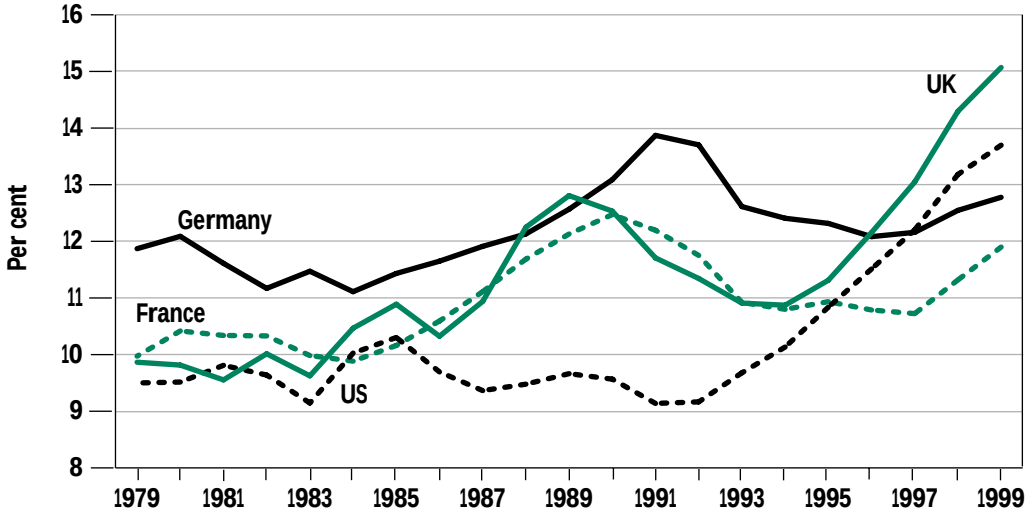
**2.5** Recently, however, greater certainty that interest rates will remain low and stable following the Government's macroeconomic reforms has helped foster a positive climate for investment in physical capital. Direct measures of the cost of capital are not available[4]. Yields on UK Government bonds have fallen sharply since 1997, with a significant narrowing of the differential with, for example, Germany (see Chart 2.2). Chart 2.3 shows that business investment as a share of GDP has increased substantially in recent years . This rise in the rate of business investment will, however, have to be sustained over a long period for the UK's capital stock to reach levels comparable to other major economies.

**Chart 2.2: Daily 10 year Government bond yields, 1997 to 2000**




*Source: HM Treasury.*

**Chart 2.3: Business investment as a share of GDP, 1979 to 1999 (constant prices)**




*Source: OECD.*

[4]This is partly because the actual cost of capital varies from project to project according to the method of financing used and the degree of associated risk.

**2.6** At the same time, the Government has announced, in the 2000 Spending Review, plans to more than double public sector investment by 2003-04. Spending this money prudently and effectively will help to create the national infrastructure and public services that businesses and people want and value.[5]

## (II) HUMAN CAPITAL

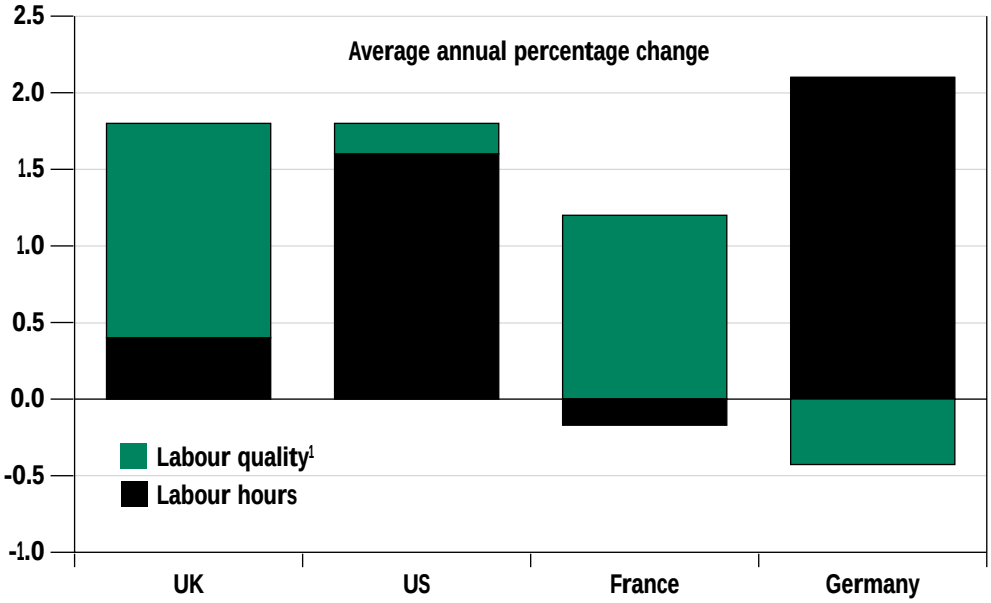
**2.7** The contribution of labour to growth depends on two things:

- The **quantity** of labour. An increase in the proportion of the population which is working is key to increasing economic growth and prosperity; and
- The **quality** of labour. A more skilled workforce is likely to be more productive and so itself also provide a source of growth[6].

**2.8** The Government's success in providing employment opportunities has helped to increase economic growth. In the last four years, UK employment has grown at an average of 1.4 per cent a year, generating additional economic output and helping to raise aggregate economic growth.

**2.9** Chart 2.4 sets out estimates of the respective contributions of increased labour quantity and labour quality to economic growth in different countries between 1986 and 1998. It shows that changes in labour quality may be as important as changes in quantity in explaining recent growth performance.

### Chart 2.4: Changes in labour input by hours and quality, 1986-1998




*[1] Changes in labour quality are estimated by assigning weights according to worker wage rates and levels of education.*

*Sources: OECD and Gust and Marquez (2000).*

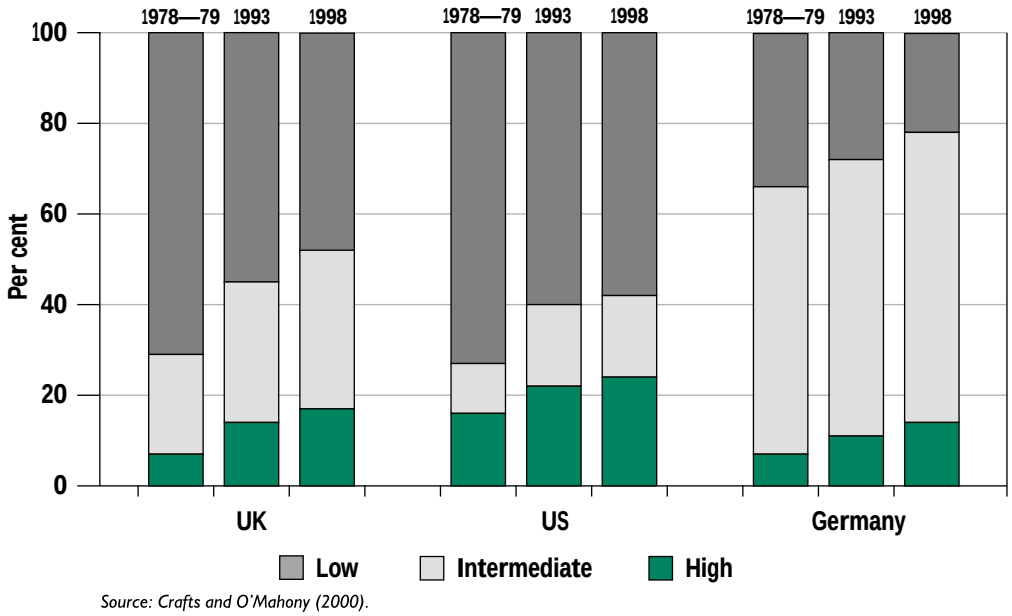
[5] A number of academic studies have looked at the link between public infrastructure and growth. For example, see Aschauer (1989) and Easterly and Rebelo (1993).

[6] The importance of human capital growth has been drawn out in the endogenous growth literature (see Technical Annex B), for example in Lucas (1988), a finding confirmed by empirical studies of growth, for example Benhabib and Spiegel (1994) and Mankiw, Romer and Weil (1992). However, many cross-country empirical studies have been affected by problems in the basic dataset measuring human capital.

**2.10** Chart 2.5 compares labour quality in the UK workforce with those of the US and Germany[7] according to whether they have higher skills (a degree or above), or intermediate skills (a vocational qualification above high school but below degree level)[8].

**2.11** The chart shows a big difference between the UK and Germany in terms of intermediate skills. Germany has far more workers with intermediate skills and fewer low skilled workers than the UK. This pattern is also investigated at the firm level in chapter 3, where the same picture emerges. Compared to the US, the UK's shortfall is in highly skilled workers.

**Chart 2.5: Employees by skill levels, 1978—79 to 1998**




*Source: Crafts and O'Mahony (2000).*

## (III) INNOVATION AND TECHNOLOGICAL PROGRESS

**2.12** Innovation and technological progress are important factors in determining economic growth[9]. Productivity growth relies on a continual stream of inventions and innovations of both new technologies and improved working practices. New ways of working provide a source of efficiency gains, enabling workers to operate more effectively and providing firms with greater opportunities to use labour and capital inputs in ways which maximise their productive potential.

[7]Comparable data for France are not available.

[8]It should be noted that comparative skill levels across countries are difficult to measure, making it difficult to provide a full comparison between countries. The above classifications are at a high level of aggregation and mask substantial differences in the education systems of countries.

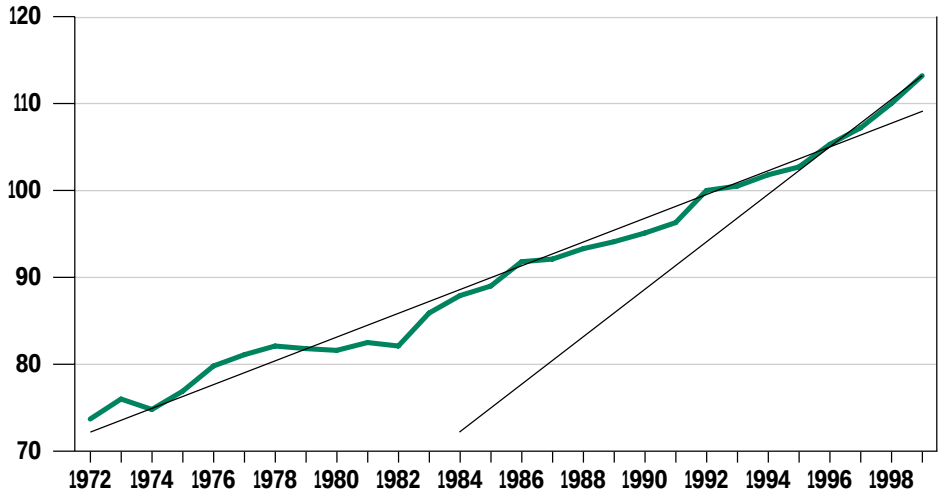
[9]See for example Griliches (1992, 1994) and Griffith, Redding and Van Reenan (2000).

Box: 2.1: The US economy: is the productivity challenge for the UK increasing?

While the UK's productivity gap with the US and other international competitors is long-standing, the most recent experience of the US suggests a further dimension to the productivity challenge.

US labour productivity has increased at an average annual rate of 2.5 per cent since 1996, more than one percentage point above the annual trend since 1973. This has helped the US achieve average annual GDP growth of 4 per cent during the last five years, as yet without the apparent emergence of inflationary pressures[1].

**Chart 2.6: Trends in non-farm US labour productivity[1], 1972–95 and 1996–99**




*[1]Measured as output per hour.*
*Source: US Bureau of Labor Statistics, 1992=100.*

As a result, most commentators now believe that trend growth in the US has increased, which has led some to describe the US as a 'new economy' (see Chart 2.6). It is argued that the US economy has benefited from a stable macroeconomic environment, low interest rates and a tight fiscal policy, which have allowed a few key factors to come together and raise the growth rate.

First, this has resulted in an increase in the rate of physical capital investment across the US economy. This increase is to a large extent attributable to very high levels of expenditure on Information and Communications Technology (ICT) equipment, which grew by nearly 40 per cent per annum in the period 1996-99[2]. Increased investment in ICT has been driven by the rapidly falling price of processing power, falling at over 25 per cent per annum in 1998-99[3] (on a hedonic price index). There are important issues of how the increase in the ICT capital is measured. Technical Annex A looks at this issue in detail.

Secondly, rapid productivity growth in the ICT sector and similar industries has been driven by rapid technological progress and increased demand for ICT equipment.

Finally, the rapid dissemination of ICT through the US economy has allowed US firms to restructure their modes of production and develop new best-practice techniques, thereby raising labour productivity growth in the wider economy.

[1]***Bureau of Labor Statistics.***
[2]***OECD (2000b).***
[3]***OECD (2000a).***

Several academic studies have attempted to quantify the relative importance of these effects on US labour productivity and trend growth. There is broad agreement in the literature that the US economy has experienced an increase in labour productivity growth over the period 1995-99 of about 1.15 percentage points (see Table 2.1, row 4). It is also agreed that a good proportion of this acceleration in labour productivity growth, 0.3 to 0.5 percentage points, is due to increased business investment rates, especially in ICT related capital investments (see row 7).

Table 2.1: Acceleration in US labour productivity growth 1995-1999[1] compared to past trend[2] (in percentage points): a summary of recent studies

| | | Gordon (2000) | Jorgenson and Stiroh (2000) | Oliner and Sichel (2000)[3] |
|---|---|---|---|---|
| 1 | Acceleration in US productivity growth | 1.35 | 1.01 | 1.05 |
| 2 | Price measurement adjustment | 0.14 | – | – |
| 3 | Labour quality adjustment | 0.05 | –0.12 | –0.13 |
| 4 | Adjusted acceleration<br>(Adjusted acceleration = acceleration – (price measurement adjustment + labour quality adjustment) [= row 1 – (row 2 + row 3)]) | 1.16 | 1.13 | 1.18 |
| 5 | Cyclical adjustment | 0.54 | – | – |
| 6 | Net acceleration<br>(Net acceleration = adjusted acceleration – cyclical adjustment [= row 4 – row 5]) | 0.62 | 1.13 | 1.18 |
| 7 | Capital deepening adjustment | 0.33 | 0.49 | 0.50 |
| 8 | TFP growth<br>(TFP growth = net acceleration – capital deepening adjustment [= row 6 – row 7]) | 0.29 | 0.63 | 0.69 |
| | *Of which* | | | |
| 9 | TFP growth in ICT related industries | 0.29 | 0.19 | 0.37 |
| 10 | TFPG growth in rest of economy | 0.00 | 0.44 | 0.32 |

[1] *Calculations are for the US non-farm business sector.*

[2] *The past trend is calculated over the period 1972-95 in Gordon (2000), over 1990-95 in Jorgenson and Stiroh (2000), and 1991-95 in Oliner and Sichel (2000).*

[3] *Data from 1995-1998.*

There is, however, some controversy about the degree to which this acceleration in labour productivity growth is sustainable. Gordon (2000) assumes that part of the explanation for the acceleration lies with the business cycle. He therefore cyclically adjusts his figures (see row 5) to derive a value for what he thinks the underlying increase in labour productivity growth is (see row 6). Jorgenson and Stiroh (2000) and Oliner and Sichel (2000), in contrast, argue that since the US economy is in the longest uninterrupted expansion in recorded history, and as of yet is showing no signs of slowing, a cyclical adjustment is problematic and cannot be justified.

All studies agree that there has been a significant increase in TFP growth in the US economy as a whole (see row 8) of between 0.29 and 0.69 percentage points. This effect can be disaggregated into TFP growth in the ICT related industries and the rest of the economy (see rows 9 and 10). Jorgenson and Stiroh and Oliner and Sichel find an increase in TFP growth both in the ICT sector and in the rest of the economy, and hence find a general 'new economy' effect in the US economy. Gordon, however, finds that all TFP growth is within the ICT and related sectors and that therefore the improved US performance can be explained by the success of one industry, rather than an economy-wide ICT effect.

Outside the US, robust evidence of any ICT effects is very limited. Indeed, growth in the OECD as a whole over the course of the 1990s was actually slower than in the 1980s, although this masks differences between countries[4].

For the UK, however, a recent study by Kneller and Young (2000) finds that, while the share of computing equipment in the capital stock remains small, it has been growing by over 33 per cent per annum over the period 1996-98. That is almost double the 1991-95 growth rate, although it still lags growth in the US.

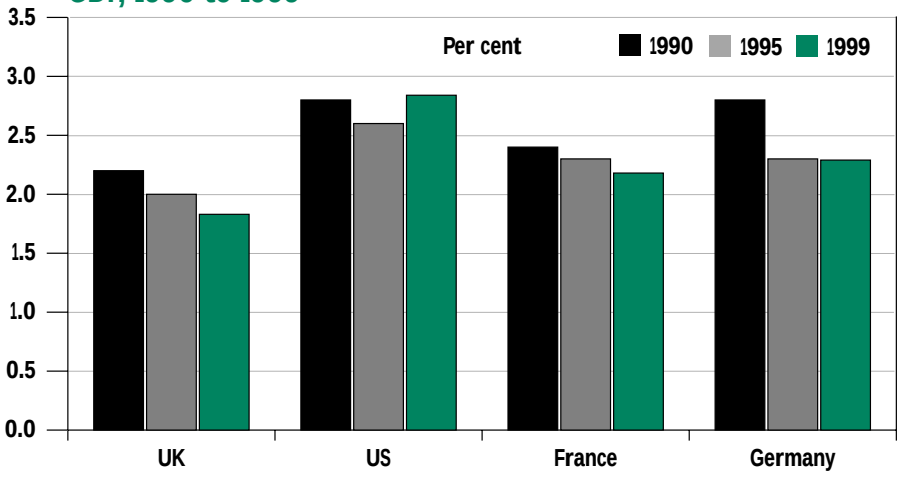
Further, OECD data show that the share of value added accounted for by ICT industries in the UK is the fifth highest in the OECD area and only marginally lower than in the US. However, on other measures the UK does less well. In particular, the UK has a lower ratio of value added to employment in ICT production compared to the US[5].

The impact of ICT on the US economy further illustrates the considerable opportunity that the UK has to tackle its historical productivity shortfall with other major economies. The US experience points to the benefits of entrenching macroeconomic stability. It also suggests an increasingly important role for education and skills, increasing investment in physical capital and R&D, and stimulating enterprise and competition.

[4] ***Scarpetta, Bassanini, Pilat and Schreyer (2000).***
[5] ***OECD (2000c).***

**2.13** One major contributor to technical progress is expenditure on research and development. Historically, the share of GDP dedicated to R&D in the UK was only slightly lower than in other countries. Over the 1980s, however, this proportion fell (see Chart 2.7). As a result, R&D spending in the UK now compares unfavourably with that of other major economies.

**Chart 2.7: Gross domestic expenditure on R&D as a share of GDP, 1990 to 1999**




*Source: OECD.*

**2.14** The US experience has highlighted the key role ICT innovations can have as a driver of growth (see Box 2.1). ICT and its associated technological developments, most notably the internet and e-commerce, have the potential to affect growth, not only through increased labour productivity as a result of increased investment, but also as a general purpose technology, through its effects on the way businesses operate and compete.[10]

[10] The exact levels of costs savings are subject to speculation and are likely to vary considerably between sectors. A study by Brookes and Wahhaj (2000) drawing on the views of market analysts has, however, claimed B2B savings on total input costs, ranging from around 2 per cent in sectors such as coal and food ingredients, to as much as 30-40 per cent in the electronic components sector.

**2.15** It is to be recognised that e-commerce and other ICT-related developments are still very much in their infancy. A recent benchmarking exercise by the DTI[11] found the UK ranked third in the G7 in respect of businesses with internet access. However, another study by Merrill Lynch[12] looked at a range of ICT measures and reported that PC penetration rates in the UK were about half of those of the US.

### Other factors affecting TFP

**2.16** Factors such as physical capital, human capital and technological progress are essential components in productivity growth. In themselves, however, they do not account for the whole productivity gap. Other elements that are not readily measurable at the national level are also essential to productivity. Examples of such factors include the level of competition in the economy and the degree of entrepreneurial activity. These issues are better assessed at the firm level. This is carried out in chapter 3.

## ACCOUNTING FOR PRODUCTIVITY DIFFERENCES

**2.17** A good deal of research has focused on which of the key factors discussed in this chapter – physical capital, human capital, innovation and technological progress – account for the different growth performance of countries. The basic approach that has been used is known as 'growth accounting' (see Technical Annex B).

**2.18** This method can be used to account for the productivity gap between countries. Table 2.2, based on work by Crafts and O'Mahony (2000), divides the UK labour productivity gap[13] with the US and Germany[14], into the components of physical capital and TFP. It shows that physical capital accounts for a sizeable element of the productivity gap with each of these countries.

Table 2.2: Decomposition of the productivity[1] gap, 1999 (per cent)

| | US | Germany |
|---|---|---|
| Physical capital | 31 | 55 |
| TFP | 69 | 45 |
| *of which: Innovation* | *65* | *17* |
| *Skills* | *0* | *14* |
| *Other* | *4* | *14* |
| Total productivity gap | 100 | 100 |

*[1]Labour productivity measured as output per hour worked.*

*Source: Crafts and O'Mahony (2000).*

**2.19** It is possible to use growth accounting methods to break down TFP further into various elements such as human capital and technological progress. However, it is important to recognise that there are considerable difficulties with such breakdowns. First, it is difficult to settle on accurate measures of inputs such as human capital and technical progress. Secondly, for reasons drawn out in the endogenous growth literature (see Technical Annex B), many of these factors inter-relate. Human capital, for example, is an essential element of R&D, and allocating the TFP gap to these factors may neglect these inter-relations.

**2.20** Nonetheless, whilst acknowledging their difficulties, the distillations of TFP by Crafts and O'Mahony (2000) are instructive. Most significantly, they indicate that different factors

[11]Department of Trade and Industry (1999).

[12]Merril Lynch (2000)

[13]Measured as output per hour worked.

[14]The full breakdown is not available for France and so it is not included in the table.

account for the TFP gap with different countries. Skills, for example, look more significant in explaining the gap with Germany, while innovation (proxied by R&D expenditure) appears very significant in accounting for the productivity gap with the US.

## CONCLUSIONS

**2.21** This chapter has shown that the UK's productivity gap can be accounted for by its deficit in physical and human capital and its lower rate of innovation compared to other major economies. Moreover, a close analysis of the UK productivity gap at a national level shows that different factors account for the particular gaps with different countries.

**2.22** Recent macroeconomic stability has contributed to an increase in business investment. Despite this, the **physical capital stock** per hour worked in the UK remains considerably below that in all its major competitors.

**2.23** The UK's **human capital stock** is deficient in comparison to the US in terms of the numbers of workers with higher skills (a degree or above) and in comparison to Germany in terms of intermediate and vocational skills.

**2.24** The rate of **technological progress** in the UK could also be improved. In part, this is due to the UK under-investing in R&D in both the public and private sectors compared to other major economies over the last 20 years.

**2.25** These conclusions underpin the Government's policy approach set out in chapter 4.

# 3 UNDERSTANDING THE PRODUCTIVITY GAP AT THE FIRM LEVEL

## INTRODUCTION

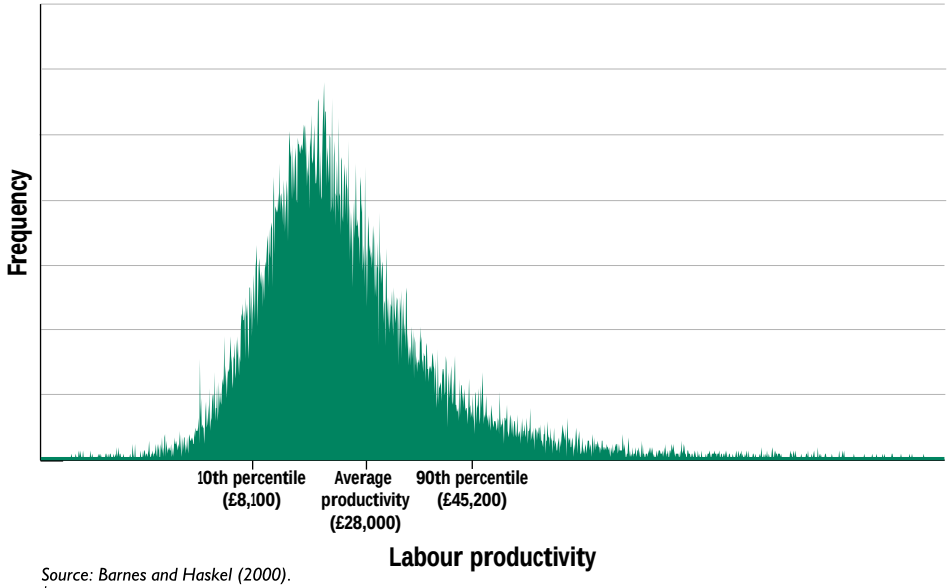
**3.1** The previous two chapters have analysed productivity growth from a national perspective. This chapter looks at firm-level data and examines what drives the productivity performance of individual firms.

## VARIATIONS IN PRODUCTIVITY BETWEEN FIRMS

**3.2** Firm and plant-level analysis[1] reveals a wide distribution of productivity among UK firms. The most productive have productivity levels that are comparable with the best in the world[2]. However, lagging behind the leaders in each sector is a long tail of firms, which are substantially less productive.

**3.3** Labour productivity varies greatly between plants both in manufacturing and services. Chart 3.1 shows the wide spread in the productive performance of plants in UK manufacturing. Barnes and Haskel (2000) find that the most productive plants are 5½ times as productive as the least productive plants.[3] Equally, within individual sectors these large variations in productivity persist, with the best plants being between 3½ and 6 times (depending on the sector) as productive as the worst plants in most cases.[4]

**Chart 3.1: Frequency distribution of plant labour productivity[1] in UK manufacturing (1994—1998)**




*Source: Barnes and Haskel (2000).*
*[1] Measured as gross value added per worker.*

[1] See Bartelsman and Doms (2000) for an overview of the literature on plant-level evidence.

[2] Owen (1998) finds that "a number of British star performers match their [continental] counterparts, but with some notable exceptions such companies tend to be small, and few in number. The productivity of the leading British companies in these industries tends to be lower than that of the leaders in the continental industries." (p. 36). See also Department of Trade and Industry (1998).

[3] Dispersion is measured between the plant at the bottom of the 90th percentile (the "most productive" plants) of the productivity distribution and that at the top of the 10th percentile (the "least productive" plants).

[4] Barnes and Haskel (2000).

**3.4** In the service sector there is evidence of even wider productivity dispersion, as much as double that in manufacturing.[5] This suggests that wide variations in productivity are common to all sectors of the economy. There could therefore be very large potential productivity gains in the UK economy if under-performing firms were to be more successful at adopting established best-practice techniques from the leaders in their sector.

**3.5** Looking at the performance of firms over time shows a more complex picture. Some firms improve their performance, others fall behind and a large number of firms enter and leave the market. However, the evidence shows that the productivity performance of firms that survive is relatively consistent over time. The most productive firms in each sector tend to remain productivity leaders, while the least productive usually only catch up slowly and frequently remain relatively unproductive.[6]

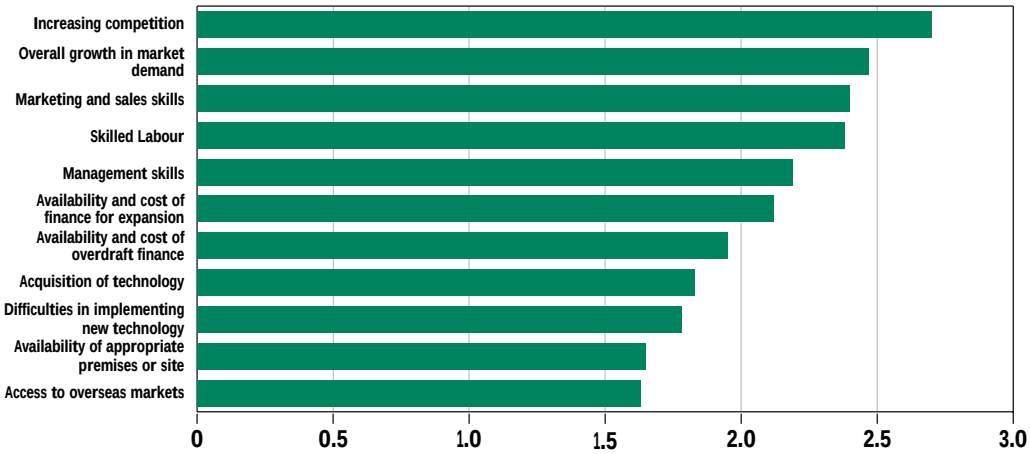
## FACTORS DRIVING FIRM PRODUCTIVITY GROWTH

**3.6** At the firm level there are two main kinds of factors that account for productivity differences between firms:

- Differences in the inputs firms use (physical capital, human capital, managerial and entrepreneurial ability and technology); and
- Differences in the competitive environment firms face.

**3.7** Survey evidence on small and medium-sized enterprises (SMEs) from Cosh and Hughes (2000a)[7] gives some illustrative indications of which of these factors may be important for firm productivity growth (see Chart 3.2).[8] The surveyed firms were most concerned about increasing competition, a shortage of skilled labour and management, the cost of finance, and the acquisition and implementation of technology. A lack of overall growth in market demand was also consistently ranked very highly.

**Chart 3.2: Factors affecting firms' ability to meet business objectives (1999)**




*Source: Cosh and Hughes (2000a).*

[5] Oulton (1996).

[6] Bartelsman and Dhrymes (1998), Bullock, Cosh and Hughes (2000) and Barnes and Haskel (2000). Some of the evidence refers to firm-level data, while other evidence comes from plant data.

[7] The survey was conducted in 1997 and 1999, results for 1999 are reported.

[8] Firms were asked to assess to what degree a series of factors constrained them in achieving their growth objectives. Means are calculated from scores on a scale of 1-5 with 1 = insignificant, 2 = slightly significant, 3 = moderately significant, 4 = very significant and 5 = crucial.

**3.8** The survey also finds differences between firms and over time. The fastest growth firms feel more constrained by supply-side factors, skill shortages and finance, than demand or competition. Older firms, in contrast, are significantly more concerned about competition and a lack of demand growth. The survey evidence also highlights the importance of product market competition in putting pressure on firms, especially older and slow-growth firms, to innovate and compete for market share.

**3.9** A comparison of the survey's results for 1997 and 1999 indicates that the availability and cost of finance for expansion and overdraft finance has become a less significant constraint on growth (especially for very small firms). This may suggest that increased macroeconomic stability has led to fewer capital market constraints on firms. By contrast over the same period the availability of skilled labour has become a more significant constraint on firm growth.

**3.10** As chapter 2 found at the national level, evidence suggests that inputs likely to be important in explaining productivity differentials are physical and human capital, technological progress and innovation. The competitive environment is equally important. This chapter considers each of these in turn.

## (I) Physical capital

**3.11** The amount and quality of physical capital associated with a job is a key determinant of workers' labour productivity. Investment by firms in physical capital, by providing the machines and infrastructure with which workers operate, is likely to have a direct impact on the amount of output each worker is able to produce.

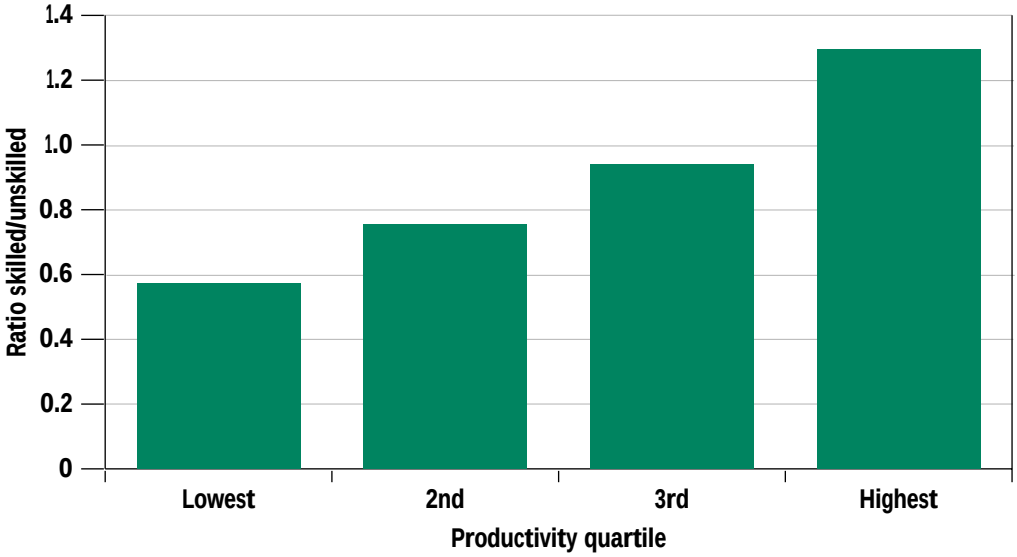
**3.12** Empirical studies have found a high correlation between firms' capital intensity and productivity. Oulton (2000) explores the sources of the labour productivity gap in the UK between foreign and domestic-owned firms. He finds that foreign-owned firms operate with 50 per cent more capital per worker than comparable UK firms and suggests that this explains a large part of the labour productivity gap, a result consistent across most sectors of manufacturing.[9] In the service sector variations in capital intensity also explain a significant amount of the productivity gap between foreign and domestic owned firms.

## (II) Human capital

**3.13** A second key determinant of labour productivity is human capital. This includes the education, skills and training of the worker, acquired both on and off the job. The skill levels of a firm's workforce have a large positive impact on the labour productivity of a firm. Chart 3.3 shows that plants in a higher productivity quartile have a higher proportion of skilled workers in their workforce. Oulton (2000) finds that differences in physical and human capital can explain around 60 per cent of the productivity gap between domestically owned firms and US-owned firms, and nearly all of the gap with other, non-US, foreign-owned firms.

[9] Oulton (2000).

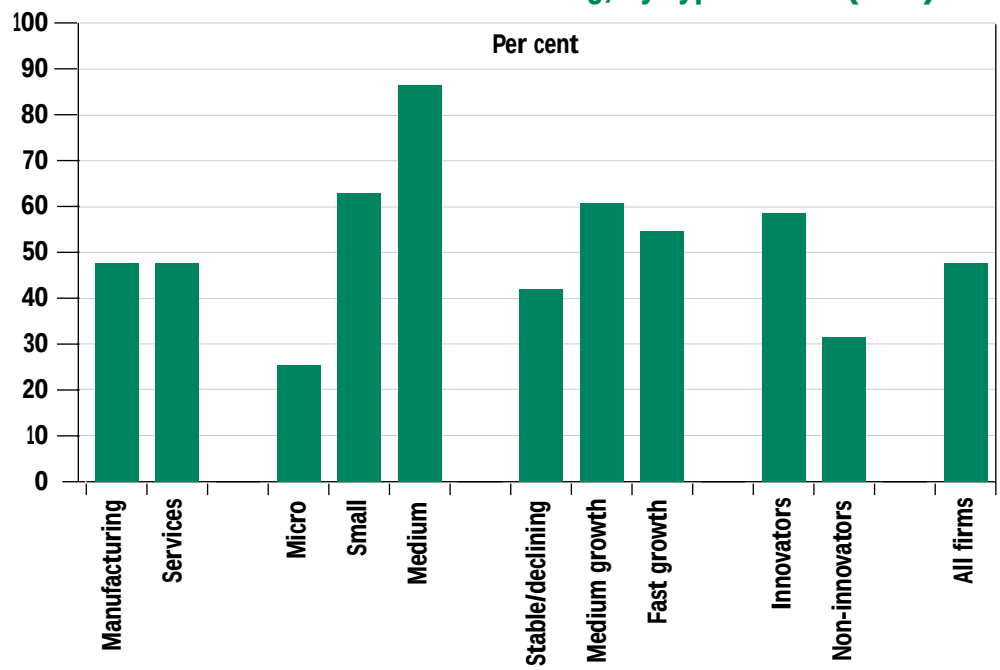
## Chart 3.3: Ratio of skilled to unskilled labour by productivity quartile in UK manufacturing plants (1994-1998)




*Source: Barnes and Haskel (2000).*

**3.14** In both services and manufacturing, the evidence shows that growing firms, innovators,[10] and larger firms spend more on training than stable/declining firms, non-innovators and smaller firms (see Chart 3.4)[11].

## Chart 3.4: Firms involved in training, by type of firm (1999)




*Source: Kitson and Wilkinson (2000a).*

[10] Innovators are defined as firms that have introduced an innovation during the last two years.

[11] The Skills Task Force final report has also found results that are consistent with this. For example, it found that only 36 per cent of firms with less than 25 employees provided off-the-job training, compared to over 90 per cent of firms with over 200 employees.

**3.15** A lack of entrepreneurial and managerial ability is also likely to be a particular constraint on the ability of firms to grow and improve their productivity performance.[12] Managers and entrepreneurs are key decision takers in firms and have an important impact through their choice of product design and production technique, the introduction of technology and their role in motivating and organising the workforce.

**3.16** A series of studies have found that the degree of managerial experience is positively associated with the growth rate of new firms.[13] Furthermore, there is evidence that ownership is an important factor in productivity growth, and that firms experience above average productivity growth for several years after a change in ownership.[14] It has also been found that productivity at a plant is positively related to the productivity of the firm to which it belongs, both in levels and growth rates.[15] This suggests that firms are frequently able to transfer key knowledge and skills to their individual plants and facilitate the introduction of new technology and best-practice techniques.

## (III) Innovation and technological progress

**3.17** The third critical input into production is technology, including innovations in best-practice techniques. Examining technological progress at the firm and industry level sheds light on some of the key mechanisms by which it is generated and disseminated in an economy.

**3.18** The evidence shows that spending on R&D is associated with a higher rate of productivity growth and produces more innovation.[16] Evidence on SMEs suggests that there are substantial variations in spending on R&D between firms (see Chart 3.5)[17]. In particular, larger firms and manufacturing firms more frequently engage in R&D than smaller firms and those in the service sector .

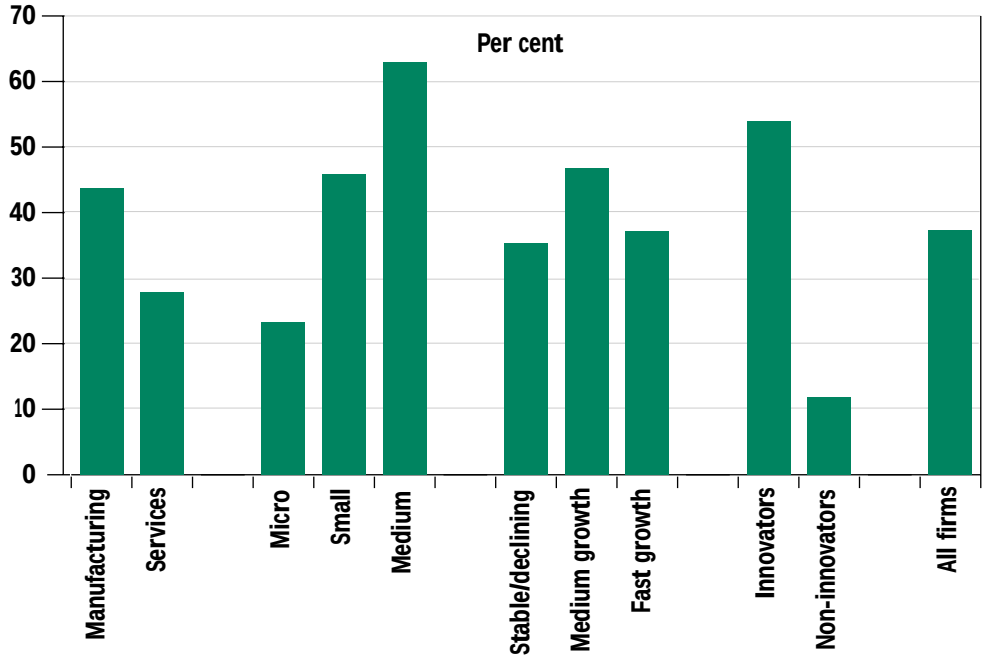
**3.19** A firm's ability to use best-practice techniques relies on all its employees being familiar with technology and having the capacity to translate this knowledge into improved work practices. Skilled workers' ability to adopt the latest technologies is essential to this process, and research at the firm level finds strong complementarities between the rate at which firms adopt new technologies and workforce skills.[18]

**3.20** As well as the importance of a skilled workforce in a firm's ability to adapt to new working practices, technological progress is frequently embodied in a firm's capital stock. Investment in physical capital is therefore an important contributor to the dissemination of new technologies.[19] In other words, the inputs to production show strong complementarities, and for firms to maximise their productive potential they need to invest in them all.

**3.21** Further, an important observation made by the study of innovative activity at the firm level is that there is strong persistence in innovative activity. Firms that have been successful innovators in the past can build on their success and increasingly outperform their competitors.[20] This suggests that investment in R&D and physical and human capital not only improves firms' current productivity performance, but also creates a platform from which they build future success.

[12] Johnson and Winterton (1999).
[13] Barkham (1991), Storey, Watson and Wynarczyk (1989), Jones (1991), Macrae (1991) and Dunkelberg and Cooper (1982) as quoted in Storey (1994) and Cosh and Hughes (2000b).
[14] Lichtenberg (1992) and McGuckin and Nguyen (1995).
[15] Baily, Hulten and Campbell (1992).
[16] Lichtenberg and Siegel (1991) and McGuckin, Streitweiser and Doms (1998).
[17] Cosh and Hughes (2000b).
[18] Doms, Dunne and Troske (1997) and Nickell and Nicolitsas (2000).
[19] Nickell and Nicolitsas (2000) and Zvi Griliches (1994).
[20] Blundell, Griffith and Van Reenan (1995).

**Chart 3.5: Firms engaged in R&D, by type of firm (1999)**




*Source: Cosh and Hughes (2000b).*

## (IV) The competitive environment

**3.22** Competition plays a central role in driving productivity growth. It encourages firms to innovate by reducing slack, putting downward pressure on costs and providing incentives for the efficient organization of production. It also reorganises market structures, by reallocating resources away from inefficient firms to more productive competitors and new entrants.[21]

**3.23** Studies by Blundell, Griffith and Van Reenan (1995) and Nickell (1996) find that various measures of competitive pressure in a sector have a positive impact on firm efficiency and productivity growth rates. They find that increases in the size of market shares and the size of supernormal profits earned by firms, both of which are positively associated with market power, have a negative impact on future productivity growth. Similarly, the wide distribution of productivity outcomes, described at the start of this chapter, is itself consistent with a lack of competitive pressure and is found to be negatively correlated with productivity growth at the sector and firm level.[22]

**3.24** Entrepreneurial ability, in creating new businesses, is an important source of competitive pressure. Studies[23] have shown that measures of enterprise and entrepreneurship, such as the numbers of people starting a business in a country or the rate at which individuals invest in start-up companies that are not their own, are highly correlated with growth.

**3.25** New entrants and the threat of entry are also a critical component of effective competition, and a source of innovation.[24] The powerful impact of competition on productivity growth through new entrants is highlighted by recent plant-level studies. In general, plants that exit from the market are less productive than the average plant. New

[21] Aghion and Howitt (1997).

[22] Oulton (1996) and Barnes and Haskel (2000).

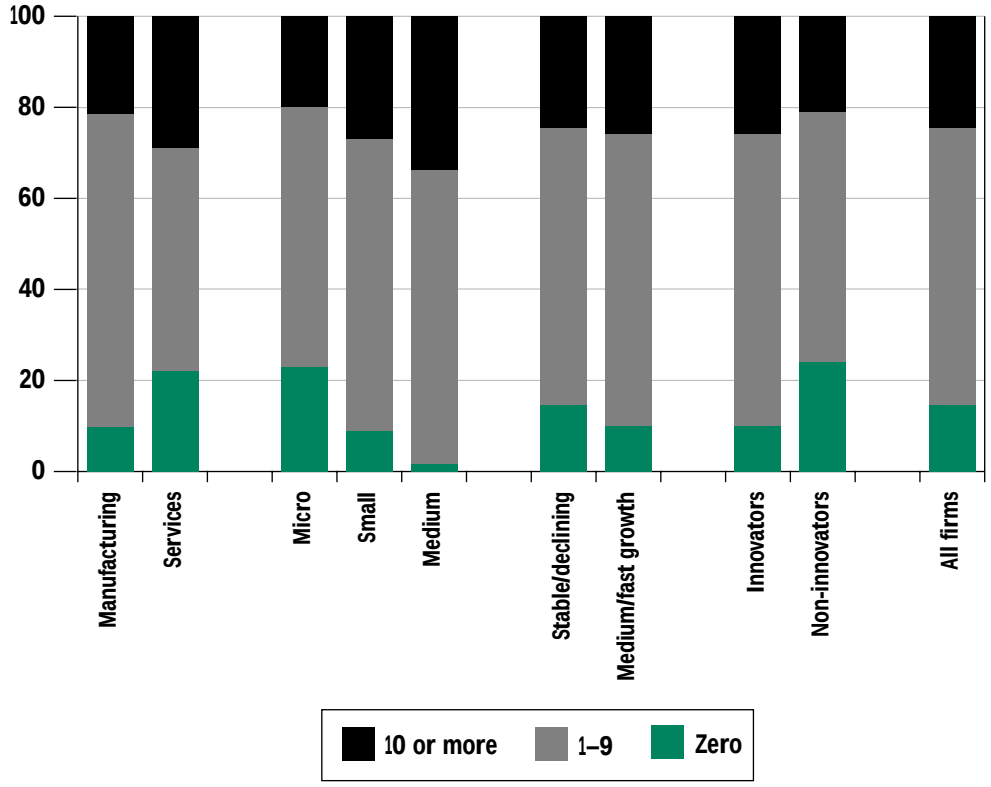
[23] London Business School (1999).

[24] Baumol, Willig and Panzer (1982) and Porter (1985).

entrants also start off less productive than incumbents, but thereafter rapidly improve their performance so that in aggregate, exit and entry provides an important mechanism by which resources are reallocated from less to more productive firms. Attempts to quantify this effect in the US and the UK[25] have led to broadly similar results attributing 30-50 per cent of productivity growth in manufacturing to exit and entry effects.

**3.26** Kitson and Wilkinson (2000b) find substantial variations in the intensity of competitive pressure to which different firms are exposed (see Table 3.1). Broadly, they find that growing, more innovative and larger firms have more competitors than firms with stable or declining sales, smaller firms and non-innovators. The study also indicates that competition in manufacturing may be more intense than in the service industry, with 22 per cent of service sector firms in the sample claiming that they face no serious competitors.

**Chart 3.6: Number of reported competitors, by type of firm (1999)**




*Source: Kitson and Wilkinson (2000b).*

## CONCLUSIONS

**3.27** The evidence from firm and plant-level analysis suggests that the key to increasing UK productivity growth lies in improving firms' access to the inputs and resources they require to raise their productivity and creating a competitive environment in which they are encouraged to do so. There are five areas of particular importance:

- **Physical capital** raises labour productivity directly by providing the equipment and infrastructure with which workers operate. It also contributes to raising productivity by facilitating the introduction of new technology. The reduction in macroeconomic volatility has lowered the cost of capital for firms

[25] The US study is by Foster, Haltiwanger and Krizan (1998). The UK results are from Disney, Haskel and Heden (1999) and recent updates of their work by Barnes and Haskel (2000).

thereby enhancing the ability of firms to invest and finance the cost of expansion.

- **Human capital** directly increases productivity by raising the productive potential of employees. The evidence also shows that firms with highly-skilled employees and experienced managers invest more in physical capital and are better at introducing new technologies and innovative work practices.
- **Innovation and technological progress**. Firm-level evidence finds that R&D, and investment in human and physical capital, have strong positive impacts on the rate at which technological and best-practice techniques are adopted.
- **Competition** reduces slack and makes a continuous stream of innovations a critical ingredient to business success. It provides strong incentives for firms to adopt best-practice techniques and engage in innovative activity, and hence increases the rate of labour productivity growth. **Enterprise** also creates competitive pressure as entrepreneurs that start up new firms introduce innovative practices and new technology and challenge incumbents' performance.

**3.28** These conclusions closely match those from the macroeconomic evidence in chapter 2. Both inform the Government's policy approach, covered in the next chapter.

# 4 THE FRAMEWORK FOR GOVERNMENT POLICY

**4.1** The Government's long-term economic ambition, is that the UK will have a faster rise in productivity than its main competitors as it closes the productivity gap. Chapter 2 has shown that to achieve this the Government must set the best economic environment to encourage firms to invest in physical and human capital and technological progress.

**4.2** By encouraging macroeconomic stability the Government has laid the foundation for improved productivity performance. It has given independence to the Bank of England to set interest rates, adhered to prudent fiscal rules and set a transparent framework for making fiscal policy decisions[1]. This has allowed interest rate decisions to be made by the Monetary Policy Committee based on the best possible assessment of the economy, and has delivered growth closely in line with sustainable productive capacity. Inflation close to the Government's target of $2^1/_2$ per cent and long-term interest rates falling from over 7 per cent in early 1997 to around 5 per cent now has also helped firms to make long-term investment decisions.

**4.3** Where there are good economic reasons for doing so, the Government has, and will continue to, build on this foundation by making microeconomic reforms to improve further the environment for productive and successful firms to flourish and grow.

**4.4** The productivity challenge does not, however, fall solely to the Government. Chapter 3 showed that firms' decisions are also critical to their productive performance. Even in specific sectors, the most productive firms are about 5 times more productive than the least productive. All participants in the economy – businesses, workers, investors and others – therefore have a critical role to play in raising aggregate economic growth. To bring all employees and employers together with Government to address the key priorities for increasing productivity, the Chancellor of the Exchequer announced on 19 October 2000 that he had asked the CBI and the TUC to work together to meet these challenges.

**4.5** If the UK does not provide an environment in which business can readily adapt, and where the workforce is properly equipped to meet changing needs, then it will miss the opportunity of strong economic growth of the type already being witnessed, for instance in the US.

## CREATING THE ENVIRONMENT FOR SUCCESSFUL BUSINESSES TO FLOURISH

**4.6** The Government's strategy is to provide the best environment for all participants in the economy to maximise their productive potential and not to interfere directly in the way businesses are run. This means that rather than supporting failing businesses or trying to 'pick winners', the key to productivity growth lies in creating and sustaining an economic environment for productive businesses, which provide high quality products or services at low prices, to flourish.

**4.7** There are two strands to the Government's policy for maximising productivity and economic growth:

- providing a **stable macroeconomic environment** within which firms can make critical long-term decisions with greater certainty and, consequently, at lower cost; and

[1] The Code for Fiscal Stability is laid before Parliament under Section 155 of the Finance Act 1998.

- making markets work through a series of carefully directed and designed **microeconomic reforms**.

## Macroeconomic stability

**4.8** Economic instability makes it difficult for individuals and firms to plan, save and invest. The high volatility of inflation and output in the UK over the last 30 years held back economic growth in the UK over that time. A broad consensus now exists that macroeconomic stability is essential for maximising long-term economic growth[2]. Past policies of 'boom and bust' may have facilitated short-term growth, but did so by sacrificing long-term growth, creating an inflationary and uncertain environment, which deterred firms and individuals from investing in the future[3].

**4.9** Since 1997 the Government has introduced a new framework for the operation of macroeconomic policy. Monetary and fiscal policy are now highly transparent, based on clear rules and targets, and underpinned by legislation. As the Chancellor of the Exchequer has set out, this acts as a discipline on policy-makers, preventing them from setting macroeconomic policy on the basis of short-term political considerations[4]. As a result, the Government has created a platform of economic stability upon which the economy can grow[5].

**4.10** Macroeconomic stability remains a cornerstone of the Government's economic policy, and the benefits of this stability are expected to increase with time.

## Setting the microeconomic environment

**4.11** Macroeconomic stability is an essential precondition for the Government to achieve its objective of raising long-term economic growth. However, other policies operating at the microeconomic level are also necessary to create the environment where firms and workers can maximise their productive potential.

**4.12** Effective markets and competition provide the best means of ensuring that the economy's resources are allocated efficiently. Well-functioning markets provide strong incentives, rewarding firms that do well with increased growth and profits, and rewarding workers for their endeavours with wages that reflect their productivity.

**4.13** All markets in the economy – in products, capital and labour – have an important part to play in promoting aggregate economic growth.

**4.14** **Product markets**. Efficiently functioning product markets create the competitive pressures that increase the economy's output in three ways:

(i) keeping prices down, causing firms to increase output to satisfy demand from more consumers;

(ii) ensuring that firms innovate as, if they do not, they will lose their position in the market; and

(iii) ensuring that firms conduct their operations in such a way as to minimise their costs of production – combining factor inputs in the form of labour and capital in the most efficient way.

[2] A number of academic studies have also found a relationship between stability and growth. For example, Ramey and Ramey (1995) looks at a sample of OECD countries and finds evidence that instability in output has an adverse effect on growth.

[3] See HM Treasury: Fiscal policy: lessons from the last economic cycle, November 1997; Delivering Economic Stability: Lessons from macroeconomic policy experience, November 1998; and Planning Sustainable Public Spending: Lessons from previous policy experience, November 2000.

[4] See the Chancellor of the Exchequer's speech at the Royal Economic Society Conference 2000.

[5] Balls (1998).

**4.15** **Capital markets**. Well functioning capital markets ensure that firms have adequate access to the capital they need to operate efficiently and to grow. Individuals also need access to finance to invest in their own human capital. Efficient capital markets promote economic growth by:

(i) ensuring that firms are able to finance potentially viable investments, enabling them to expand operations to meet demand;

(ii) providing funds for firms to innovate, generating new technologies and new, more productive, ways of operating;

(iii) enabling shareholders to place incentives on firms to maximise the efficiency of their operations; and

(iv) allowing people to maximise their productive potential by borrowing against their future earnings to pay for the acquisition of skills and training.

**4.16** **Labour markets**. Well-functioning labour markets are not only essential to tackling the underlying causes of deprivation and inequality, but they are also vital for generating growth in the following ways:

(i) increased labour supply allows employment to rise to meet the demands of a growing economy for increased output;

(ii) flexible labour markets ensure that the economy is able to adjust rapidly to take advantage of new growth opportunities, such as those associated with information and communications technology; and

(iii) well-functioning labour markets reward workers according to their performance and skills.

**4.17** In sum, fair and efficient product, capital and labour markets provide the best means of ensuring that as many of the economy's resources as possible are available to generate economic growth and well-being.

Box 4.1: Economic reform in Europe

The approach to policy developed in this paper also underpins the process of economic reform in Europe. This process was started during the UK presidency of the EU of 1998, and received an important boost at the Lisbon summit of March 2000. Technical annex C sets out how the development of EU structural indicators is driving reform at the EU level.

Economic reform in Europe is about reforming Europe's product, capital and labour markets in order to raise EU levels of productivity and employment to meet global best practice.

Key instruments for delivering product market reform in the EU are competition, the single market and research policy. At Lisbon, Heads of State agreed to full liberalisation of the telecommunications market by 2001 and to speed up liberalisation of energy, postal and transports markets. The European Commission is developing a strategy for completing the single market in services. Lisbon agreed a package of measures to encourage R&D, including an EU patent, under the heading of European Research Area.

The Lisbon Council conclusions[1] also recognise the way in which efficient capital markets stimulate growth. They state that "efficient and transparent financial markets play an essential role in fuelling new ideas, supporting entrepreneurial culture and promoting access to and use of new technology". The financial services action plan sets out a programme to complete the single market in financial services by 2005. The risk capital action plan comprises measures to be taken by 2003 to narrow the gap in the supply of venture capital between the EU and the US. US venture capital spending per capita is 5 times that in the UK. Lisbon called for a review of the financial instruments of the European Investment Bank and the European Investment Fund, to ensure that government intervention is properly focused on areas of market failure.

Labour market reform is a central aspect of EU economic reorganization. The Lisbon Council called for member states to take measures necessary to raise the EU employment rate towards 70 per cent by 2010. Reforms to tax-benefit systems and active labour market policies pioneered by the UK are being pursued in Europe through a series of Employment Guidelines.

[1] Lisbon European Council (2000).

## Making markets work

**4.18** Markets provide the best means of allocating an economy's resources. However, many markets are subject to imperfections or failures. Market failure exists when the competitive outcome of markets is not efficient from the point of view of the economy as a whole. This is when the benefits that the market confers on individuals or firms carrying out a particular activity diverge from the benefits to society as a whole. Put another way, markets fail when the private returns which an individual or firm receives from carrying out a particular action diverge from the returns to society as a whole – resulting in a sub-optimal amount of it being done.

**4.19** Market failures can occur in many different ways and for a wide range of causes. They can all, however, be classed into four generic categories as follows:

- **Externalities.** These are spill-over effects which occur when actions by a firm or individual create benefits (or costs) that do not accrue (or are not borne by) that firm or individual. Examples of externalities relating to productivity include:

  (i) **research and development** – R&D often generates knowledge that is difficult to appropriate. Thus the benefits of one firm's R&D activity may be shared by other firms;

(ii) **training** – a firm cannot stop employees changing jobs and so may not be able to reap the rewards of investment in an employee's training; and

(iii) **public goods such as infrastructure investment** – investment in areas such as transport is also subject to externalities. For example, although a firm may benefit from building a road to its factory, it is likely that this would also be of benefit to other road users.

Because of spill-over effects, there is an incentive for each firm in these cases to wait for someone else to invest, and then gain from their investment without committing any cost. Hence, if left entirely to the market, firms may tend to under-invest.

- **Market power.** When competition works effectively, firms innovate and set prices to win business. Where there is market power, however, this process is hindered. First, firms reduce efficiency in production and set higher prices. Secondly, market power shifts the dynamic incentive to innovate, which is essential to growth. There are a wide variety of sources of market power[3]:

  (i) a lack of entry and exit by firms;
  (ii) weak competitive rivalry between firms;
  (iii) a lack of product substitution on the part of consumers;
  (iv) weak buying power by consumers, or other firms buying from firms with market power; and
  (v) strong buying power by firms with market power.

- **Information** A lack of information can cause problems for the efficent functioning of markets. For example:

  (i) if savers are unsure about the quality of the various savings products on offer, then they may be deterred from saving for their future;[4] or
  (ii) if workers are not fully aware of the benefits they will gain from training, they might under-investor or if firms are worried that the government is not commited to delievering stability they might under-invest.

- **Poor regulation**. Although Government regulation has a clear and vital role to play in ensuring that markets operate efficiently, excessive or unnecessary Government regulation can obstruct efficient market functioning.

[3] Based on Porter (1980).

[4] More specifically, markets with informational asymmetries are characterised by moral hazard and adverse selection, both of which can cause problems for effective market functioning. Holmstrom, (1984) has looked at the issue of moral hazard in market services. The most famous example of adverse selection is by Akerlof (1970) who looks at the market for used cars or "lemons".

Box 4.2: An example of private and social returns diverging: R&D

Private and social returns to R&D can deviate from each other because of market imperfections such as spill-over effects. R&D creates new knowledge. It is an investment from which other firms can benefit, and the returns may not be fully appropriated by the firm making the investment. This means that social returns to R&D often exceed private returns and that, as a result, individual companies are likely to invest less than might be optimal from the point of view of the economy as a whole.

Seminal work in this area was carried out in the US by Zvi Griliches[1], who concluded that social returns to R&D were in the order of 40% and about 1½ times the private return. It has been argued that these estimates may understate the social returns to R&D[2] for a number of reasons. For example, they ignore the fact that R&D yields further benefits to the economy by generating new growth opportunities[3] – a point underlined by the models of endogenous growth.

This evidence bears out the claim that there are market imperfections, such that the market left to its own devices would under-invest in R&D.

[1] For example Griliches (1992).
[2] Griffith (2000).
[3] Jones and Williams (1998).

## THE GOVERNMENT'S APPROACH

**4.20** To improve the UK's productivity performance, the market failures above need to be overcome where they occur. In successive Budgets and Pre-Budget Reports since 1997, the Government has introduced policies to address some of the market imperfections above. Table 4.1 below shows how the policies the Government has introduced since 1997 to address the productivity gap and the labour market have tackled particular market failures[5].

**4.21** To develop its policy agenda on productivity, the Government has established five priority areas for action – referred to as the five drivers of productivity growth. These have been developed by assessing the issues that the academic literature suggests are most likely to improve productivity performance as discussed in chapters 2 and 3. The detailed conclusions of some of these studies conflict, but a general consensus emerges that:

(i) **Investment** in physical capital has long been known to be an important determinant of growth[6], and this has become a well-established finding in the empirical studies in the area[7].

(ii) Improving **skills and human capital** is important in promoting growth, both as an input to production and by aiding technological progress. This has been recognised both in endogenous growth theory[8] and also in empirical studies comparing growth in different countries[9].

(iii) Greater **innovation**, and particularly more R&D, is associated with higher growth. This relationship has been found from studies in a number of

[5] It should be recognised that some Government policies address more than one market failure
[6] The original Solow-Swan model of growth gives capital accumulation the pivotal role in growth.
[7] For example DeLong and Summers (1991).
[8] For example, Lucas (1988).
[9] Benhabib and Spiegel (1994) and Mankiw, Romer and Weil (1992).

countries. For example, Griliches (1992, 1994) found very high social returns to R & D.

(iv) **Competition** is a key component of growth. Research by Steve Nickell (1996), for example, has shown that increasing market share and profits, both of which are indicators of market power, have a negative impact on productivity growth.

(v) **Enterprise** is important to increasing growth. Studies[10] have shown that measures of enterprise and entrepreneurship, such as the numbers of people starting a business in a country or the rate at which individuals invest in start-up companies that are not their own, are correlated with growth.

## Table 4.1: Government policy to encourage productivity growth since 1997

| | Capital Markets | Labour Markets | Product Markets |
|---|---|---|---|
| Externalities/Public Goods | • Financial Services and Markets Act.<br>• Changes to the CGT system.<br>• Corporate Venturing Scheme.<br>• Improvements to Enterprise Investment Scheme and Venture Capital Trusts. | • Improve standards in schools.<br>• Create Learning and Skills Councils to improve education and training for those aged 16 and over.<br>• Improve lifelong learning through Individual Learning Accounts and University for Industry.<br>• Council for Excellence in Management and Leadership to improve management education.<br>• The New Deal.<br>• Reforms to work permits. | • R&D tax credits for SMEs.<br>• Policy to encourage clusters.<br>• Improving the science base through the Joint Infrastructure Fund and University Challenge.<br>• Improvements to commercialization of public sector science following the Baker Report.<br>• Science and Innovation White Paper. |
| Market Power | • Cruickshank Review of Banking.<br>• Competition Commission reference into SME banking.<br>• Setting up of Paycom. | • The Minimum Wage and Low Pay Commission. | • The new Competition Act.<br>• International price comparisons.<br>• The Consumer White paper, 1999. |
| Informational problems | • Macroeconomic framework<br>• Myners Review of Institutional Investment.<br>• DTI enterprise fund.<br>• 100 per cent Capital Allowances for Small Business Spending on ICT equipment. | • Employee share ownership to align incentives of staff, management and shareholders.<br>• Enterprise Management Incentives. | • The OFT Review of professional services.<br>• CAT standards on investment products. |
| Regulation and taxation | • Reduction in Corporation Tax rates to 30, 20 and 10 per cent.<br>• Introduction of permanent 40 per cent Capital Allowances for SMEs.<br>• Abolition of Advance Corporation Tax. | • Policy to make work pay including the Working Families Tax Credit. | • Small Business Service<br>• Regulatory Impact task-force. |

**4.22** These conclusions underlie the key drivers of productivity: competition, enterprise and innovation, skills and investment. They tie closely to the analysis in the previous chapters.

[10] London Business School (1999).

Box 4.3: Maximising the capabilities of Government

In creating policy the Government needs to have a realistic view of the capabilities it has to correct the effects of market imperfections, as opposed to simply creating different problems.

In implementing policy the Government has been careful to ensure that policy is delivered in a manner which ensures that it has the full beneficial effects intended. For instance, it is important to:

- minimise the dangers of policy being impeded by imperfect information;
- ensure strong incentives for those tasked with delivering policy; and
- create transparent institutions to maximise public accountability .

**4.23** Taking each of the five drivers of productivity growth in turn, some of the main policy developments are detailed below.

## Investment

**4.24** As well as the macroeconomic climate, the tax system affects business behaviour. The Government has focused on reducing the marginal rates of **corporation tax**, moving to a 30 per cent main rate and introducing a new 10 per cent starting rate for the smallest companies. Aside from lowering tax-driven distortions, reducing the rates of corporation tax has the additional benefit of leaving firms with greater access to internal financing[11].

**4.25** In reforming the system, the Government has also addressed some of the major distortions in the corporation tax regime it inherited. Before 1997, the regime included **payable tax credits** on dividends that encouraged companies to pay out profits as dividends rather than retain them in the firm. Given the historic under-performance of UK business investment outlined in chapter 2, such an incentive structure was likely to hold back productivity growth. The Government announced in 1997 the removal of this distortion through making the tax credits non-payable.

**4.26** A further distortion arose from the existence of **Advance Corporation Tax** (ACT), a system that collected tax when dividends were paid. For firms with large foreign relative to domestic earnings this created double taxation of overseas profits[12]. The Government abolished ACT from April 1999 and moved to a system of payment on account that is more in line with modern international collection systems.

## Skills and Human Capital

**4.27** Chapter 2 shows the importance of a skilled workforce in increasing economic growth. In the period between 1986 and 1998, the majority of labour input into economic growth came from increases in skills rather than increased employment growth (Gust and Marquez 2000).

**4.28** Despite the importance of education in developing the skills of the future and current workforce, spending across the UK rose by only 1.5 per cent a year in real terms between 1978–79 and 1996–97[13]. As a result, capital investment, for example in school buildings, was neglected. In 1996, only 57 per cent of children aged 11 had reached the standard of literacy

[11] Bond and Meghir (1994).

[12] Bond et al (1996) found Storey (1994) and evidence that surplus ACT was distorting firms' commercial decisions.

[13] HM Treasury: Comprehensive Spending Review: new public spending plans 1999–2002 (Cm 4011) (July 1998).

expected for their age. As well as under-investment, the education system had no firm targets against which the outcomes it produced could be judged, reducing the incentives for successful policy making and implementation.

**4.29** To increase the level of skills in the economy, the Government will increase spending on **education and training** in the UK by over £10 billion between 2000-01 and 2003-04[14]. This is a real increase of 5.4 per cent a year over this time. The money will improve standards throughout the schools system and help to deliver lifelong learning through the University for Industry and Individual Learning Accounts. It will also provide funds to make progress towards the Government's ambition that 50 per cent of those aged between 18 and 30 should have the chance by the end of the decade to enter Higher Education.

**4.30** Chapter 3 showed that skills are also important to improving productivity and growth at the firm level. Research has found that a lack of skilled senior staff is an important barrier to growth in small firms[15]. Additionally share options provide an important mechanism, especially in high growth firms, for aligning key employees' incentives with those of their shareholders.

**4.31** In the past, employees' incentives have often failed to match those of managers and shareholders. This can be addressed if employees also have a direct stake in their firms performance. In particular, evidence has shown that employee share ownership can increase a firms productivity, especially when combined with other means of active employee participation, by overcoming these problems[16]. The Government has therefore introduced a **new all-employee share ownership scheme** , which is the most tax-advantaged all-employee share scheme ever introduced in the UK. The Government also introduced in Budget 2000 an **Enterprise Management Incentive scheme**. This allows firms with high growth potential to recruit and retain key staff by issuing tax privileged share options.

## Innovation and technology

**4.32** There is clear evidence that the social returns to R&D exceed the private returns (see Box 4.2). In addition, as discussed in chapter 2, the aggregate level of UK R&D expenditure has lagged behind its competitors. These factors suggest that the Government should intervene to overcome the externalities that lie behind the problem.

**4.33** In April 2000, the Government introduced a new **R&D tax credit**, targeted on all small and medium-sized companies[17]. The credit will increase the 100 per cent relief for current spending on R&D to 150 per cent. So when added to the existing relief, the cost of R&D will be reduced by 30 per cent for a company benefiting from the small companies' corporation tax rate.

**4.34** The Government has also introduced policies to improve the UK's science base. The recent Science and Innovation White Paper announced a new £1 billion programme in partnership with the Wellcome Trust and £250 billion to promote research in key new areas such as genomes[18].

[14] Announced in HM Treasury, Spending Review 2000 (July 2000).

[15] Storey (1994) and Cosh and Hughes (2000)

[16] For example, this conclusion is reached in Blinder, (1990).

[17] There is evidence showing that tax credits are effective in raising the level of R&D expenditure. For example, Hall and Van Reenan (1999).

[18] See Department of Trade and Industry (2000)

## Competition

**4.35** Recognising the strong link between **competition** and productivity[19], the Government has sought to strengthen competition policy. The Restrictive Trade Practices Act (RTPA) and the Fair Trading Act (FTA), the system of control in the past, were ineffective and inefficient. On anti-competitive agreements, for example, it concentrated mainly on the form of the agreement rather than the effect it had in the market concerned. As a result, time was spent scrutinising innocuous agreements, while agreements that may well have been anti-competitive were often outside its scope. Furthermore there was little incentive for parties to curb anti-competitive activities as there were no financial penalties for breaches of the RTPA and the investigative powers of the Office of Fair Trading (OFT) were weak.

**4.36** To strengthen UK competition policy, the Government has introduced the new Competition Act 1998, which came into force on 1 March 2000. The Act enhances the powers available to the OFT to tackle anti-competitive practices and abuses of a dominant position. It also introduces strong penalties for transgressors – up to 10 per cent of UK turnover for each year of the infringement up to a maximum of three years – and ensures that the OFT is able to identify and pursue cases of anti-competitive behaviour entirely independently of Ministers.

**4.37** Effective **competition in banking** is important to reduce market power in the supply of finance. The Cruickshank Review[20] into competition in banking looked at sources of market power and made a series of recommendations to tackle them. Following the report, the Government has committed itself to legislation opening up and overseeing access charges to the payments systems. It has also referred the supply of banking services to SMEs to the Competition Commission for further investigation. In addition, it is addressing informational problems in the market through the provision of better comparative information for consumers.

## Enterprise

**4.38** Chapter 3 showed how a competitive environment is strengthened by the entry of new firms to put increased competitive pressures on incumbents. This requires individuals and entrepreneurs to be able to set up new businesses and to have the incentives to succeed.

**4.39** External support has an important role in helping small firms to achieve their potential, by improving their access to advice and information. There is good evidence that a key constraint on small firms' ability to grow successfully is the need for internal management development, for example as they start to require more specialised skills. Good quality business support can play a key role in helping firms manage this transition. The **Small Business Service** was launched on 3 April 2000 to ensure that Government support for small business is improved both in terms of quality and coherence.

**4.40** To improve incentives for enterprise, the Government has made significant reforms to the **Capital Gains Tax** (CGT) regime, which previously did not distinguish between short and long-term investment. The Government has introduced a more generous taper rate, particularly for business assets, and changes that encourage longer term investment, reducing the CGT charge the longer an asset has been held. These changes align the system more closely with entrepreneurial investment cycles[21]. In Budget 2000, the Government also widened the definition of business assets, to ensure that the full benefits of the CGT business assets taper regime were available to a broader range of shareholdings.

[19] As in Nickell (1996).

[20] Don Cruickshank *Competition in Retail Banking*, A report to the Chancellor of the Exchequer. March 2000.

[21] Mason and Harrison (1999).

## PUBLIC SECTOR PRODUCTIVITY

**4.41** As well as ensuring the right environment for firms to increase their productive input, the Government is directly responsible for a substantial part of the economy. Although this paper has focused on productivity in the wider economy, the public sector itself is insufficiently productive, The Government has therefore also sought to introduce policies to ensure that it operates as efficiently as it should and makes concrete improvements in service delivery[22]. The Government will be publishing a further paper addressing public sector productivity specifically in due course.

**4.42** The Government has used **public private partnerships** to bring new investment and improved management into service delivery. The projects that the Government has signed since May 1997 have leveraged in over £12 billion of capital investment. Projects that are privately financed are, on average, delivering savings of 17 per cent compared to public sector alternatives[23].

**4.43** **Public Service Agreements** (PSAs), first published after the 1998 Comprehensive Spending Review[24], and updated and improved as part of the 2000 Spending Review[25], set targets for key policy outcomes and service improvements. The new set clearly identify the high-level aims and objectives and concrete targets to which each main department and cross-departmental programme is working.

**4.44** The real test however, is in ensuring delivery of these commitments. The new Service Delivery Agreements, published earlier this month, make clear the detailed programmes and actions that departments will be working on in order to deliver the PSAs. Detailed public reporting, through Departmental Annual Reports, provides a strong incentive to deliver the commitments contained in the PSAs, and the Cabinet Committee on Public Services and Public Expenditure (PSX), supported by the Treasury, rigorously monitors departmental performance.

## CONCLUSIONS

**4.45** The Government's microeconomic reform agenda is based on a strategy to correct market failures that obstruct productivity growth in the key areas of investment, skills, R&D and innovation, competition and enterprise. The Government has also made changes to improve productivity in the public sector and to ensure that Government policy is designed to have the best chance of correcting the market failure identified.

**4.46** The Government will continue to develop its microeconomic reform agenda, building on the necessary foundation of continued macroeconomic stability, to close the productivity gap.

[22] Public Sector productivity has been covered in detail recently in the 2000 Spending Review. See HM Treasury, Spending Review 2000: New public spending plans 2001-2004 (Cm 4807), July 2000, especially chapter 5. The Public Sector Productivity Panel, a central part of the Government's strategy to improve public sector performance, has also looked at improving public sector service delivery in several areas. Public Services Productivity Panel: Public Services Productivity: Meeting the challenge (August 2000), stresses that a good performance management system embedded in the culture of an organisation is essential to deliver consistent top class performance.

[23] HM Treasury, Public Private Partnerships: the Government's approach (2000).

[24] HM Treasury, Comprehensive Spending Review: new public spending plans 1999-2002 (Cm 4011), July 1998.

[25] HM Treasury, Spending Review 2000: Public Service Agreements 2001-04 (Cm 4808), July 2000.

**4.47** However, as chapter 3 showed, individual firms' decisions are also important if they are to reach their productive potential. Improving government policy can provide a better environment, but ultimately it is also up to firms and employees to overcome the barriers to increased productivity growth in the UK.

# 5 Conclusions

**5.1** Following the Treasury's publication on trend growth (HM Treasury, 1999), this paper analyses the evidence on the UK's productivity and sets that out alongside the Government's approach for improving its performance.

**5.2** The UK's productivity performance has been poor for a long time in comparison to other major economies. As a result, the UK now has a productivity gap, measured in output per worker, that is substantial on all measures in comparison to the US, Germany and France.

**5.3** The UK's productivity gap has been examined on two levels:

- At the national level, the UK has a shortfall against its major competitors in terms of investment in physical and human capital and in terms of technological progress. All these areas are important to productivity growth and the UK trails different countries by different amounts on each. Furthermore, the inter-relationships between them are also crucial to increasing productivity. The national analysis therefore shows that to increase productivity growth, the UK has to increase its investment in all three areas of physical capital, human capital and technological progress.

- At the firm level, evidence shows that although the country's most productive firms perform well, they are trailed by a long tail of far less productive firms. Even in the same sector, the most productive firms can be around five times more productive than the least. The UK can therefore improve its overall productivity performance by the least productive firms lifting their performance towards the level of the best firms in their sector, and by strengthening the competitive pressures on them to do so.

**5.4** Investigating firm-level data in more detail shows that the poor overall performance of UK firms is due to weaknesses in areas that are closely related to those identified through the macroeconomic evidence. These are: a lack of investment in physical capital; low investment in human capital; insufficient innovation, highlighted by low levels of R&D; weak competitive pressures; and a lack of enterprise.

**5.5** Firm-level data support the conclusions of analysis of national data and suggest that to increase productivity, the UK needs to improve in all these areas to realise its full productive potential.

**5.6** The Government's approach to reducing the productivity gap has two pillars:

- Promoting macroeconomic stability to encourage firms and individuals to invest, innovate and to allow them to make long-term decisions; and

- Microeconomic reforms to ensure that market failures are overcome and that firms are operating in the best environment for realising their productive potential.

**5.7** Through the new monetary policy framework in which operational independence was granted to the Bank of England in 1997 and by adhering to fiscal rules, the Government has created a platform of stability. This has already contributed to an increase in business investment. Evidence shows that the gains to growth from macroeconomic stability should increase the longer economic stability persists. It is therefore a cornerstone of the Government's approach to increase productivity that it maintains macroeconomic stability.

**5.8** The microeconomic reform agenda to promote productivity has at its centre the aim of overcoming market failures to improve the environment in which firms operate. The policies introduced to achieve this focus on five priorities consistent with the conclusions outlined in this paper:

- Increasing investment in physical capital;
- Developing human capital;
- Promoting innovation and R&D;
- Strengthening competition; and
- Encouraging enterprise and entrepreneurship.

**5.9** The Government will continue to focus on these issues as it takes forward its ambition to have a faster rise in productivity than its main competitors over the next decade so that it closes the productivity gap.

**5.10** Finally, meeting the productivity challenge must involve businesses and employees as well as Government. That is why the Chancellor of the Exchequer has asked the TUC and CBI to work together to overcome the major barriers to increased productivity growth in the UK.

# A TECHNICAL ANNEX: DATA AND MEASUREMENT ISSUES

**A1** There are methodological differences between the UK and the US approaches to measuring the contribution of Information and Communications Technology (ICT) to the economy. These may account for at least some of the divergences in recent performance. Some commentators have gone further by arguing the UK is understating output, and therefore productivity growth, in absolute and not just relative terms. This annex describes some of the problems in accurate statistical measurement of ICT that may lead to distortions in official estimates of output and productivity.

**A2** It is well known that measuring the prices and volumes of computers and associated equipment and software in the economy is problematic. This is because the rapid pace of technological change in ICT industries leads to rapid increases in product quality. In order to make like-for-like comparisons of output and prices over time, as well as to take into account the benefits to consumers and businesses, these quality improvements need to be adjusted for.

**A3** Countries adopt different statistical techniques in order to capture these quality adjustments. Much interest has recently focused on the differences between the methodology employed by the US statistical authorities and that pursued by their counterparts in other countries – including the UK.

**A4** The US employs a quality adjusted, or hedonic price index, to measure computer prices. This method makes larger adjustments for increased computing quality than the non-hedonic technique practised in the UK and many other industrialised countries. The US approach prices the individual components that make up 'computer boxes' individually. Regression techniques are used to estimate the relationship between the price of computers and the components or characteristics that comprise it. Price quotes for the computer as a whole are adjusted by the hedonically estimated parameters and the quantity index (e.g., for output or investment) is derived by deflating nominal data using the hedonic price index.

**A5** Contrary to what is sometimes asserted, the UK does make adjustments for improved computer quality – but in a different way to the US. At the output level, the UK uses two methods. If an extra characteristic (or option) is added to the specification of a product, the producer is asked whether this is priced separately. If so, the Office of National Statistics (ONS) adjusts the new price by half the cost of the new option, to allow for producers exploiting economies of scale from standardising an option. However, in many cases, a separate price for a new option or specification change will not exist. In that case, the manufacturers are asked for their estimate of the cost of upgrading the specification and this amount is fully taken into account in the quality adjustment of the price.

**A6** Because hedonic techniques tend to give rise to bigger estimates of quality improvements than non-hedonic techniques, the result is that US data show a sharper drop in computer prices, and therefore a greater increase in ICT output and productivity - as well as greater investment in computers and software. There has been some discussion of using hedonic regressions in the UK. Indeed, a recent ONS report[1] looked at the impact this might have on measures of UK output. It estimated that deflating the UK Index of Production using US price indices for computers would increase overall growth in manufacturing output since 1995 by around 6 per cent. A similar exercise by the Bundesbank in Germany found that when the US deflator was used ICT spending in Germany was more than twice as high as suggested in the official statistics.[2]

[1] Office of National Statistics (2000).

[2] HSBC (2000).

**A7** However, looking at the effects of domestic computer prices just in terms of their effect on output can be misleading. A recent paper by the OECD[3] shows that any assessment of the potential statistical bias has to take several other factors into account. These include whether the products under consideration are final or intermediate products, the effect of imported products, and whether national accounts use fixed or chain weighted index numbers. Taking into account these various factors can offset some of the potential bias in GDP estimates that seems apparent from looking at particular aspects or components of the accounts.

**A8** Moreover, applying US price data would not bring UK productivity growth up to US rates – nor would it help to explain the slowdown in UK manufacturing productivity growth between 1995 and 1998. The merits of alternative approaches to price deflation are debatable, and arguments can be made for both hedonic and non-hedonic methods. It is unclear to what extent one methodology is more 'correct' than another. For example, hedonic techniques require a significant volume of research and data collection before they can be reliably adopted. They are also based on the assumption that the regression equations produce a good 'fit' of the data. Hedonic techniques are, however, somewhat less judgemental than alternative approaches.

**A9** The ONS is currently giving a high priority to 'new economy' related issues, including the questions surrounding ICT measurement. Moreover, because differences in quality adjustment lead to difficulties in comparison, the ONS is at the forefront in trying to get international agreement within the OECD and Eurostat as to what quality adjustment methodologies should be used in order to allow consistent inter-country comparisons.

**A10** The ONS is also actively taking forward other parts of the agenda to ensure full and proper measurement of the effects of ICT in the economy. Recent published work has combined information from various surveys to look at households and individuals and their use of the Internet. In this way ONS has shown, for example, that 45 per cent of UK adults (20.4m people) have used the Internet.[4]

**A11** Meanwhile two different surveys of business are envisaged, one looking at the activities of Internet Service Providers (ISPs), and another looking at all businesses' use of e-commerce. The ONS is also looking across its current statistics to see where there might be an e-commerce effect, and therefore where it needs to adapt its methods and procedures – an audit was produced in May 2000.

**A12** The second methodological difference between the UK and the US is that the headline measure of US productivity growth is based on output per hour – in contrast to the UK approach that uses output per worker, although ONS is also working on a per hour measure. Changes in average hours worked therefore mean the two series are only broadly comparable. Moreover, US data measure productivity in the non-farm business sector, in contrast to the UK where estimates relate to the whole economy. The inclusion of the public sector in the UK data – where measured productivity growth is perceived to be lower than in the private sector may also therefore depress relative performance.

**A13** A third issue of concern is the measurement of the service sector in national statistics. It is well known that service sector output poses potential measurement difficulties, so there may be some underestimation of output that leads to productivity gains also being understated. For example, how should cash dispensed by auto-tellers rather than bank clerks be valued? But such problems are likely to be a feature of most industrialised countries

[3] Schreyer (2000b).

[4] Office of National Statistics: Internet Access. *First Release*, 26 September 2000.

including the US – where productivity has actually fallen in some service industries – so it does not necessarily imply the gap in productivity growth between the US and other countries is being exaggerated. In order to address these difficult issues, the UK is developing an Index of Services that will attempt to improve measurement of the volume of service sector output by measuring it directly in the same way as the Index of Production.

# B Technical Annex: Growth accounting and endogenous growth theory

**B1** This annex reviews the basic methodology involved in growth accounting, and then describes how recent endogenous growth theory has further refined understanding of the sources of growth.

**B2** Growth accounting aims to assess the contribution of various inputs into production to economic growth.[1] The basic approach is to start with a simple production function:

$$Y(t) = F(K(t), A(t), L(t))$$

where Y denotes national output, L and K are the labour and capital inputs and A is a measure of our 'knowledge stock' or the 'effectiveness of labour'[2]. This in turn yields an equation for the growth rate of the economy:

$$g_y = \alpha_K g_K + \alpha_L g_L + r(t)$$

$g_y$, $g_K$ and $g_L$ denote output, capital stock and employment growth respectively. r(t) is known as the Solow residual, frequently interpreted as a measure of technological progress and referred to as total factor productivity (TFP). TFP is a measure of all sources of growth other than those of capital accumulation via its private return and increases in the quantity of labour employed in production.[3]

**B3** Growth accounting does not provide an explanation as to why some economies have greater availability of physical capital, human capital or labour. Furthermore, it provides no insights into the process of technological progress. Hence, it leaves the ultimate sources of long-run growth unexplained and provides little information to government on how it can influence the rate of trend growth. This is where endogenous growth theory makes its contribution.

**B4** In the last decade and a half the endogenous growth literature has substantially refined understanding of the mechanisms underlying economic growth.[4] It concerns itself with explicitly modelling the process of innovation. The endogenous growth literature has in this way been able to provide insights into how a wide array of social and economic factors and institutions affect the long-run growth rate.

**B5** A central theme of the literature is that new technologies are embodied in new forms of human and physical capital. Hence, investment in physical and human capital raises labour productivity not only via factor accumulation, but also by stimulating the creation and dissemination of innovations. In this approach human and physical capital can be viewed as contributing to knowledge capital, which accumulates like any other factor of production.[5] An important feature of this approach is that innovative activity can be viewed as part of the production process itself, where workers engage in learning-by-doing.[6] Investments in human and physical capital raise the rate of learning-by-doing and

[1] Growth accounting was pioneered by Abramovitz (1956) and Solow (1957).

[2] This basic framework can be extended in many ways, most frequently by incorporating a human capital term (H) into the production function, see Mankiw, Romer and Weil (1992) for an early example of this.

[3] See Romer (1996) for a longer exposition of growth accounting.

[4] See Aghion and Howitt (1998) for a comprehensive discussion of endogenous growth theory, and Temple (1999) for a recent survey of the empirical growth literature.

[5] See Nelson and Phelps (1966) and Lucas (1988) for early examples of modelling the contribution of human capital to innovation, and Romer (1986) and Aghion and Howitt (1997) for different approaches to modelling the impact of capital accumulation on innovation.

[6] An idea going back to Arrow (1962).

consequently the rate of innovation. By this process technological change becomes endogenous, explained by the process of factor accumulation.[7]

**B6** Further insights are gained by modelling innovation under imperfect competition based on the Schumpeterian idea of 'creative destruction'.[8] This provides the opportunity for understanding the role private incentives play in fostering innovation, but also the impact of the potential divergence between social and private returns to innovation on the growth rate.

**B7** This approach has been applied in a number of areas important to economic policy. The central significance of product market competition for economic growth has been highlighted.[9] There has also been important research on the incentives for R&D investment in an open economy with technological transfers and international trade.[10] The two-way relationship between inequality and growth can also be addressed through the framework of endogenous growth theory,[11] as can the impact of economic growth on unemployment.[12]

**B8** From a policy perspective the important features of endogenous growth models are that the growth rate is no longer assumed to be invariant to policy and that the mechanisms by which the long-run growth rate can be raised are made explicit. This allows government to formulate a constructive and informed approach to generating economic growth and an understanding of how this will impact on other policy objectives, such as issues of equity and employment.

[7] See Romer (1990) for a model of endogenous technological change.

[8] Schumpeter (1934), Aghion and Howitt (1992).

[9] Aghion, Dewatripont and Rey (1997), Aghion, Harris and Vickers (1995), Aghion and Howitt (1997) and Lucas (1993).

[10] Grossman and Helpman (1991, 1996) and Young (1991).

[11] Rebello (1991) and Aghion, Caroli and Garcia-Penalosa (1999).

[12] Pissarides (1990) and Aghion and Howiit (1994).

# C Technical Annex: EU structural indicators: an instrument for better structural policies

**C1** Structural reform – to raise productivity levels and attain high and sustainable rates of employment – is a priority for EU Member States. To guide economic reform policies, the Lisbon European Council in March 2000 asked for work to be done on developing EU structural indicators and requested a report by the end of 2000. Once completed, the indicators will provide a consistent basis of comparison between Member States, and between the EU and other countries, for economic reform.

**C2** The UK Government has actively endorsed the Lisbon economic reform agenda, and recognises the key role that the structural indicators have to play in driving forward reform. Structural indicators focus attention on economic outcomes as well as the necessary processes of reform. They also allow governments to look critically at policy and to learn from other member states. The Government believes that measuring and monitoring performance against the best encourages improvement and demonstrates where progress has been made.

**C3** The set of indicators now being developed will cover the four priority areas developed in Lisbon: employment, innovation, economic reform and social cohesion. In addition, some background indicators will be included to present the overall macroeconomic context in which structural reforms are taking place.

**C4** The objectives of the work on structural indicators are:

- to gain broad agreement on a set of indicators that can be used in monitoring progress on achieving the key Lisbon objectives;
- to provide an accurate picture of progress on structural reform, including strengths and weaknesses; and
- to sustain the pressure to reform through improved monitoring using the indicators, better quality policy discussion and more intensive peer pressure, including making recommendations in the annual EU Broad Economic Policy Guidelines more concrete.

**C5** The indicators include a high-level set of mainly performance indicators, which it is proposed should be the focus of the Commission's report to the Stockholm European Council next year. There is also a second, more detailed set of indicators including policy indicators, which are proposed for next year's assessment of the implementation of the Broad Economic Policy Guidelines[1]. The indicators being used or developed in a range of other EU processes and action plans fit into this overall structure as a third layer.

**C6** A set of desirable characteristics for the indicators has been agreed. They should be: policy relevant; limited in number; easy to understand; timely; reliable; mutually consistent; and comparable across countries inside and outside the EU. Importantly, data collection should not impose an additional burden on enterprises and Member States.

**C7** The indicators will provide a useful starting point for debate on economic reform in Europe – but they should not be read mechanistically. The relation between the numeric values of an indicator and the achievement of policy goals is not always clear-cut. It may be necessary to take account of the institutional context, the general level of development, the size of the economy or the cyclical position of the economy. In these cases, it can be misleading and counter productive to take individual figures and interpret them literally as

[1] The Broad Economic Policy Guidelines for the EU and its Member States are prepared annually. These non-binding recommendations provide the reference text for the European Commission and Council to monitor economic developments within the EU and member states.

policy benchmarks. It will sometimes be important to look at groups of indicators together, rather than picking out individual indicators, which can give an unrepresentative impression.

**C8** Given these caveats, the indicators can serve two functions:

- focusing on the evolution of an indicator within a country offers useful background when assessing performance in the specific area illustrated by that indicator; and
- cross-country comparisons of indicators enable Member States to take a critical look at policy and learn from each other.

**C9** This work is the first stage of an ongoing process, which aims to both increase the momentum on structural reform and demonstrate the progress that has been made. One aspect of future work will be to identify areas where indicators themselves need to be developed and improved.

# APPENDIX

## Letter sent by the Chancellor of the Exchequer to the Confederation of British Industry and the Trades Union Congress

19 October 2000

I am writing to the Presidents of the CBI and TUC, the Director General of the CBI and the General Secretary of the TUC, about the Government's productivity initiative and the role the Government believes workforces and management can play in meeting the challenges we face.

Over the last three years we have as a Government sought to build a platform of stability.

I believe that this new found stability gives us enormous scope for productivity improvements and offers us a moment of opportunity for our economy.

Britain's productivity gap with our main competitors remains as much as 35 per cent. There are substantial shortfalls – not just with the US, but with Germany and France as well.

The choice for Britain is whether to retreat back into the complacent short-termism and stop-go or quick fixes of the past, or whether to build from our new-found stability in a national productivity drive to bridge these gaps. The objective for our country should be to achieve over the next decade a faster rise in productivity than our competitors.

From a platform of stability, Government can do much to shape an environment in which productivity improvements can take place – one which supports investment, enterprise, innovation, competition and a high level of skills. These are amongst the Government's central priorities. However, within that environment Government can sometimes do best by getting out of the way.

For our part we will continue – in the Pre-Budget Report and beyond – to entrench a culture of stability by policies of monetary and fiscal discipline. And in addition to our policies for monetary and fiscal stability, we will continue to raise investment in science; in transport and infrastructure; in regional economic development; and in skills and education. We will continue to promote all employee share ownership, and continue our drive to make work pay.

These are challenges for Government. Stephen Byers is taking many of these issues forward. We cannot bridge the gaps, however, without a broader drive from managers and workforces across the country to address:

- **how together the UK's shortfalls in workplace skills and training can be remedied**. Germany has three times our proportion of 25-28 year-olds with level 3 vocational qualifications. Moreover these workplace training shortfalls are especially concentrated in SMEs – only 36 per cent of firms employing less than 25 people provide some off-the-job workplace training, against 90 per cent for larger firms. David Blunkett stands ready to help take this forward.

- **how-long term under-investment in the UK can best be overcome.** UScapital stock per worker is 30 per cent higher than in the UK; in Germany it is 70 per cent greater. Industrial R&D is a particular weakness, with the lowest proportion of GDP in the G5.

- **how we can speed up use and spread of technology.**

I believe we must also address the following critical issues:

- **can UK businesses be more effective in adopting best practice and innovative techniques from elsewhere, and from one another?**
- **how can – benchmarking the best – modern British industrial relations be more effective? How well-equipped are they for the information age?**
- **how often is the quality of British management, at every level, genuinely world-class?**

I am therefore writing to invite a positive response from unions and managements in regions and in sectors to address some of our old problems and together work through an agenda for economic reform. In short, whether we can remove all the old barriers to employment and prosperity for all.

I propose that, to tackle the productivity issue, the CBI should work with the TUC, educationalists, and other organisations to confirm that the six challenges I have set out above are indeed the top priorities to be addressed. Thereafter I suggest that for each of the agreed challenges you identify case studies of strong and poor performance and seek proposals from individual employers and unions for concrete improvements as well as to highlight issues for Government to address.

For this to be fully effective there will need to be strong regional engagement, and I urge you to develop this work as widely as possible in the regions, including with the new Regional Development Agencies and the Small Business Service.

I would suggest that you should assess progress in each of the agreed working groups and publish reports by next autumn, at which time you and we can consider the fruits of this work and determine a future agenda. It would be helpful to receive interim reports in advance of the Budget where appropriate.

This is a moment of opportunity. The challenge for our country – to seize it – is now under way.

**GORDON BROWN**

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