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The Director of ONS is also the National Statistician and the Registrar General for England and Wales.

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You can also find National Statistics on the Internet at: www.statistics.gov.uk

A fuller list of contact points can be found on page 67.

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In brief

Consultation on redeveloping Workforce Jobs

On 13 June 2007, the Office for National Statistics (ONS) published its response to recommendations made in the Review of Workforce Jobs (WFJ) Benchmarking. The first recommendation was that 'the estimation methodology for the Short Term Employment Surveys (STES) is changed to a ratio estimator in line with best practice and that the computer system is rewritten to accommodate the change'. This is a substantial development and ONS is proposing to make other modifications to the range and frequency of WFJ outputs and consequently estimates of productivity and unit wage costs..

ONS ran a public consultation from 19 June to 11 September 2007, to seek users' views on the proposals. ONS gratefully received a number of responses, mainly from central and regional government users and university researchers. A report summarising the responses was published on 1 October 2007.

In general, respondents accepted many of the proposals, including:

- changing the estimator
- producing all estimates on a quarterly cycle (thus removing monthly employee jobs in the production sector)
- producing all regional estimates by Government Office Regions (rather than the old Standard Statistical Regions).

However, users objected to the proposals to drop the gender and full/part-time breakdown, and reduce the industry detail in certain areas. In response, ONS will conduct further analysis and consultation to review the industry breakdown, balancing user needs, employment trends and quality issues, in the context of new classification (SIC 2007). ONS will also look at potential methods for deriving the gender and full/part-time breakdown from other sources as an alternative to collecting the information, which is costly and burdensome for businesses

More information

www.statistics.gov.uk/statbase/product.asp?vlnk=9765

www.statistics.gov.uk/about/consultations/redeveloping-workforce-jobs.asp

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Labour Force Survey, interim reweighting 2007

On 14 November 2007, the Office for National Statistics published revised Labour Force Survey (LFS) aggregate results to take account of the new mid-year population estimates (MYEs) for 2006, revised MYEs for 2002 to 2005 and revised population projections for 2007.

Methodological improvements to the estimation of the MYEs, which include an improved method for estimating international migration, contributed to the higher population growth seen in the latest estimates.

The Labour Market Statistics (LMS) First Release contains the latest data for employment, economic activity, economic inactivity and unemployment obtained from the LFS. The LFS is a continuous household sample survey, which collects information from approximately 52,000 households each quarter. Since those responses reflect only a sample of the total population, they are weighted on the basis of subnational population totals by age and sex to give estimates for the entire household population. The population estimates used to produce the LFS population totals are based on the MYEs, and latest population projections.

The annual rescaling of the LFS aggregate results ensures that the data in the monthly LMS First Release are in line with the latest population totals by region, age group and gender. This established methodology is known as 'interim reweighting'. The LFS data sets used for detailed analysis, known as the LFS microdata, are not affected. They continue to be weighted to the population estimates published in February 2003.

The revisions to the LFS aggregates were small and caused no real change to the recent labour market picture. The main outcomes were as follows:

- there were upward revisions to the LFS household population for people aged 16+ and for people of working age (men aged 16 to 64 and women aged 16 to 59) from mid-2000 onwards
- the largest revisions were for the three-month period June to August 2007. For this period, the population aged 16+ was revised up by 79,000 or +0.2 per cent. The working age population was revised up by 115,000, or +0.3 per cent
- for the same period, there was an upward revision to the economically active population aged 16+ of 91,000, or +0.3 per cent, and a downward revision to the economically inactive population of 12,000, or –0.1 per cent. This downward revision was mainly due to lower estimates of the number of people above working age
- the revisions to the rates, for example, employment rate, were very small – no more than 0.1 of a percentage point and, in many cases, zero. This is because the population revisions are included in both the numerator and denominator for the rate calculations
- the largest revisions by Government Office Region were also for the period June to August 2007. For this period, the population aged 16+ for Yorkshire and the Humber was revised up by 65,000 or +1.6 per cent, and the population aged 16+ for London was revised down by 106,000 or –1.7 per cent

The full article on 2007 interim reweighting can be downloaded from the National Statistics website at the address given below.

More information

www.statistics.gov.uk/cci/article.asp?id=1884

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Local area labour markets

The latest local area labour market data show that the area with the highest employment rate was the City of London with 100.0 per cent (note that this estimate is based on a very small sample). Excluding the City of London, the

highest employment rate was Bromsgrove, Worcestershire (89.9 per cent) while the lowest rate was in Tower Hamlets (54.6 per cent). There is a considerable variation within each region. For example, in the region with the highest average rate, the South East (78.3 per cent), employment varies between 88.8 per cent in West Oxfordshire and 66.5 per cent in Oxford.

The area with the highest unemployment rate in the 12 months ending March 2007 was Tower Hamlets (13.2 per cent), while the lowest rate was in Eden, Cumbria (2.2 per cent). Again, there were considerable variations within regions. In the region with the lowest average rate, the South West (3.9 per cent), unemployment varied between Plymouth (6.4 per cent) and Purbeck (2.6 per cent). London had the highest average rate (7.4 per cent), but individual boroughs varied between Tower Hamlets (13.2 per cent) and Richmond upon Thames (3.8 per cent).

The latest estimates of jobs density (2005) show there were 0.84 jobs per working-age resident in the UK. London had the highest jobs density at 0.94 compared with 0.75 in the lowest region, the North East. The local area with the highest jobs density was the City of London, with almost 60 jobs per working-age resident, while the lowest was in Carrickfergus, Northern Ireland, with 0.39 jobs per resident.

People who work in the City of London had the highest earnings, with median full-time gross pay of £834 a week as at April 2007. The lowest pay was for people who work in Torridge, South West, at £313 a week.

The report, 'Local area labour markets: Statistical indicators October 2007', was published on the National Statistics website on 31 October 2007. It also contains sections looking at economic inactivity, ethnicity and the labour market, claimants of Jobseeker's Allowance (the claimant count), and earnings by place of residence. It brings together data from a number of different sources – the Annual Population Survey, Annual Business Inquiry, Annual Survey of Hours and Earnings, and administrative data on benefits from the Department for Work and Pensions – to give an overall picture of the labour market looking at both labour supply and demand in each area.

Also available are spreadsheets giving data for key indicators such as employment, unemployment, economic inactivity, claimant count and jobs for both local authorities and parliamentary constituencies.

More information

www.statistics.gov.uk/statbase/product.asp?vlnk=14160

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GSS Leaders in Statistics Conference 2007

The Government Statistical Service (GSS) held its annual Leaders in Statistics Conference in London Docklands at the end of November and attracted 250 delegates from 34 government departments and agencies. The conference marked the formal start of learning and engagement on Independence and also covered the impact of analysis and use of evidence in government. The Conference is an important part of the 'glue' that helps to bind the decentralised GSS together and offers an excellent opportunity for statisticians across government to own and influence important new GSS strategies and to network.

During the action-packed 24 hours, key notes were delivered by Karen Dunnell, National Statistician and Head of the GSS; Ian Watmore, Permanent Secretary, Department for Innovation, Universities and Skills; and Sir Michael Scholar, Chair-designate, Statistics Board.

Parallel sessions covered:

- the impact of Independence on policy departments
- shaping the Statutory Code
- creating a new GSS Code of Conduct
- statistician makeover?
- increasing the demand for our skills and services
- working effectively as analysts across government, and
- developing a forward-thinking strategy to support policy needs

The evening of the first day also saw many of the delegates dancing the night away at the Ceilidh – which everybody agreed was great fun and an excellent team-building activity!

Conference materials (including a report of the proceedings) will be placed on StatNet, the GSS intranet, by the end of December.

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UPDATES

Updates to statistics on www.statistics.gov.uk

5 November

Index of production

Manufacturing: unchanged in Q3 2007

www.statistics.gov.uk/cci/nugget.asp?id=198

7 November

Gender pay gap

Narrowest since records began

www.statistics.gov.uk/cci/nugget.asp?id=167

9 November

UK trade

Deficit widened to £5.1 billion in September 2007

www.statistics.gov.uk/cci/nugget.asp?id=199

12 November

Producer prices

Factory gate inflation rises to 3.8% in October

www.statistics.gov.uk/cci/nugget.asp?id=248

13 November

Inflation

October: CPI up to 2.1%; RPI up to 4.2%

www.statistics.gov.uk/cci/nugget.asp?id=19

14 November

Average earnings

Pay growth steady in year to September 2007

www.statistics.gov.uk/cci/nugget.asp?id=10

Employment

Unchanged at 74.4% in three months to September

www.statistics.gov.uk/cci/nugget.asp?id=12

15 November

Retail sales

Positive underlying growth continues

www.statistics.gov.uk/cci/nugget.asp?id=256

20 November

Public sector

October: £3.6 billion current budget surplus

www.statistics.gov.uk/cci/nugget.asp?id=206

22 November

Business investment

Little changed in Q3 2007

www.statistics.gov.uk/cci/nugget.asp?id=258

23 November

Index of services

0.9% three-monthly rise into September

www.statistics.gov.uk/cci/nugget.asp?id=558

GDP growth

Economy rose by 0.7% in Q3 2007

www.statistics.gov.uk/cci/nugget.asp?id=192

28 November

Service prices

SPPI inflation at 2.6% in Q3 2007

www.statistics.gov.uk/cci/nugget.asp?id=253

FORTHCOMING RELEASES

Future statistical releases on www.statistics.gov.uk

3 December

Environmental accounts – autumn 2007

4 December

Mergers and acquisitions involving UK companies – Q3 2007

6 December

Index of production – October 2007

7 December

International service transactions of the film and television industries – 2006

10 December

Producer prices – November 2007

11 December

Foreign direct investment – 2006

UK trade – October 2007

12 December

Labour market statistics – December 2007

MM19: Aerospace and electronic cost indices – September 2007

Public sector employment – Q3 2007

13 December

Public and private sector breakdown of labour disputes

14 December

Digest of engineering turnover and orders – October 2007

MM24: Monthly review of external trade statistics – October 2007

MQ10: UK trade in goods analysed in terms of industries – Q3 2007

Regional gross value added – income measure (NUTS 1, 2 AND 3)

18 December

Consumer price indices – November 2007

MM22: Producer prices – November 2007

19 December

Business investment revised results – Q3 2007

Investment by insurance companies, pension funds and trusts – Q3 2007

20 December

Balance of payments – Q3 2007

Consumer trends – Q3 2007

Experimental market sector gross value added (GVA) – Q3 2007 update

Public sector finances – November 2007

Quarterly national accounts – Q3 2007

UK economic accounts (UKEA) – Q3 2007

21 December

Distributive and service trades – October 2007

Index of services – October 2007

Monthly digest of statistics – December 2007

Productivity – Q3 2007

Public sector finances: supplementary (quarterly) data

Retail sales – November 2007

SDM28: Retail sales – November 2007

Economic review

December 2007

Catherine Marks
Office for National Statistics

SUMMARY

GDP growth continued to grow robustly in 2007 quarter three, although at a slightly slower pace than in quarter two. Growth continued to be driven by the service sector offset by lower manufacturing growth. On the expenditure side, household spending strengthened, whilst business investment was unchanged in comparison with quarter two. The current account deficit narrowed but the trade deficit widened. The labour market continued to be buoyant but average earnings remain relatively subdued. The public sector finance position improved in October 2007. Consumer price inflation increased above the government's target. Producer output price inflation increased slightly in October exhibiting signs of upward pressure.

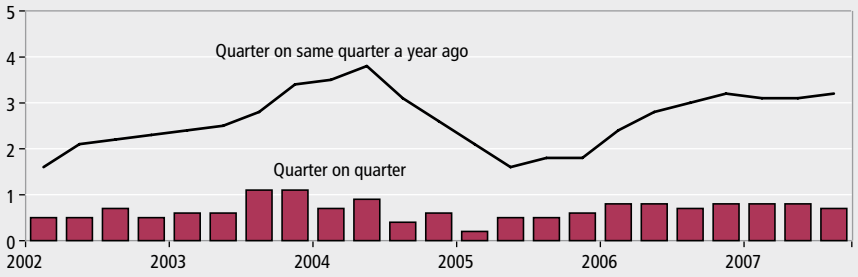
GROSS DOMESTIC PRODUCT

Third quarter growth of 0.7 per cent

GDP growth for the third quarter of 2007 is estimated to have continued to be strong despite a slight slowing since the second quarter. The latest estimate of GDP growth is 0.7 per cent, revised down by 0.1 per cent since the preliminary estimate. This compares with growth of 0.8 per cent in the second quarter. The annual rate of growth has now reached 3.2 per cent up from 3.1 per cent in quarter two. The latest GDP release for 2007 quarter three contains more information than the preliminary estimate. It provides the first estimates for expenditure and more complete data on the output side. It is still, however based on incomplete information (**Figure 1**).

The growth rate in the UK economy in quarter three continued to be driven by strong service sector output. This was offset by a weakening in industrial output growth in the production sector of the economy, in particular there was a slowing in manufacturing and mining and quarrying. The construction sector continued to grow strongly.

Figure 1
Gross Domestic Product
Growth



OTHER MAJOR ECONOMIES

Global growth rebounds

Preliminary data for 2007 quarter three are now available for the other major OECD countries. Data for 2007 quarter three reported an upturn in growth for the major OECD countries.

US GDP data for the third quarter of 2007 showed a continued upturn following stronger growth in quarter two. Growth was 1.0 per cent in quarter three compared with 0.9 per cent in quarter two, this relatively strong growth followed subdued growth of 0.1 per cent in quarter one. Growth in the third quarter reflected an improvement in consumer spending with growth of 0.7 per cent compared to 0.3 per cent in quarter two. Export growth strengthened further compared to quarter two but part of the growth was offset by an increase in import growth. There was a declaration in the rate of non-residential investment growth from 2.6 per cent in quarter two to 1.9 per cent in quarter three. Residential investment growth decreased further in quarter three to –5.4 per cent. Negative growth has now been recorded in this category of investment through the last six consecutive quarters.

Japan's GDP growth also showed an upturn in the third quarter. Growth increased by 0.6 per cent compared to a fall of –0.4 per cent in quarter two. The improvement was primarily driven by exports (up 2.9 per cent on the previous quarter), combined with a fall in the rate of import growth (to 0.5 per cent) this led to net trade adding 0.4 per cent to GDP. Positive growth was also recorded in private non-residential investment (1.7 per cent), private consumption and government consumption (both recorded growth of 0.3 per cent). Residential investment continued to record negative growth for the third consecutive quarter; it was down 7.8 per cent compared to a fall of 4.1 per cent in quarter two.

Growth in the three biggest mainland EU economies – Germany, France and Italy – recorded rebounds in GDP growth after a disappointing quarter two. According to

Eurostat's estimate, euro area GDP grew by 0.7 per cent in 2007 quarter three. This is an acceleration compared to growth of 0.3 per cent in the previous quarter.

German GDP growth, according to the preliminary release, recorded an increase in growth in quarter three. Growth was 0.7 per cent compared to modest growth of 0.3 per cent in the second quarter. Growth was driven by domestic factors: capital formation in machinery and equipment and construction increased compared to quarter two. Growth was also supported by increases in final consumption expenditure of households and Non-Profit Institutions Serving Households (NPISH). In contrast to the second quarter, the balance of trade did not contribute to growth in quarter three, mainly due to an increase in imports.

French GDP growth increased in 2007 quarter three, growth was 0.7 per cent compared to growth of 0.3 per cent in quarter two. Exports increased sharply, with growth of 1.7 per cent in quarter three compared to 0.7 per cent in quarter two. The net trade contribution increased further due to a decline in the rate of import growth. Imports grew by 1.4 per cent in quarter three down from growth of 1.8 per cent in quarter two. Household consumption expenditure and Gross Fixed Capital Formation recorded growth of 0.8 per cent and 0.6 per cent respectively, compared to growth of 0.6 per cent and 0.4 per cent in quarter two.

Italian GDP growth rebounded in quarter three after a poor second quarter. Growth in quarter three was 0.4 per cent compared to 0.1 per cent in quarter two. The increase was mainly due to industrial production and the service sectors.

FINANCIAL MARKETS

Share prices weaken and pound stabilises

Equity performance recorded a weakening in 2007 quarter three after showing evidence of fairly buoyant growth in 2007 quarter two. The FTSE All-Share index fell by around 3 per cent in quarter three following growth of around 4 per cent in quarter two. The decrease in equity growth can mainly be attributed to concerns regarding a slow-down in the world economy following fears over the US economy particularly in the financial sector, in part connected to the markets risk aversion towards assets associated with the US sub-prime market.

In the currency markets, 2007 quarter three saw sterling's average value broadly flat compared to the previous quarter. The pound appreciated against the dollar by 1.7 per cent in 2007 quarter three, similar to the rate in the previous quarter. Against the euro, sterling's value depreciated by 0.2 per cent after depreciating by 1.2 per cent in the previous quarter. Overall, the quarterly effective exchange rate was flat after depreciating by 0.5 per cent in 2007 quarter two (**Figure 2**). In October, the pound appreciated by 1.3 per cent against the dollar. Against the euro, the pound depreciated by 1.0 per cent, the effective exchange rate also depreciated by 0.5 per cent.

The recent movements in the exchange rate might be linked to a number of factors. First, exchange rate movements can be related to the perceptions of the relative strengths of the US, the Euro and UK economy. The appreciation of the pound against the dollar in 2007 quarter three may be partly linked to perceptions of stronger UK economic growth, leading to greater inflationary pressures and therefore the prospects of higher interest rates. In the UK interest rates were increased by the Bank of England in May 2007 by 0.25 per cent, rates were increased by a further 0.25 per cent in June 2007 to 5.75 per cent. The trend may begin to decline as the November Inflation Report signalled that the markets had priced in interest rate cuts in 2008.

In contrast, there have been particular concerns in recent months regarding the relative weakness of US GDP growth. Furthermore, inflationary pressures have been relatively subdued in the US. Interest rates were lowered by 0.50 percentage points in September 2007 to 4.75 per cent, in response to fears about a US economic slowdown, partly caused by the housing market weakness. These interest rate decreases will have made the dollar less appealing to investors compared to other currencies.

In the euro-area, the depreciation may be partly due to the perception that interest rates in the UK have peaked. The depreciation of the pound against the euro in the second quarter of 2007 may have come in response to prospects of monetary tightening in the euro-zone. The European Central Bank increased interest rates by 0.25 per cent in June to 4.0 per cent. However, compared to US and UK rates, euro-zone interest rates still remain fairly moderate and accommodative.

The second factor causing the depreciation of the US dollar relative to the pound could be that the US currently has a current account deficit which is generally considered a sign of weakness for the economy. The dollar may have fallen in response to a readjustment process, with the intended consequence of making exports cheaper and imports dearer – thus, in theory, leading to switch in expenditure to home produced goods and ultimately leading to a narrowing in the deficit.

A third factor could be the lack of international appetite for US dollar denominated assets, particularly from central banks, whom are choosing to spread their currency assets on their balance sheets (for portfolio and risk management purposes) thereby further undermining the value of the dollar.

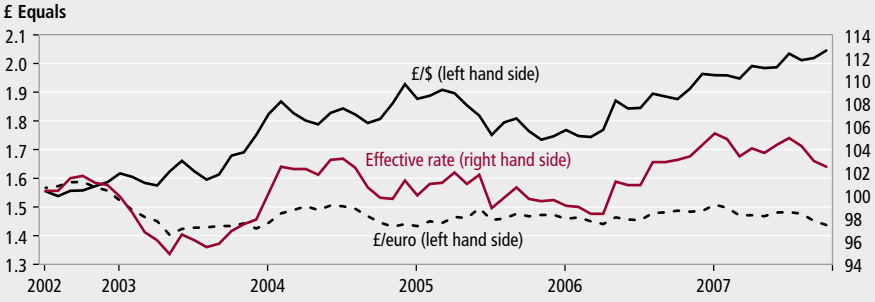
OUTPUT

Services sector drives economic growth

GDP growth in 2007 quarter three was estimated at 0.7 per cent, down from 0.8 per cent in the previous quarter. On an annual basis it was 3.2 per cent, up from 3.1 per cent in the previous quarter.

Construction activity continued to

Figure 2
Exchange rates



grow strongly in the third quarter of 2007. Construction output is estimated to have grown by 0.8 per cent, compared to growth of 0.7 per cent in the previous quarter. Comparing the quarter on the same quarter a year ago, construction output rose by 3.4 per cent following growth of 3.5 per cent in the previous quarter (**Figure 3**).

In terms of external surveys of the construction sector, the CIPS survey signalled strengthening activity in 2007 quarter three with the average headline index at 62.3, up from 59.3 in the previous quarter. Stronger activity was driven by a rise in commercial activity. In October, the headline index fell slightly to 57.4, indicating continued strong growth despite the survey recording its lowest reading for eight months. The RICS construction survey for 2007 quarter three reported a stabilisation in construction growth at a high level with the balance at plus 16, unchanged from the previous quarter.

Total output from the production industries recorded unchanged growth in 2007 quarter three after an increase of 0.7 per cent in the previous quarter. On an annual basis it rose by 0.4 per cent, down from 0.7 per cent in the previous quarter. The main driver for the slowdown in production was manufacturing output. Manufacturing output was unchanged in quarter three, after fairly strong growth of 0.8 per cent in the previous quarter. On an annual basis, manufacturing output growth decelerated to 0.4 per cent from 1.1 per cent in the previous quarter (**Figure 4**). Lower production was also partly driven by a large contraction in the output of the mining and quarrying industries (including oil & gas). Output fell by 1.3 per cent following growth of 1.3 per cent in the previous quarter. This was offset by a strengthening in the output of electricity, gas and water supply which increased by 0.8 per cent compared to a contraction of 0.4 per cent in the previous quarter. On an annual basis utilities output was down 0.2 per cent after falling 1.1 per cent in the previous quarter.

Production growth has generally been slow since the second quarter of 2006 due to weakness in mining and quarrying and utilities output, offset through most of this period by relatively strong manufacturing output. There was a pick up in production in 2007 quarter two, but this appears not to have been sustained in quarter three due to a decline in the rate of manufacturing output growth. However, manufacturing output has been volatile in recent quarters.

The output of the agriculture, forestry and fishing industries weakened slightly in the latest quarter with output falling by 0.3 per cent after an increase of 0.2 per cent in the previous quarter.

External surveys of manufacturing for 2007 quarter three showed a mixed picture (**Figure 5**). In the past, it has not been unusual for the path of business indicators and official data to diverge over the short term. These differences happen partly because the series are not measuring exactly the same thing. External surveys measure the direction rather than the magnitude of a change in output and often inquire into expectations rather than actual activity.

The CIPS average headline index for manufacturing indicated a stable but robust picture in the latest quarter. The headline index was 55.6, up from 54.5 in the previous quarter. In October the headline index fell to 52.9, the lowest reading in 2007 so far. The CBI in its 2007 quarter three Industrial Trends survey reported a weak picture with the total orders balance at minus 6. According to the latest survey in October order books continued to be weak with a balance of –6. The BCC in its 2007 quarter three survey reported a mixed but overall a fairly buoyant picture of manufacturing activity. The home sales balance was plus 36 and the home orders balance was plus 26.

Overall the service sector, the largest part of the UK economy, continues to be the main driver of UK economic growth.

Figure 3
Construction output

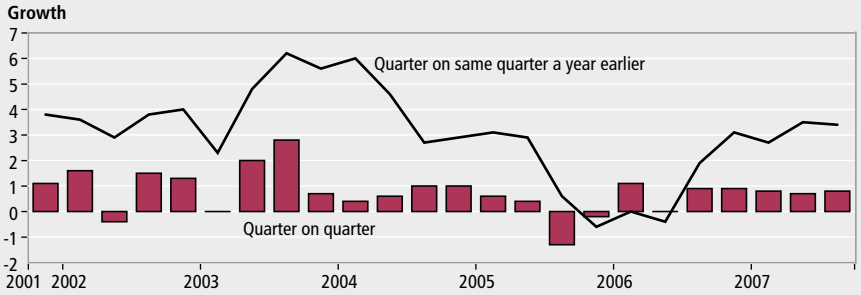


Figure 4
Manufacturing output

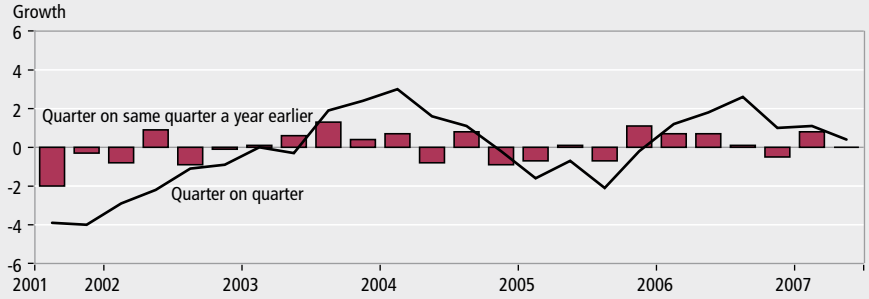
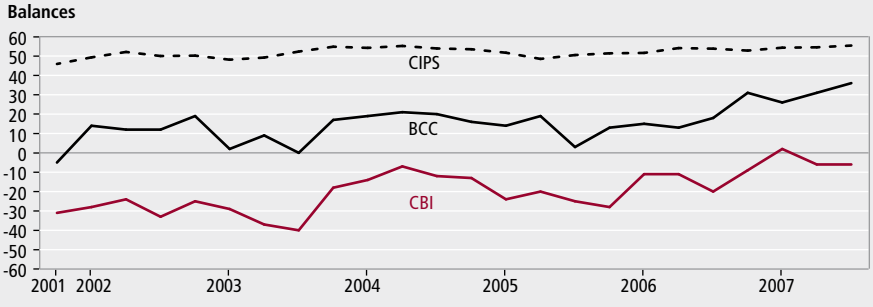


Figure 5
External manufacturing indicators



Growth was 0.9 per cent in 2007 quarter three, unchanged from the previous quarter (**Figure 6**). Growth on an annual basis was 3.9 per cent, up from 3.7 per cent in the previous quarter. Growth was recorded across all four broad sectors. The main contributor to the growth continued to be the business services and finance sector which grew by 1.5 per cent in the latest quarter, down slightly compared to the 1.7 per cent growth in the previous quarter. There was also strong growth in the distribution, hotels and catering sector of 0.9 per cent, up compared to 0.6 per cent in the previous quarter. The transport, storage and communication sector recorded growth of 0.7 per cent, down from 0.8 per cent in the second quarter. There was a slight increase in the growth of the government and other services sector compared with the previous quarter, growth was 0.2 per cent in quarter three compared to 0.1 per cent in quarter two. The external surveys on services continued to show a fairly robust picture in line with the official picture. The CIPS average headline index in 2007 quarter three was 57.1, down slightly from 57.4 in the previous quarter but above the long-run average. Growth continued to be led by new orders. In October the headline index was 53.1, indicating the weakest rate of growth since May 2003. It should be noted that the CIPS survey has a narrow coverage of the distribution and government sectors.

The CBI and BCC also reported a fairly healthy picture of service sector activity (**Figure 7**). The CBI service sector survey for August reported differing fortunes for the business and professional services sector and the consumer service sector. Business and professional services sector recorded above normal sales growth whilst in the consumer services sector sales growth decelerated. The consumer services volume balance was at plus 15 from plus 44 in the previous quarter. For business & professional services, the balance was at plus 31 from plus 27 in the previous quarter. The BCC survey for 2007 quarter three survey reported a weakening picture of service sector activity, but overall balances for home orders and sales remained positive at plus 23 and plus 29 respectively.

Figure 6
Services output

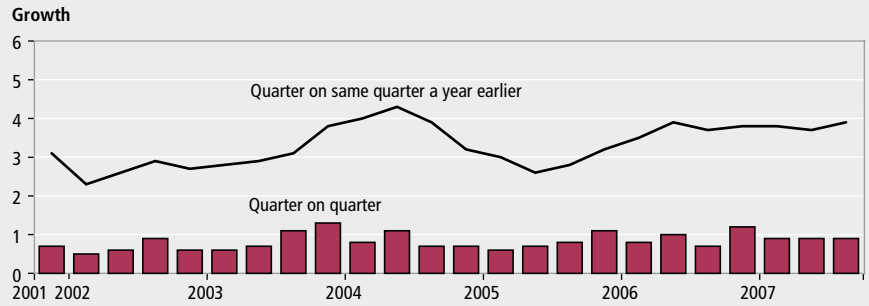
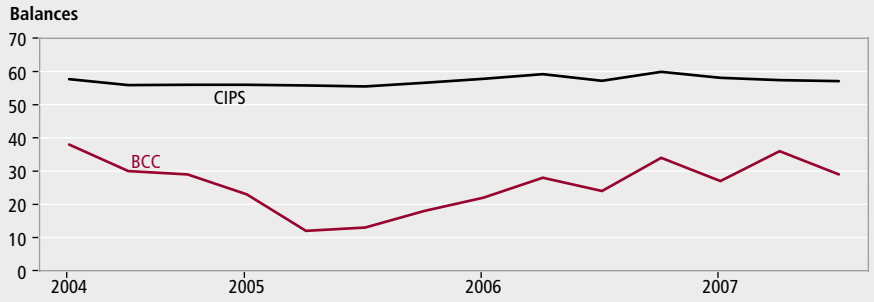


Figure 7
External services



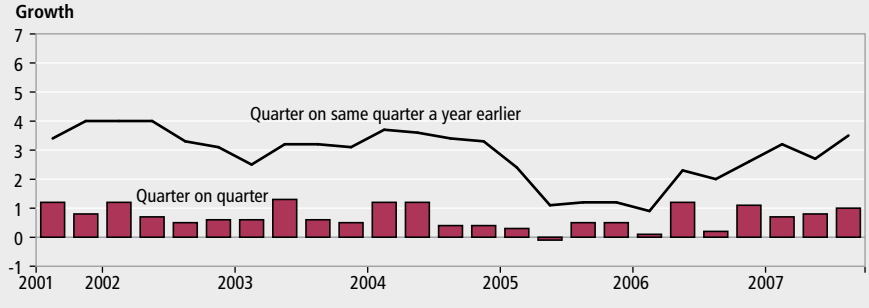
EXPENDITURE

Consumers' spending buoyant

Household consumption expenditure growth accelerated in 2007 quarter three at a strong rate of 1.0 per cent. This follows growth of 0.8 per cent in the previous quarter. Growth compared with the same quarter a year ago was 3.5 per cent, up from 2.7 in quarter two

The impact on the UK economy from the US sub-prime housing crisis and the subsequent credit crunch is still uncertain. Early indications suggest that the impact in the UK, in terms of consumer expenditure has not had much effect. However, in the future there may be some impact on mortgage borrowing, possibly as a result of tighter lending criteria adopted by some banks and building societies, particularly towards first time buyers and those considered higher risk. There may also be an impact in the form of higher interest rates charged by banks for customers who have borrowed on variable interest rate mortgages in the short term and in the longer term there may be an impact on those who take out fixed rate mortgages. The first sign of this happening came from Standard Life, the first of the large mortgage lenders to increase their mortgage rates despite the fact that interest rates were left on hold by the Bank of England in November. There are fears that other lenders could follow

Figure 8
Household demand



suit impacting on consumers and in turn consumer expenditure as the amount of disposable income declines.

One key indicator of household expenditure is retail sales. Retail sales growth strengthened in 2007 quarter three from quarter two. Retail sales grew by 1.6 per cent in quarter three, an acceleration from growth of 1.4 per cent in the previous quarter. However, the underlying picture suggests that the increase in retail sales has been generated in many cases by heavy discounting in shops and early sales which are reflected in the price deflator (that is, shop prices) which fell on average by around 1.2 per cent in the latest quarter compared to relatively modest growth of 0.5 per cent on average in the previous quarter.

Retail sales figures are published on a monthly basis and the latest available figures for October signalled a slight slowing compared to September but still suggested relatively strong growth (**Figure 9**). In the three months to October the volume of retail sales increased by 1.4 per cent compared to a 1.6 per cent increase in the three months to September. On an annual basis in October, the latest three months growth compared to the same three months a year ago recorded growth of 5.1 per cent, the same rate of growth as recorded in September. This underlying positive growth may suggest that in the third quarter past interest rate rises have not yet had an impact on consumers and their spending, however as mentioned earlier, discounting is continuing to support retail sales growth – the implied price deflator continued to record negative growth.

Retail sales can be disaggregated into 'predominantly food' and 'predominantly non-food' sectors. In three months to October the 'predominantly non-food' sector recorded growth of 1.4 per cent, whilst this is still showing growth it is at a lower rate than in recent months – in the three months to September this sector grew by 2.1 per cent. The 'predominantly food sector' recorded growth of 1.2 per cent which represents an increase in the rate of growth compared to 0.6 per cent recorded in the three months to September. A further sector is non-store retailing and repair which grew by 2.8 per cent in the three months to October, down from 3.4 per cent in September. The 'predominantly non-food' sector can be split down further to give more detail. In the three months to October the textile, clothing and footwear stores recorded the strongest growth of 2.3 per cent. Non-specialised stores and household goods stores also recorded strong growth of 1.2 per cent and 1.1 per cent respectively. Other stores also recorded growth of 0.9 per cent.

External surveys for retail sales presented a picture of slower growth. The CBI monthly Distributive Trades survey for October reported a continued slowing in growth, with a balance of plus 10 in October down from plus 12 in September and down further from plus 15 in August. The BRC reported an increase of 1.0 per cent in retail sales on a like-for-like basis in October, down from 3.0 per cent in the previous month (**Figure 10**).

Another indicator of household consumption expenditure is borrowing. Household consumption has risen faster than disposable income in recent years as the household sector has become a considerable net borrower and therefore accumulated high debt levels. Bank of England data on stocks of household debt outstanding to banks and building societies shows household debt at unprecedented levels relative to disposable income.

There are two channels of borrowing available to households; i) secured lending, usually on homes; and ii) unsecured lending, for example, on credit cards. On a general level, an increase in the interest rates increases debt servicing costs, may discourage borrowing and in the process displace consumer expenditure on certain goods.

The Bank of England have published data on bank deposits from and lending to UK residents. The credit crunch does not seem to have had a great impact on the quarter three data; however the impact may become apparent in future quarters. In quarter three deposits from other financial corporations increased whilst deposits from non-financial corporations decreased. There was an increase in lending to both non-financial and other financial corporations.

According to the latest Bank of England figures, total net lending to individuals was £11.2 billion in September, higher than the £9.6 billion recorded in August. The increase in total net lending was driven by an increase of £9.8 billion in lending secured on dwellings compared to £8.5 billion in August. Net consumer credit also increased by a greater amount in September than August, increases of £1.4 billion and £1.1 billion respectively. Net lending secured on dwellings and net consumer credit both recorded higher than the six month average increases in September.

Household expenditure can be linked to

Figure 9
Retail sales

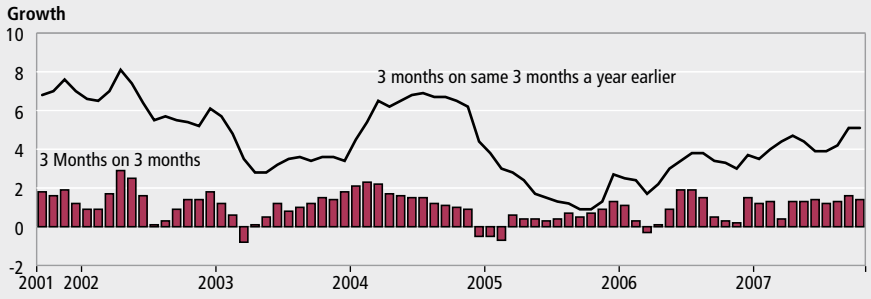
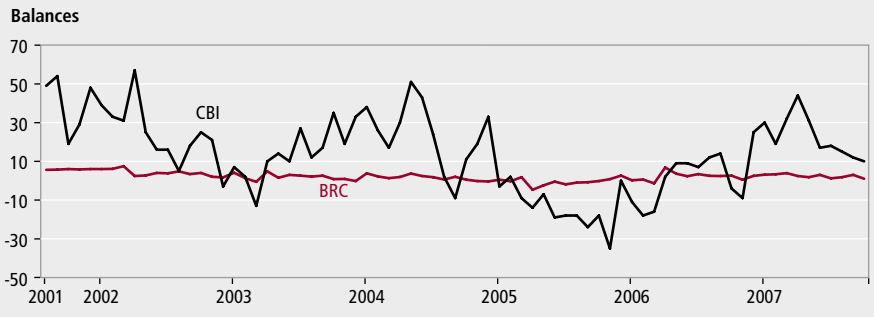


Figure 10
External retailing indicators



house equity withdrawal (HEW). Halifax reported a fall in house price growth in October of 0.5 per cent; annual growth is now 8.9 per cent. In contrast Nationwide recorded an increase in house prices of 1.1 per cent in October and annual growth of 9.7 per cent. Both surveys agreed that underlying activity in the housing market suggested a further slowing; possibly indicating interest rate rises are beginning to have some effect on the housing market. Bank of England figures for 2007 quarter two showed HEW falling by £3.0 billion to £10.0 billion from the previous quarter, and this could extend into a further downward trend in quarter three, thereby impacting somewhat on expenditure.

An alternative measure of expenditure showed an extremely weak picture for October. M4 (a broad money aggregate of UK money supply) rose by £2 billion in October compared to a rise of £15.2 billion in September. The rise in October is considerably below the average for the previous six months of £17.2 billion. The £2 billion change in M4 can be further split down; retail deposits and cash increased by £3.7 billion whilst wholesale deposits fell by £1 billion. In terms of month on month growth rates, M4 grew by 0.1 per cent in October compared to 0.9 per cent in September. This data appears to show a delayed impact of the credit crisis as banks stop holding wholesale deposits whilst the retail banking sector seems to be less affected.

BUSINESS DEMAND

Business investment unchanged

Total investment rose by 1.6 per cent in quarter three compared to a fall of 0.9 per cent in the previous quarter. On an annual basis, total investment grew by 5.1 per cent, a slowdown from 6.2 per cent in the previous quarter. The strengthening in total investment was primarily driven by government investment and dwellings (**Figure 11**).

Business investment grew relatively strongly throughout 2006. In 2007 quarter one business investment weakened but then recovered into quarter two recording fairly modest growth. During quarter three growth remained unchanged, compared to an increase of 0.4 per cent in quarter two. On an annual basis, total investment grew by 4.6 per cent, a slowdown from 7.8 per cent growth recorded in the previous quarter. Within total investment, distribution services recorded a fall of 6.4 per cent compared to the previous quarter

Evidence on investment intentions from the latest BCC and CBI surveys showed a mixed picture. According to the latest quarterly BCC survey, the balance of manufacturing firms planning to increase investment in plant and machinery rose 5 points to plus 33 and in services firms fell 2 points to plus 17 in 2007 quarter three. The CBI Industrial Survey for October reported a subdued investment picture, with the investment balance of plant and machinery weakening to minus 14 from minus 6 in the previous quarter.

Figure 11
Total fixed investment

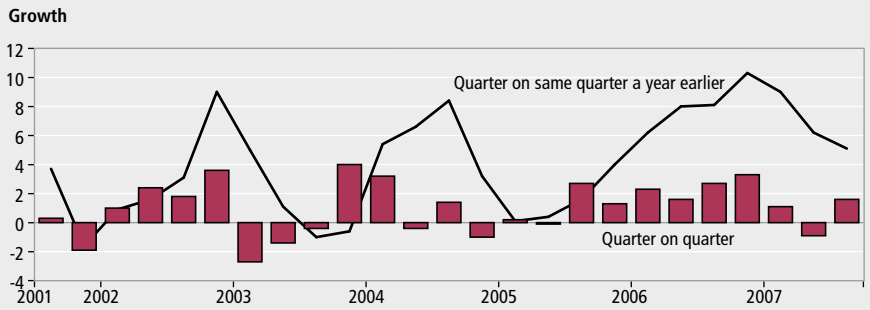
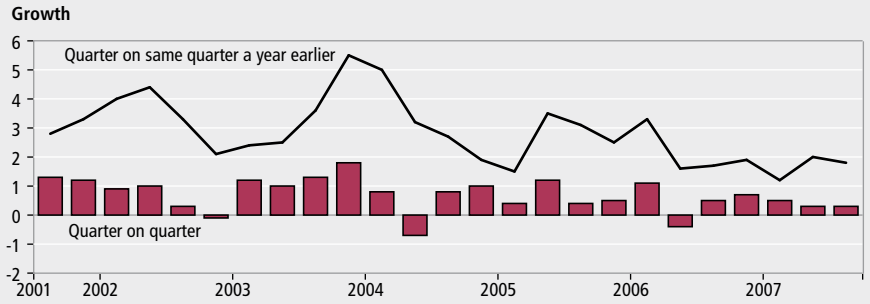


Figure 12
Government spending



GOVERNMENT DEMAND

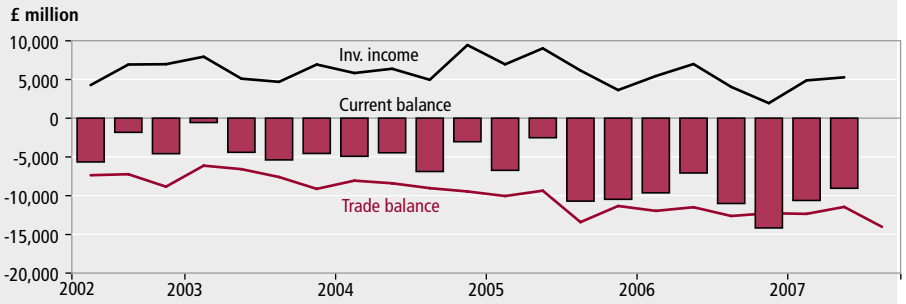
Government expenditure moderates

Government final consumption expenditure continued to grow at a fairly modest pace in quarter three. Growth in quarter three was 0.3 per cent; the same rate of growth was recorded in quarter two. Growth quarter on the same quarter a year earlier was 1.8 per cent, down slightly from the 2.0 per cent growth recorded for quarter two (**Figure 12**).

Public sector finances improve

The latest figures on the public sector finances reported a slight improvement in the current financial year to October 2007 compared with September. It showed a lower current budget deficit and a slightly lower level of net borrowing. Overall, the government continued to operate in a financial deficit, with government expenditure continuing to exceed revenues, partly to fund capital spending. In the financial year April to October 2007/08, the deficit was £11.5 billion; this compares with a deficit of £7.3 billion in the financial year to April to October 2006/07. In the financial year to April to October 2007/08 net borrowing was £24.2 billion; this compares with net borrowing of £17.5 billion in the financial year April to October 2006/07. The lower current budget deficit was mainly due to an increase in receipts for October, particularly as there was an increase in taxes on income and wealth. This sub-divides into income and capital gains tax and 'other'. It is the 'other' category that is driving the increase. The category includes corporation tax and petroleum revenue tax, the increase in this category appears to be due to the increase in fuel duty introduced at the beginning of

Figure 13
Balance of payments



October 2007.

Since net borrowing became positive in 2002, following the current budget moving from surplus into deficit, net debt as a proportion of annual GDP has risen steadily. Public sector net debt in October 2007 was 36.3 per cent of GDP, similar to October 2006. In the financial year 2006/07, net debt as a percentage of GDP was 36.8 per cent.

TRADE AND THE BALANCE OF PAYMENTS

Current account deficit narrows; goods deficit widens

The publication of the latest quarterly Balance of Payments shows that the current account deficit narrowed in 2007 quarter two to £9.1 billion, from a deficit of £10.6 billion in the previous quarter (**Figure 13**). As a proportion of GDP, the deficit fell to 2.6 per cent of GDP from 3.1 per cent in 2007 quarter one. The narrowing in the current account deficit in 2007 quarter two was due to a higher surplus on investment income and trade in services, and a lower deficit on trade in goods and current transfers. The surplus in income rose to £5.3 billion from £4.9 billion, while the surplus in the trade in services rose to £8.9 billion from £8.2 billion. The increase in income was driven by a rise in earnings on other investment abroad and on portfolio investment in debt securities, which outweighed a fall in earnings on direct investment abroad and on portfolio investment abroad in equity securities.

The run of current account deficits since 1998 reflects the sustained deterioration in the trade balance. The UK has traditionally run a surplus on the trade in services, complemented by a surplus in investment income, but this has been more than offset by the growing deficit in trade in goods partly due to the UK's appetite for cheaper imports.

Data for 2007 quarter three recorded a continuation of the large trade deficit in goods. Total exports of goods rose but imports of goods increased by a higher margin resulting in a widening of the deficit. The goods trade deficit was £22.3 billion in quarter three, up from £20.3 billion in quarter two. In terms of growth, exports of goods rose by 4.5 per cent whilst imports of goods rose by 6 per cent over the quarter. Services exports fell by 2.9 per cent whilst services imports fell by 1.3 per cent. Over the quarter, total exports increased by 1.6 per cent and total imports increased by 4.0 per cent.

However, these figures are distorted by volatility in VAT Missing Trader Intra –Community (MTIC) Fraud and therefore need to be treated with caution. According to the latest figures, the level of trade in goods excluding trade associated with MTIC fraud is estimated to be to £0.1 billion in September, unchanged from the previous month, and by £0.2 billion in the third quarter of 2007.

External surveys on exports reported a less positive picture for exports compared to earlier in the year. The BCC reported that the export sales net balance fell by 1 point to plus 29 and the export orders balance remained unchanged at plus 26 in 2007 quarter three. The latest CBI survey reported a balance of minus 9 in the October publication of the Quarterly Industrial Trends survey compared to minus 8 in July.

LABOUR MARKET

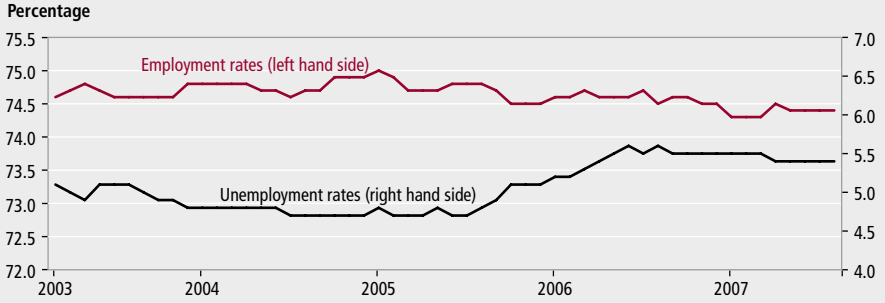
Labour market activity buoyant

The labour market in the latest reference period showed a mixed but overall, strong picture - continuing the trend of high levels of employment and low levels of unemployment seen throughout 2006 and in 2007. The robust labour market picture continues to be a reflection of fairly strong demand conditions in the UK economy.

The latest figure from the Labour Force Survey (LFS) pertains to the three-month period up to September 2007 and showed a mostly positive picture. The number of people in employment rose but the employment rate was unchanged. There was an increase in the number of vacancies. There was a fall in the claimant count but an increase in the number of inactive people of working age, the inactivity rate however remained unchanged. The number of people unemployed increased but the unemployment rate was unchanged. In terms of average earnings, including bonuses earnings growth increased, excluding bonuses earnings growth was unchanged. Overall average earnings remain subdued with weak real wage growth.

Looking at a detailed level, the increase in the employment level was mainly

Figure 14
Employment and unemployment



driven by women, in particular, women in full-time employment and part-time self employment. The current working age employment rate was 74.4 per cent in the three months to September, unchanged from the previous three months to June but down 0.1 percentage point from a year earlier. This appears to be a reflection of job growth not keeping pace with the growth in working age population. The number of people in employment rose by 69,000 in the three months to September compared to the three months to June, to an employment level of 29.22 million in the three months to September. The unemployment rate was 5.4 per cent in the three months to September, unchanged from the three months to June but down 0.2 percentage points from a year earlier. The number of unemployed people increased by 6,000 in the three months to September but was down 47,000 from a year earlier, the current level of unemployment is 1.67 million.

Employment and unemployment

According to the LFS, in the period July to September 2007, the number of people in employment rose by 69,000. The increase was led by a rise in employees of 67,000 and an 8,000 rise in self-employment. This was offset by a 3,000 fall in unpaid family workers. In terms of full and part-time workers, the number of people in full-time employment rose by 50,000 whilst the number of people in part-time employment increased by 18,000.

Workforce jobs increases

According to employer surveys, there was an increase of 87,000 jobs in the three months to June 2007. Most sectors showed increases in jobs over the quarter. The largest quarterly contribution to the increase came from finance and business services (up 40,000), followed by distribution, hotels and restaurants (up 33,000), agriculture, forestry and fishing (up 20,000) and construction (up 15,000). This was offset by a continuing decrease in the manufacturing sector (down 15,000). The other sectors to show decreases were; education, health and public administration (down 8,000) and other services (down 1,000). Over the year, total workforce jobs increased by 280,000. Of the total, the largest contribution to the increase over the year came from finance and business services (up 161,000) followed by construction (up 70,000) and distribution, hotels and restaurants (up 60,000). The manufacturing sector in contrast lost the largest number of jobs on the year (down 51,000), followed by transport and communication (down 19,000).

Claimant count level continues to fall

The claimant count measures the number of people claiming the Jobseekers Allowance. The latest figures for October showed the claimant count level at 824,800, down 9,900 on the previous month and down 130,300 on a year earlier. The claimant count rate in October 2007 was 2.6 per cent, unchanged from the previous month but down 0.4 percentage points from a year earlier.

Vacancies rise

The number of vacancies created in the UK continued to show a healthy demand position for the economy. There were 667,000 job vacancies in the three months to October 2007, up 10,800 from the previous three months and up 67,100 from the same period a year earlier.

Inactivity level rises

The working age inactivity rate was 21.2 per cent in the three months to September, unchanged on the three months to June 2007 and up 0.2 percentage points from a year earlier. In level terms, the number of economically inactive people of working age was up 8,000 over the quarter to a level of 7.97 million in the three months to September 2007. This represents a 0.1 per cent increase in the level over the quarter. In terms of level changes over the quarter, the largest level increase in inactivity was recorded for students (up 24,000), other (up 21,000), temporary sick (up 7,000), discouraged workers (up 7,000) and long-term sick (up 5,000). These increases were offset by falls in the level of inactivity for two sectors: looking after family / home (down 52,000) and retired (down 3,000).

Average earnings remain subdued

Average earnings recorded steady pay growth in the year to September. Average earnings including bonuses increased by 4.1 per cent in the three months to September, up 0.4 per cent from the previous month. Average earnings excluding bonuses increased by 3.7 per cent, unchanged from the previous month. In terms of the public and private sector split, the impact of bonuses was important for the three months to September. Excluding bonuses the gap in wages remained fairly steady with an increase of 0.1 per cent in public sector wage growth (to 3.2 per cent) and unchanged growth for the private sector at 3.8 per cent. Including bonuses the gap between the public and private sector wage growth increased slightly, there was an increase of 0.1 per cent in the public sector (up to 3.0 per cent) and an increase of 0.3 per cent in the private sector (up to 4.3 per cent).

Overall, the numbers still point to a fairly buoyant labour market, with employment at high levels and unemployment at a stable level. This is consistent with higher workforce participation rates, underpinned by robust GDP growth. Average earnings show stable but fairly modest growth, consistent with increased supply in the labour force.

PRICES`

Producer output prices buoyant; input prices rise

Industrial input and output prices are an indication of inflationary pressures in the economy. During quarter three, with the exception of a slight fall in August, output prices exhibited further signs of an acceleration of growth from quarter two 2007 and therefore provided signs of continued inflationary pressures. Input prices also accelerated in the third quarter. This suggests that firms were attempting to maintain their profit margins by passing on the higher costs of inputs to customers after facing a profit squeeze earlier in 2007.

Input prices on average rose by around 2.6 per cent in 2007 quarter three. This compares with 1.0 per cent in 2007 quarter two. The core input price index, excluding food, beverages, tobacco and petroleum rose by an average of 2.2 per cent in 2007 quarter three (12 month non-seasonally adjusted growth), a deceleration from growth of 2.9 per cent in the previous quarter. In October, input prices increased by 8.6 per cent from 6.5 per cent in September. The largest contributions to the increase came from crude oil and home food materials which increased by 32.1 and 14.8 per cent respectively in the twelve

months to September. The core input price inflation rose by 3.0 per cent in October compared to 3.4 per cent in September.

Output prices grew on average by 2.6 per cent in 2007 quarter three, a slight strengthening from growth of 2.4 per cent in the previous quarter. The underlying picture also suggests inflationary pressures. On the core measure which excludes food, beverages, tobacco and petroleum, producer output prices rose on average by 2.3 per cent in 2007 quarter three, unchanged from quarter two. In October output prices increased further to 3.8 per cent from 2.8 per cent in September. The largest contributions to the increase came from petroleum products and food which increased by 12.0 and 6.0 per cent respectively. The core output price index rose by 2.3 per cent compared to 2.2 per cent in September.

Consumer prices increase above target

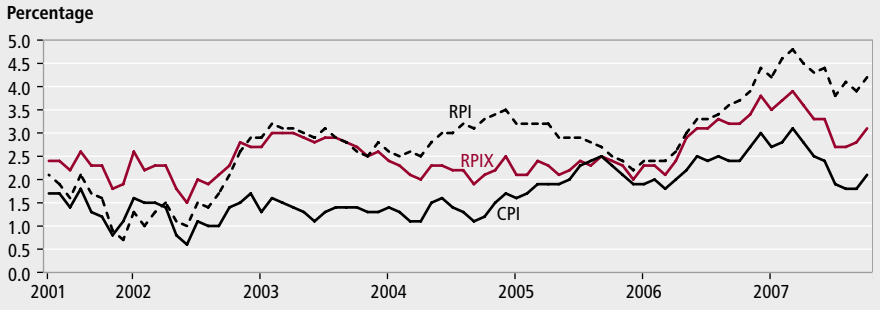
Growth in the consumer prices index (CPI) – the Government's target measure of inflation – was 2.1 per cent in October, up from 1.8 per cent in September. This is lower than the peak in March when inflation reached 3.1 per cent but above Government's 2.0 per cent inflation target (**Figure 15**).

The largest upward contributions to the change in the CPI annual rate come from changes in transport costs, reflecting the increase in fuels and lubricants following the increases in oil prices and subsequently petrol prices. Petrol pump prices rose by 2.7 pence per litre in October whereas in October 2006 there was a fall of 5.2 pence per litre. The increase was in part due to the increase in fuel duty. A further large upward contribution came from air travel reflecting an increase in the fares to European destinations in contrast to the usual seasonal pattern. There were also upward effects recorded from food and non-alcoholic beverages, mainly due to the price of meat and fruit, and furniture and household goods.

The largest downward contribution came from housing and household services. Gas and electricity bills both fell slightly as a result of the phasing in of tariff reductions, over the same period last year gas and electricity prices increased. Other downward effects came from communication, clothing and footwear, alcohol and tobacco and restaurants and hotels.

RPI inflation rose by 4.2 per cent in October compared to 3.9 per cent in September. As with the CPI, the largest upward effect came from motoring expenditure reflecting the increase in petrol pump prices compared to October 2006. Other upward effects came from food, household goods, fares and other travel costs and leisure goods. The largest downward contribution came from fuel and light. The all items RPI excluding mortgage interest payments rose by 3.1 per cent in October, up from 2.8 per cent in September.

Figure 15
Inflation



Independent forecasts

November 2007

UK forecasts

The tables below supplement the Economic Review by providing a forward-looking view of the UK economy. The tables shows the average and range of independent forecasts for 2007 and 2008 and are extracted from HM Treasury's Forecasts for the UK Economy.

2007

	Average	Lowest	Highest
GDP growth (per cent)	*3.0*	*2.5*	*3.3*
Inflation rate (Q4, per cent)			
CPI	*2.0*	*1.2*	*2.3*
RPI	*3.9*	*2.8*	*4.4*
Claimant unemployment (Q4, million)	0.86	0.80	1.10
Current account (£ billion)	–43.4	–53.2	–37.6
Public Sector Net Borrowing (2007–08, £ billion)	36.2	31.0	40.9

2008

	Average	Lowest	Highest
GDP growth (per cent)	*2.0*	*–0.1*	*3.0*
Inflation rate (Q4, per cent)			
CPI	*2.1*	*1.6*	*3.2*
RPI	*2.6*	*1.5*	*3.8*
Claimant unemployment (Q4, million)	0.93	0.75	1.23
Current account (£ billion)	–46.2	–58.6	–33.0
Public Sector Net Borrowing (2008–09, £ billion)	36.5	22.8	50.7`

Notes

Forecast for the UK economy gives more detailed forecasts, and is published monthly by HM Treasury. It is available on the Treasury's website at: www.hm-treasury.gov.uk/economic_data_and_tools/data_index.cfm

Selected world forecasts

The tables below supplement the Economic Review by providing a forward-looking view of the world economy. The tables show forecasts for a range of economic indicators taken from Economic Outlook (preliminary edition), published by OECD (Organisation for Economic Co-operation and Development).

2007

	US	Japan	Euro area	Total OECD
Real GDP growth (per cent)	*2.1*	*2.0*	*2.5*	*2.6*
Consumer price (percentage change from previous year)	*2.6*	*–0.3*	*2.0*	*2.3*
Unemployment rate (per cent of the labour force)	*4.7*	*3.7*	*6.9*	*5.6*
Current account (as a percentage of GDP)	*–6.1*	*4.8*	*0.4*	*–1.5*
Fiscal balance (as a percentage of GDP)	*–2.8*	*–2.7*	*–0.8*	*–1.9*

2008

	US	Japan	Euro area	Total OECD
Real GDP growth (per cent)	*2.6*	*2.2*	*2.2*	*2.7*
Consumer price (percentage change from previous year)	*2.2*	*0.4*	*2.1*	*2.0*
Unemployment rate (per cent of the labour force)	*4.9*	*3.6*	*6.6*	*5.4*
Current account (as a percentage of GDP)	*–6.2*	*5.4*	*0.4*	*–1.5*
Fiscal balance (as a percentage of GDP)	*–2.8*	*–3.2*	*–0.7*	*–1.9*

Notes

The OECD *Economic Outlook* is published bi-annually. Further information about this publication can be found at www.oecd.org/eco/Economic_Outlook

Key indicators

The data in this table support the Economic review by providing some of the latest estimates of Key indicators.

Seasonally adjusted unless otherwise stated

	Source CDID	2005	2006	2007 Q1	2007 Q2	2007 Q3	2007 Aug	2007 Sep	2007 Oct
GDP growth - chained volume measure (CVM)									
Gross domestic product at market prices	ABMI	1.8	2.8	0.8	0.8	0.7	..	..	..
Output growth - chained volume measures (CVM)									
Gross value added (GVA) at basic prices	ABMM	1.9	2.8	0.8	0.8	0.7	..	..	..
Industrial production	CKYW	–2.0	0.0	–0.2	0.7	0.0	0.1	–0.5	..
Manufacturing	CKYY	–1.2	1.4	–0.5	0.8	0.0	0.5	–0.6	..
Construction	GDQB	1.5	1.1	0.8	0.7	0.8	..	..	..
Services	GDQS	2.9	3.6	0.9	0.9	0.9	..	..	..
Oil and gas extraction	CKZO	–10.5	–9.1	1.1	1.1	–2.0	–4.2	1.0	..
Electricity, gas and water supply	CKYZ	–0.4	–2.5	1.2	–0.4	0.8	–0.1	1.0	..
Business services and finance	GDQN	4.4	5.3	1.0	1.7	1.5	..	..	..
Household demand									
Retail sales volume growth	EAPS	2.0	3.3	0.4	1.4	1.6	0.7	0.3	–0.1
Household final consumption expenditure growth (CVM)	ABJR	1.5	2.0	0.7	0.8	1.0	..	..	..
GB new registrations of cars (thousands)[1]	BCGT	2,444	2,340	678	573	671	76	419	..
Labour market[2,3]									
Employment: 16 and over (thousands)	MGRZ	28,707	28,947	29,053	29,154	29,223	29,223	..	..
Employment rate: working age (%)	MGSU	74.7	74.6	74.3	74.4	74.4	74.4	..	..
Workforce jobs (thousands)	DYDC	31,042	31,409	31,602	31,689	..	..	..	..
Total actual weekly hours of work: all workers (millions)	YBUS	918.6	923.7	929.5	937.5	937.8	937.8	..	..
Unemployment: 16 and over (thousands)	MGSC	1,429	1,660	1,705	1,660	1,667	1,667	..	..
Unemployment rate: 16 and over (%)	MGSX	4.7	5.4	5.5	5.4	5.4	5.4	..	..
Claimant count (thousands)	BCJD	861.7	944.7	916.3	877.1	846.8	848.6	834.7	824.8
Economically active: 16 and over (thousands)	MGSF	30,135	30,607	30,759	30,814	30,889	30,889	..	..
Economic activity rate: working age (%)	MGSO	78.5	78.9	78.8	78.8	78.8	78.8	..	..
Economically inactive: working age (thousands)	YBSN	7,939	7,851	7,954	7,964	7,972	7,972	..	..
Economic inactivity rate: working age (%)	YBTL	21.5	21.1	21.2	21.2	21.2	21.2	..	..
Vacancies (thousands)	AP2Y	616.8	594.7	636.8	647.5	667.0	664.7	667.0	667.0
Redundancies (thousands)	BEAO	126	145	145	120	134	134	..	..
Productivity and earnings annual growth									
GB average earnings (including bonuses)[3]	LNNC	..	..	4.4	3.4	4.1	3.7	4.1	..
GB average earnings (excluding bonuses)[3]	JQDY	..	..	3.6	3.4	3.7	3.7	3.7	..
Whole economy productivity (output per worker)	A4YN	..	..	2.8	2.7	..	..	..	..
Manufacturing productivity (output per job)	LOUV	..	..	..	..	..	3.4	3.0	..
Unit wage costs: whole economy	LOJE	..	..	2.4	1.2	..	..	..	..
Unit wage costs: manufacturing	LOJF	..	..	..	..	..	0.2	0.1	..
Business demand									
Business investment growth (CVM)	NPEL	15.7	–4.3	–0.5	0.4	0.0	..	..	..
Government demand									
Government final consumption expenditure growth	NMRY	2.7	2.1	0.5	0.3	0.3	..	..	..
Prices (12–monthly percentage change – except oil prices)									
Consumer prices index[1]	D7G7	2.1	2.3	2.9	2.6	1.8	1.8	1.8	2.1
Retail prices index[1]	CZBH	2.8	3.2	4.5	4.4	3.9	4.1	3.9	4.2
Retail prices index (excluding mortgage interest payments)	CDKQ	2.3	2.9	3.7	3.4	2.7	2.7	2.8	3.1
Producer output prices (excluding FBTP)[4]	EUAA	2.1	2.3	2.6	2.2	2.3	2.4	2.2	2.3
Producer input prices	EUAB	11.6	9.7	–0.8	0.9	2.6	0.7	6.7	8.5
Oil price: sterling (£ per barrel)	ETXR	30.36	35.93	29.95	34.05	36.93	35.47	38.09	40.38
Oil price: dollars ($ per barrel)	ETXQ	55.05	66.11	58.53	67.64	74.67	71.36	76.92	82.60

Seasonally adjusted unless otherwise stated

	Source CDID	2005	2006	2007 Q1	2007 Q2	2007 Q3	2007 Aug	2007 Sep	2007 Oct
Financial markets									
Sterling ERI (January 2005=100)	BK67	100.4	101.2	104.6	104.1	104.1	104.3	103.0	102.5
Average exchange rate /US$	AUSS	1.8197	1.8429	1.9546	1.9870	2.0211	2.0111	2.0185	2.0446
Average exchange rate /Euro	THAP	1.4629	1.4670	1.4916	1.4732	1.4705	1.4762	1.4515	1.4370
3-month inter-bank rate	HSAJ	4.57	5.26	5.56	5.93	6.18	6.55	6.18	6.17
Selected retail banks: base rate	ZCMG						5.75	5.75	5.75
3-month interest rate on US Treasury bills	LUST	3.92	4.89	4.91	4.68	3.62	3.91	3.62	3.86
Trade and the balance of payments									
UK balance on trade in goods (£m)	BOKI	–68,789	–77,563	–20,605	–20,346	–22,257	–6,948	–7,754	..
Exports of services (£m)	IKBB	115,182	124,586	33,231	33,986	33,993	10,976	10,922	..
Non-EU balance on trade in goods (£m)	LGDT	–31,912	–45,587	–11,451	–10,724	–13,108	–3,953	–4,711	..
Non-EU exports of goods (excl oil & erratics)[5]	SHDJ	119.8	118.0	115.2	115.3	117.3	121.9	114.2	..
Non-EU imports of goods (excl oil & erratics)[5]	SHED	116.8	124.4	126.5	128.3	134.5	131.4	133.6	..
Non-EU import and price index (excl oil)[5]	LKWQ	101.2	103.9	104.6	104.5	103.4	103.5	103.7	..
Non-EU export and price index (excl oil)[5]	LKVX	100.1	101.5	101.9	101.9	102.2	101.8	103.7	..
Monetary conditions/government finances									
Narrow money: notes and coin (year on year percentage growth)[6]	VQUU	3.1	5.0	4.1	4.8	5.4	4.6	5.4	..
M4 (year on year percentage growth)	VQJW	11.3	13.0	12.6	12.9	12.8	13.5	12.8	..
Public sector net borrowing (£m)	–ANNX	40,776	30,347	–2,138	15,873	9,276	8,417	7,151	–993
Net lending to consumers (£m)	RLMH	19,724	13,077	2,480	2,485	3,677	1,114	1,350	..

External indicators – non-ONS statistics

		2007 Apr	2007 May	2007 Jun	2007 Jul	2007 Aug	2007 Sep	2007 Oct	2007 Nov
Activity and expectations									
CBI output expectations balance	ETCU	18	18	25	10	13	17	10	9
CBI optimism balance	ETBV	16			–2			–13	
CBI price expectations balance	ETDQ	14	26	18	17	17	20	15	22

Notes:

1 Not seasonally adjusted.
2 Annual data are for April except for workforce jobs (June), claimant count (average of the twelve months) and vacancies (average of the four quarters).
3 Monthly data for vacancies and average earnings are averages of the three months ending in the month shown. Monthly data for all other series except claimant count are averages of the three months centred on the month shown.
4 FBTP: food, beverages, tobacco and petroleum.
5 Volumes, 2003 = 100.
6 Replacement for series M0 which has ceased publication.

For further explanatory notes, see Notes to tables on page 63.

FEATURE

Developing an R&D satellite account for the UK: a preliminary analysis

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SUMMARY

This article presents preliminary analysis treating expenditure on research and experimental development (R&D) as investment in an intangible scientific asset, in line with proposed revisions to the United Nations System of National Accounts. The purpose of this analysis is to communicate to users of statistics the potential impacts of capitalising R&D in the National Accounts in a new set of satellite accounts. Capitalising R&D raises the level of UK GDP by approximately 1.5 per cent, but has limited impact on estimates of recent GDP growth. These figures are preliminary, based on experimental methods, and should therefore be interpreted with caution. The author welcomes comments and complementary evidence that can be used to substantiate or revise the assumptions made throughout this article.

There is considerable consensus amongst economists, politicians and the public in general that research and experimental development (R&D) is a key determinant of economic growth and improvements in living standards. This is reflected by the importance of R&D performance indicators in policy making, as demonstrated by the UK Government's Public Service Agreements and the EU Lisbon competitiveness indicators, which track R&D expenditure as a ratio to gross domestic product (GDP). ONS plays a major role in collecting the required evidence and publishing such indicators, which have National Statistics status.

The Organisation for Economic Co-operation and Development (OECD) provides detailed guidance on how R&D expenditure should be measured in its Frascati Manual (FM).[1] This measurement framework is independent from the National Accounts (NA), which provide a systematic statistical framework for summarising and understanding economic events and the wealth of an economy. It is therefore legitimate for users of statistics to ask how R&D is reflected in the official statistics and whether the measurement framework enables an adequate understanding of the economic impacts of R&D.

International standards for the 1993 System of National Accounts (SNA) and the 1995 European System of Accounts (ESA) set out how countries must record economic transactions and wealth in their National Accounts. According to these guidelines, business expenditure on R&D is treated as intermediate consumption, namely goods produced and consumed in the same period for the production of other goods and services. For instance, the output of an R&D laboratory, affiliated to a pharmaceutical company or undertaking R&D on its behalf, is counted as output of the R&D sector and as intermediate consumption of the 'using' pharmaceutical sector. By treating its use as current expenditure, the production of R&D does not directly contribute to increasing gross value added (GVA) or GDP, which net out such expenses from gross output.[2]

The treatment of R&D use as current expenditure is at odds with the evidence that the knowledge acquired as a result of R&D often delivers benefits to the owner of the intellectual property over several years. That is in essence the National Accounts definition of investment. From that point of view, R&D should be treated no differently from the production of a new piece of capital equipment with an expected service life of more than one year.[3] The current treatment is unsatisfactory for three main reasons. Firstly, it is inconsistent that artistic and literary originals are recognised in the System as produced assets while scientific originals achieved through R&D are not. Secondly, exclusion from the production boundary leads to estimates of GDP that may provide a partial picture of the flow of goods and services produced in the economy at the point in which structural

changes may lead to increased specialisation in the production of intellectual goods. Thirdly, the analysis of the sources of productivity growth can also be incomplete as a result, because productivity changes are not attributable to the accumulation of knowledge assets. This could in turn distort fiscal and monetary policy insofar as potential supply could be underestimated.

Statistical agencies, including ONS, are aware of these limitations and agree that measurement frameworks need to evolve to reflect the changes in the economy and users' needs. These demands need to be assessed against the need for comparability across countries and over time, while addressing the problems involved in the reliable valuation of R&D as an asset. In this context the United Nations Statistical Commission officially called in 2003 for an update of the 1993 SNA in order to reflect new user needs and developments in the economy. Once agreed, the SNA revisions will lead to a revision of the ESA. This is likely to result in a pan-European requirement for member countries to produce supplementary tables reporting the new proposed treatment for R&D. Some countries have already published preliminary satellite accounts on R&D and a few, including the United States, have already developed a satellite account as a prelude to capitalisation in the core accounts. Satellite accounts are extensions to the main National Accounts that seek to facilitate the analysis of the wider impact of economic change using similar concepts and classifications while avoiding conflict with the core conceptual framework.

This article documents the preliminary outcomes of an ongoing research programme aiming to develop satellite accounts that treat R&D use as investment in an intangible 'scientific knowledge' asset. While the revision timetable spans a number of years up to 2014 and detailed guidance is yet to be produced, Eurostat has asked statistical agencies to conduct early assessments and communicate the potential impacts to users before detailed mandatory guidance is issued. Figures in this article should therefore be treated with caution, noting their preliminary and experimental status.

The capitalisation of R&D expenditure: challenges and methods

What are the main R&D measurement challenges?

R&D exhibits a number of features that complicate its measurement on a conceptual and practical basis within an accounting framework:

- R&D knowledge exhibits public good features because it is not depleted as it is consumed
- access to R&D knowledge can be restricted, but companies use secrecy to prevent their knowledge from being used by others without paying for it
- partly as a result, R&D is often performed on own-account, for internal use within companies
- each R&D project by definition is unique, therefore limiting the basis for value comparisons
- the public good features of R&D knowledge provide a rationale for government involvement in the funding and performance of R&D, thus affecting valuations

The recording of scientific knowledge transactions in the SNA

Market contract research involves the undertaking of an R&D project by one firm on behalf of another, with the objective of obtaining knowledge that will be owned by the customer firm. A producer's R&D output is treated as intermediate consumption by the purchaser of the services. In the SNA revision, the consumption of R&D would be treated as gross fixed capital formation (GFCF) instead of intermediate consumption. While it is often the case that the internal R&D transactions within companies are not recorded, the output of R&D should always be captured in the SNA revision because its use will no longer be treated as intermediate consumption that offsets output, but as GFCF of a produced intangible asset which adds to GDP.

A key problem with the current methodology is that no connection is made between the R&D activity that leads to improved scientific knowledge and its appearance as intellectual property. When a patent or other form of protection to scientific knowledge is awarded, the System adds a non-financial non-produced asset, known as 'patented entity', to an account that reflects changes in assets which are generated outside the System and are not produced by units within it. Following the SNA revision, the recognition of scientific originals requires the outright removal of patented entities from the System.[4] In the 1993 SNA, the licensing of intellectual property is treated as lessors' output but matched by lessees' intermediate consumption. This treatment is also appropriate for the SNA revision because the licensee only buys services from the asset rather than the knowledge asset itself.

Scope of the R&D capitalisation exercise

Defining R&D

The first step in this exercise is to define what economic activities can be consistently characterised as R&D for the purposes of capitalisation within the National Accounts. The SNA provides a functional description rather than a formal definition of R&D, excluding related activities such as routine technical testing and market research, and placing a strong emphasis on the fact that R&D must help deliver new goods and improved processes. The FM definition has potentially a wider scope, defining research and experimental development as '… creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture, and society, and the use of this stock of knowledge to devise new applications' (OECD, 2002). In the absence of 'an appreciable element of novelty and the resolution of scientific uncertainty', activities are not considered to be R&D. While it has been agreed that the FM definition should provide the basis for recognising a new scientific knowledge asset, it has been made clear this should not be interpreted as including human capital as capital formation within the System.

Success, failure and the 'at cost' valuation approach

Accounting standards do not allow individual businesses to capitalise R&D expenditure when there is substantial uncertainty about its value. While many projects are unlikely to recoup their costs, a few will succeed. For profit-seeking firms, economic theory argues that they are willing to invest in R&D up to a level where the marginal pound spent is expected to deliver a marginal return at least as high as the next best investment opportunity. This 'at cost' approach is the preferred basis for the valuation of the output of R&D because, as explained, it is not systematically traded in transparent markets where prices aggregate all the relevant information. This is consistent with the approach adopted for capitalising mineral exploration costs, which are included in GFCF whether or not the exploration is successful.

R&D in the social sciences
R&D in the social sciences and humanities is an R&D subsector and a product subcategory in the SNA. Both the concept and units in this sector are also covered by the FM definition and sources. Although there may be some measurement bias against including social science R&D, for example, due to their ineligibility for R&D tax credits, this article assumes no adjustment is required to account for omitted R&D in the social sciences. In the UK, the social science R&D sector accounts for a very small fraction of business R&D expenditure, less than 1 per cent, with approximately £30 million worth of estimated R&D. This is in contrast with the reported turnover for the subsector, £170 million, which suggests that an upward adjustment may be necessary once more detailed international guidance is available.

Potential overlap with other recognised intangible investments
R&D and software development are intimately related, but software is already recognised as a produced asset in the National Accounts while scientific originals are not. The methodology for estimating own-account software development includes the earnings of programmers that could be working on genuine R&D projects. Given the lack of auxiliary information, the complexities of the interdependencies, and the wish to avoid revising software estimates, this analysis deducts 50 per cent of total R&D in the computer services industry, assuming that this represents avtivity already counted in and correctly assigned to software estimates.

Inclusion of non-market R&D, exclusion of spillovers
In line with OECD recommendations, only the portion of economic benefits arising from the acquisition of R&D should be recorded as an asset in the System. It is this magnitude that will theoretically match with the R&D cost estimate used to estimate R&D output. Neither rented knowledge (through patent licensing for example) nor knowledge freely available following a patent expiration would count as an asset. However, R&D undertaken and effectively owned by non-market producers such as government is to be included in the System. This treatment is analogous to that of toll-free roads.

Capitalisation methodology options

There are three possible approaches to compiling an experimental set of accounts that treat R&D knowledge as an asset; these are listed below.

Same sources, different allocation to uses
This option entails using data on R&D services currently recorded in the Input-Output Supply and Use Tables (SUTs) and reclassifying expenditure from intermediate consumption to investment. This method is fairly straightforward to implement but has two key shortcomings. Firstly, SUTs underestimate the extent of R&D output because many businesses do not report separately on their own-account R&D activities by identifying a separate establishment, as recommended by the 1993 SNA. Although this underestimation has no impact on GDP when R&D is treated as intermediate consumption, capitalising only identified R&D output would underestimate the true impact on GDP. Secondly, expenditure on R&D by government and non-profit sector is likely to be assigned to uses of other services such as health, defence and education because of the limited detail of information available.

New integrated sources and methods
This option would lead to revised statistical inquiries with more detailed questions on R&D output and purchases which can then be built into core systems. This would involve considerable changes to the Annual Business Inquiry, which is the major source of output and purchases data used for constructing SUTs. Although this should be considered thoroughly as a long-term alternative for full consistency with the core accounts, the substantial resource implications make it unfeasible for the purposes of a preliminary satellite account.

Bridging approach from FM sources
This approach has been adopted by all the statistical agencies that have already produced R&D capitalisation estimates, including Australia (Australian Bureau of Statistics 2004), the US (Robbins 2005; Okubo *et al* 2006; Robins and Moylan 2007), Israel (Peleg and Brenner 2006) and The Netherlands (De Haan *et al* 2006).

Because the FM methodology differs from National Accounts measurement principles, a number of adjustments need to be made to adjust FM R&D expenditure to measures which are conceptually consistent with the National Accounts. The main advantage of this method is that, by and large, it is not necessary to collect additional sources at the current development stage and despite the need for assumptions, it makes the preferred choice for the purposes of evaluating the impacts of R&D capitalisation in a satellite account. This is also the OECD recommended approach on the compilation of R&D satellite accounts within its forthcoming *Handbook on Measuring Intellectual Property*, to be released in 2008, in coordination with Eurostat (OECD 2007).

Evaluating the impact of R&D capitalisation in the National Accounts: R&D resources and uses

Outline of the FM-SNA bridging methodology

This article proposes a methodology to estimate the impact of R&D capitalisation on the National Accounts that is consistent with the product by product balancing of supply and demand of resources. This is done within the context of the latest available SUTs, consistent with the ONS *Blue Book* 2006 (BB06), which includes figures from 1997 up to 2004 (ONS 2006a, 2006b, 2006c).

Because the FM sources gather information on the cost of performing (the FM term for 'producing') R&D, the first step involves adding up such costs leading to an overall estimate of R&D gross output. This is calculated by adding intermediate consumption, compensation of employees, gross operating surplus and taxes less subsidies on production linked to R&D production across all sectors. In this version, no detailed industry analysis is provided. In future development stages, detailed production accounts should be built up from the individual establishment level. The gross output estimate at basic prices is used to define the domestic output of R&D in the supply table. Additional imports and tax information help estimate the full value of R&D resources. This total will be balanced to total uses (demand) of R&D. Information on funding and assumptions on ownership of R&D services are then used to apportion total demand across different uses and users, completing a full picture of R&D supply and uses.

In this exercise, the new supply-use estimates for R&D services replace BB06 R&D estimates. However, further steps are required. By recognising an additional asset in the System, its consumption by non-market producers needs to be added to their output, which is generally measured at cost of production. Furthermore, since the FM may capture R&D in these units assigned to other public services in BB06, it is then necessary to make corrections to avoid

double-counting of non-market output.

The Frascati sources for the experimental R&D satellite account

Due to an emphasis on simplicity and transparency of estimates in this preliminary satellite account, this article builds on two main sets of published inputs.

'Research and Development in UK Business' (MA14) is an ONS publication based on business surveys that documents R&D expenditure in the Business Enterprise (BE) sector, with detail by type of expenditure on inputs, funding sector, civil versus defence uses and functional type of R&D (for example, basic or applied research), R&D personnel and product field the R&D contributes to, for example, pharmaceuticals and transport equipment. The BERD expenditure split by input is crucial in identifying the necessary bridging changes to a National Accounts-consistent output figure. In the absence of similar input data for non-market producers, this article assumes all sectors have identical cost structures.

The second and main source of information is the ONS release on 'UK gross domestic expenditure on R&D (GERD)'. This provides FM-consistent estimates for the total R&D expenditure performed in, and funded by, the different FM sectors, building on a number of statistical and administrative sources. The construction of bridge tables for capitalisation in the National Accounts relies heavily on Table 1 in the release, which reports R&D performed in the UK in each sector according to source of funding. This helps translate the performance and funding information in GERD into National Accounts-comparable information about supply and use. Figures for 2004 are reported in **Table 1**.

Performance, funding and ownership of R&D

For bridging purposes, it is necessary to draw a correspondence between the FM sectors and the institutional sectors in the SNA. For the purposes of the satellite account, some simplifying assumptions are made and summarised in **Table 2.** Government, research councils and the higher education funding councils make up the total of the general government sector for R&D purposes. Higher education (HE) is entirely assigned to the non-profit institutions serving households (NPISH) sector, grouped with private non-profit (PNP) organisations, which includes charitable organisations that perform R&D. The BE sector comprises three different SNA sectors: public corporations, financial corporations and private non- financial corporations. They account for 5, about 1 and 94 per cent of BE R&D, respectively. Quasi-corporations such as partnerships and sole traders account for a very marginal share of BERD. Finally, the FM 'abroad' sector is identified with the rest of the world sector in the SNA.

Introducing R&D as an asset in the system requires a clear definition of ownership. The characteristics of R&D make this task particularly difficult, which is partly why the FM methodology does not attempt to measure ownership. However, information about who funds R&D can provide a reasonable first-order approximation to identifying who owns the output of R&D. There are two main problems to using funding data without further adjustments.

Firstly, funding of R&D is constrained to equal total R&D expenditure and data are in most cases collected from the performers rather than the funders of R&D. As a result, it will fail to reflect the full costs of R&D to the user of the R&D services. The assumption made in this article is that funding provides a good approximation to the share (rather than the level) of R&D output performed in a sector which is funded by another.

Secondly, funding R&D does not always imply ownership over its output. For market producers, funding is bound to equal ownership, with the exception of corporate donations. This is also likely to apply to non-profit private institutions which fund the work of charitable institutions at home or abroad. This article assumes that these funds are negligible relative to the total funds provided. R&D funded by government provides room for a more significant departure from the funder-owner identity. The reason for this is the potential inclusion of R&D grants in R&D funding estimates. This preliminary satellite account makes a number of assumptions about the relative importance of grants in total funds provided by government to R&D in other sectors. These are summarised in **Table 3**.

Table 3 is structured in three main panels. The panel on the left depicts the share of R&D performed in sector 'i' in each row funded by each sector 'j' in columns, using the estimates for 2004 provided in Table 2. The central panel summarises the assumptions about the share of funds provided by 'j to 'i' which do not involve ownership by 'j'. For example, of the total funds provided by government to the business sector, the table indicates that

Table 1
R&D performed in the UK in each sector according to source of funding, 2004

£ million, current prices

	Sector carrying out the work (performer)							
Sector providing the funds (funder)	Gov	RCs	HE	BE	PNP	Total (UK)	Abroad	Total
Government (Gov)	1,053	120	242	1,325	82	2,822	428	3,250
Research councils (RCs)	3	630	1,354	9	88	2,084	220	2,304
Higher education funding councils (HEFC)	0	0	1,804	0	0	1,804	0	1,804
Higher education (HE)	1	10	212	0	6	229	0	229
Business enterprise (BE)	158	37	243	8,484	69	8,991	1,421	10,412
Private non-profit (PNP)	11	78	761	5	105	960	0	960
Abroad	15	54	388	2,993	57	3,507	-	3,507
Total	1,241	929	5,004	12,816	407	20,397	2,069	22,466

Source: National Statistics

Table 2
Simplified relationship between FM and SNA sectors

Frascati Manual (FM) sector	System of National Accounts (SNA) sector
Government	General government
Research councils (RC)	General government
Higher education funding councils (HEFC)	General government
Higher education (HE)	Non-profit institutions serving households (NPISH)
Private non-profit (PNP)	Non-profit institutions serving households (NPISH)
Business enterprise (BE)	Financial, public and private non-financial corporations
Abroad	Rest of the world (RoW)

Source: National Statistics

Table 3
Funding of R&D in 2004 and sectoral ownership assumptions

	Share of sector i's R&D funded by sector j f[i,j][1]				Share of sector i's R&D funded by j that is owned by sector j Z(i,j)[2]				Share of sector i's R&D owned by sector j S(i,j)[3]			
Funder (j)	Business enterprise	General government	NPISH	Rest of world	Business enterprise	General government	NPISH	Rest of world	Business enterprise	General government	NPISH	Rest of world
Performer (i)												
Business enterprise	0.66	0.10	0.00	0.23	1.00	0.50	1.00	0.90	0.74	0.05	0.00	0.21
General government	0.09	0.83	0.05	0.03	1.00	1.00	1.00	0.90	0.09	0.84	0.05	0.02
NPISH	0.06	0.66	0.20	0.08	1.00	0.10	1.00	0.90	0.06	0.07	0.80	0.07
Rest of world	0.69	0.31	0.00	1.00	0.90	1.00	0.76	0.22	0.00	-		
Source	GERD funding data				Assumptions				Estimate			

Notes:

1 Funded share f(i,j)=F(i,j)]/F(i,*), where F(i,j) is R&D performed by i funded by j and F(i,*) is total R&D performed by i.
2 Residual ownership stays with performer.
3 S(i,j)=f[i,j]*Z(i,j) for j≠i. S(i,i)=f(i,i)+(1-Z(i,j))*f(i,j)*1(j≠i).

this article assumes only 50 per cent is undertaken as procurement (owned by government) while the rest consists of grants. This proportion falls to 10 per cent for funds provided to the NPISH sector, because of the significant share of grants to the HE sector allocated by the funding councils. R&D funded by the rest of the world is adjusted for the possibility that some of the funds provided to domestic sectors are grants from abroad. Similarly, R&D performed abroad funded by the UK government is adjusted for the possibility of grants being provided to R&D performers abroad. This article assumes that the residual 'non-owned' component of funds is effectively owned by the performer. This is reflected in the estimation of ownership shares over each sector's R&D output, displayed in the right-hand panel. The assumptions made imply that the business and NPISH sectors own significantly higher shares of their own output than implied by the funding shares, 74 per cent and 80 per cent respectively, compared with 66 per cent and 20 per cent implied by funding. It is important to emphasise that this is entirely based on assumptions that will be tested against more detailed information on R&D grants and procurement data.

Estimating R&D output

Adopting an 'at cost' valuation approach for R&D output requires summing over the full range of economic costs incurred in performing R&D. This article relies on input expenditure for R&D available for the business sector to estimate such costs. **Table 4** summarises the main similarities and discrepancies between the BERD sources and the requirements of an SNA-consistent valuation approach.

Compensation of employees

According to FM and BERD guidance, wages and salaries on R&D and auxiliary personnel should also include non-salary employment costs, making the reported figure comparable to the SNA concept of 'compensation of employees'. A deflator for this component is calculated using additional information on full-time equivalent R&D employees by broad occupational category and auxiliary information from the Annual Survey of Hours and Earnings. The latter provides hourly wage estimates for detailed occupational groups such as scientists, engineers and technicians, which can be matched to the BERD occupational categories.

Intermediate consumption of goods and services other than R&D

Information on 'other current expenditure' captures all purchases of goods and services necessary for R&D but excludes extramural R&D to avoid duplication of primary R&D expenditure in the computation of an overall GERD estimate. This category should include payments for the use of intellectual property such as licence fees to patent holders. According to the FM, this is also supposed to include gross taxes on the production of R&D. There is no information about the relevant subcomponents of other current expenditure. For simplicity, this article uses a deflator that combines, equally weighted, the aggregate PPI for purchases of goods and the deflator for technical and testing services output as a reasonable proxy for the specific services required to undertake R&D.

Intermediate consumption of R&D services

There is limited information about the purchases of R&D services required for the production of R&D. If all R&D is treated as GFCF, then the R&D cost component of doing R&D follows from the consumption of R&D capital services as long as there is some residual value for the R&D asset which can be used for other purposes. Some countries have identified all acquisition of extramural R&D as an input in R&D production. Because counting R&D extramural purchases as R&D costs inflates R&D output and R&D intermediate consumption, the impact on most indicators of interest turns out to be nil. However, it seems conceptually preferable to impute only those R&D purchases as R&D intermediate consumption when the R&D performer does not use the outcomes

Table 4
Relationship between components of R&D expenditure and output

FM R&D expenditure	NA economic cost of R&D production	Source
Wages and salaries current expenditure	Compensation of employees	Data from BERD, MA14
Other current expenditure	Purchases of goods and services other than R&D	Data from BERD, MA14
-	Intermediate consumption of R&D services	Estimated, various sources
Capital expenditure	-	Data from BERD, MA14
-	Consumption of fixed capital used in R&D production	Estimated, various sources
-	Net operating surplus (net return on capital used)	Estimated, various sources
-	Taxes less subsidies on R&D production	ONS from R&D tax credits data
Sum: intramural R&D expenditure	Sum: gross R&D output at basic prices	

for the production of other goods and services. In this article only R&D purchases by companies in the R&D sector are treated as R&D intermediate consumption.

Gross operating surplus

Capital expenditure is the third and final component of intramural R&D expenditure. According to the BERD survey guidance, this includes both acquisition and lease of fixed capital goods. For simplicity, this article assumes that reported capital expenditure only includes purchases or long-term financial leases, with rental payments included in the other current expenditure figure. The BERD survey collects more detailed information on two types of assets, land and buildings on one hand and plant, machinery and equipment (PME) on the other. Among the first, buildings are an asset within the production boundary and its formation is already captured in the National Accounts. This article treats the land and buildings figure as the current investment in a buildings asset strictly used for R&D activity. Expenditure on plant, machinery and equipment is broadly equivalent to the formation of the National Accounts asset which includes computers and purchased software. This expenditure should therefore count not as R&D production costs, but as build assets, the use of which for R&D purposes generates economic costs to their owners.

Currently it is not possible to identify whether capital expenditure includes expenditure on intangible assets recognised in the SNA, such as software development, mineral exploration or artistic and literary originals. Abstracting from these problems, stocks of fixed assets used for R&D for the two separate categories reported in BERD are estimated. Constant price investments in such assets are estimated by deflating land and buildings expenditure with the buildings deflator for the business services sector (ONS code RIWW) and PME with the equipment (including computers) deflator for the R&D sector (ONS code RKZA). Stocks are calculated using the perpetual inventory model (PIM) and geometric depreciation rates of 1.5 per cent and 15 per cent respectively. Capital services for the use of both stocks are calculated using an assumed net rate return of 7 per cent nominal applied to the Hall-Jorgenson formula, which characterises an equilibrium in the rental market for assets, to infer rental rates that equal the sum of a net return plus depreciation net of capital gains (Hall and Jorgenson 1967).

Taxes less subsides on production

BERD sources do not explicitly collect information on this item but, as noted, the FM requires other current expenditure to include taxes on R&D production. The FM states that subsidies should not be netted out from gross R&D expenditure and are therefore excluded. For National Accounting purposes, it is, however, necessary to discount such subsidies in order to arrive at a gross output figure at basic prices. R&D tax credits in the UK provide incentives to companies to perform R&D, which reduce the required return on investments for companies to undertake R&D.

There has been some discussion about whether R&D tax credits, which are integrated in the corporation tax system, should be counted as production subsidies rather than tax adjustments. Because small and medium companies can claim an enhanced relief on what they spend on R&D for corporation tax purposes and claim a credit when there is no net tax liability, ONS decided to treat payable tax credits as a subsidy on production for R&D (ONS 2002). HMRC (2006) currently publishes data on claims for the various R&D tax credit schemes as a new set of National Statistics. This article adopts the ONS R&D subsidy figures in Mahajan (2006).

Estimates of output for the business sector

For this sector, gross output at basic prices is calculated as follows: half of the R&D performed by the computer services sector is subtracted from the total R&D expenditure performed by the business sector. Capital expenditure is also subtracted and replaced by estimates of capital services for buildings and equipment used for R&D. An estimate of intermediate consumption of R&D services equal to the estimated extramural expenditure in R&D by the R&D sector is added. Gross output at basic prices is estimated by subsidies on R&D production. Estimates of gross output at purchasers' prices are derived by adding taxes less products on R&D services, as obtained from the SUTs.

Adjustments for non-market sectors

The earlier calculations for the business sector provide an indicative adjustment factor for the FM R&D expenditure in the government and non-profit sectors to be converted into gross output figures. Because these are essentially non-market producers, consistency with National Accounts methods requires imposing a nil rate of return in estimating the capital services of fixed assets used in R&D production.

Estimating total R&D supply

The FM methodology largely focuses on the identification of R&D performed in individual countries. However, a country has access to a larger scope of R&D resources if it can acquire these services from abroad. Understanding the total level of resources is crucial in estimating how much the UK economy invests in scientific knowledge.

Imports and international trade in R&D

There are two alternative sources of information for estimating R&D imports (and exports). GERD figures on R&D performed abroad, funded by domestic UK sectors (R&D performed in the UK funded by the rest of the world), provide a possible estimate of R&D imports (exports). An alternative source is the UK Balance of Payments (BoP) (*Pink Book*), which provides official estimates for the UK's international trade in services, including a separate category for R&D services' exports and imports. These are essentially based on quarterly and annual business surveys on International Trade in Services (ITIS). Although the definitions of R&D in Frascati and ITIS sources are identical, there are conceptual and practical differences between these sources which can lead to differences in values.

For the purposes of this analysis, stronger emphasis is placed on the internal consistency of the estimates by using the export and import figures implied by the FM R&D sources, subject to the adjustment for grants explained above. Full incorporation into the National Accounts will require the complete resolution of discrepancies between the BoP and ITIS figures and a better understanding of knowledge flows within multinational companies.

Resources

The estimation of total R&D resources in the economy builds on the estimates of R&D gross output, which is then added to estimates of R&D imports, taxes less subsidies on the R&D services provided (using data from the SUTs), and other intermediation margins (nil for R&D) that depict total supply at purchasers' prices. The results for 2004 are summarised in **Table 5**. Total resources are approximately £2 billion higher than gross output because of the inclusion of R&D imports.

Estimating R&D uses

Consistency with National Accounts methodology requires supply and demand for R&D to be fully balanced. Since the bridging methodology relies on a single main source, this condition is automatically imposed by equating total R&D uses to estimated total R&D supply. Uses of R&D are then apportioned to the various institutional sectors using the estimated ownership shares for each sector's output in Table 3. The results are provided in **Table 6**.

The total estimated use of R&D services by each sector is split by type of use. In the case of uses by the rest of the world, all uses fall into the export category. Estimates of intermediate consumption for each sector build on earlier estimates used in constructing R&D output. There is therefore no intermediate consumption of R&D services for purposes other than the production of R&D in the R&D sector. The residual uses within each sector are subsequently allocated to GFCF in the R&D knowledge asset. It is important to note that neither government nor NPISH undertake final consumption of R&D services in this analysis. This happens to be currently the case only for government, although NPISH are currently portrayed as final consumers of R&D services. The solution to this problem is to treat the use of R&D as investment, with the R&D asset contributing to an activity other than R&D, for example, health services for medical research. Further detail will be provided in future analysis.

R&D projects can extend over more than one accounting period. This implies that they should be treated as work in progress before completion. Because the knowledge arising from a research project follows continuously and can be used for other purposes, this article ignores any gestation lag times in R&D knowledge production, therefore excluding changes in inventories (work in progress) for R&D.

Table 5
Estimation of R&D output from Frascati R&D expenditure, 2004

£ million, current prices

	Corporations	General government	NPISH	All domestic sectors
Starting point: Frascati Manual intramural R&D expenditure	12,816	2,170	5,411	20,397
less software adjustment	*–550*	*0*	*0*	*–550*
equals: within scope R&D expenditure	12,267	2,170	5,411	19,848
plus adjustment for tangible fixed assets	*1,316*	*-36*	*–89*	*1,191*
equals: cost of R&D production excluding R&D IC	13,582	2,134	5,322	21,039
plus intermediate consumption (IC) of R&D in production of R&D	*72*	*39*	*2*	*113*
equals: R&D output at producers' prices	13,655	2,173	5,325	21,152
less subsidies on production	*–717*	*0*	*0*	*–717*
equals: R&D gross output at basic prices	12,938	2,173	5,325	20,435
plus taxes less subsidies on R&D services	*324*	*0*	*0*	*324*
equals: R&D gross output at purchasers' prices	13,262	2,173	5,325	20,760
plus imports of R&D	*1,421*	*583*	*0*	*2,004*
plus intermediation margins	*0*	*0*	*0*	*0*
equals: total R&D supply	14,683	2,756	5,325	22,764

Source: Author's calculations on a number of ONS sources

The impact of R&D capitalisation on the National Accounts

In order to incorporate a new set of estimates for R&D uses and resources in the accounts, it is necessary to perform a number of adjustments to the SUTs.

In the case of R&D services, the first step is to remove current estimates of R&D supply and uses, in order to avoid double-counting. However, further adjustments are required. Treating most of R&D uses as capital formation and estimating their value from independent Frascati sources has a number of impacts on the supply and use of other goods and services in the SUTs.

Avoiding non-market output double-counting

By measuring R&D output 'at cost', this article adopts a very similar methodology to that generally used for valuing the output of non-market producers, particularly at current prices. If R&D output by non-market producers is fully reflected in the National Accounts estimates, the revised non-market output estimates of R&D should not add to the total R&D output. All changes to total output should stem from the inclusion of own-account R&D. However, this does not appear to be the case, as **Table 7** shows.

Levels of R&D performed (FM definition) and produced by sector (as estimated above) are reported against those estimated in BB06. Since the split of R&D output in the National Accounts is not available by institutional sector, indicative values are estimated by apportioning the

Table 6
Estimates of uses of R&D services

£ million, current prices

	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total uses (= total resources)	16,066	17,069	18,366	19,320	20,046	21,608	21,991	22,764	24,700
Uses by corporations	8,874	9,244	10,062	10,561	10,527	11,049	10,892	11,702	12,309
Intermediate consumption	45	57	76	77	66	96	96	72	88
Gross fixed capital formation	8,829	9,187	9,986	10,484	10,461	10,953	10,797	11,630	12,221
Uses by general government	2,707	2,726	2,762	2,922	2,512	2,543	3,228	3,440	3,474
Intermediate consumption	33	36	43	39	32	39	48	39	37
Gross fixed capital formation	2,673	2,690	2,719	2,883	2,480	2,503	3,180	3,401	3,438
Uses by NPISH	2,436	2,581	2,789	3,162	3,583	4,060	4,145	4,377	4,995
Intermediate consumption	1	2	2	3	2	3	3	2	2
Gross fixed capital formation	2,434	2,579	2,786	3,159	3,581	4,057	4,142	4,375	4,993
Uses by rest of world (exports)	2,050	2,518	2,754	2,675	3,424	3,956	3,725	3,244	3,922

Source: Author's calculations on a number of ONS sources

Table 7
Comparison of alternative R&D output estimates, by institutional sector, 2004

£ million, current prices

	Corporations	General government	NPISH	All domestic sectors
R&D FM gross expenditure	12,816	2,170	5,411	20,397
R&D gross output at basic prices (NA)[1] *(Estimates based on SUT total output)*	6,587	723	723	8,032
R&D gross output at basic prices *(Bridging methodology: satellite account)*	12,938	2,173	5,325	20,435
Difference: experimental satellite *less* NA	6,351	1,450	4,602	12,403
Difference: experimental satellite *less* FM	122	3	–86	38

Note:

1 Imputed across sectors on basis of R&D employment shares.

Source: ONS and author's calculations on a number of ONS sources

reported total, using R&D employment shares from the Inter-Departmental Business Register establishment data. These suggest that NPISH and general government accounted each for about 9 per cent of total R&D establishment employment. These shares are used to estimate the share of National Accounts R&D output that would theoretically correspond to each sector. The results for the business sector are as expected, with R&D basically doubling, which is consistent with the estimate from MA14 that about half of business intramural R&D expenditure is financed out of own funds. However, the results also suggest that R&D output in the government and NPISH sectors is substantially underestimated. Since the valuation methodologies for overall output should be near identical, the only plausible explanation is that government and NPISH output estimates for other goods and services include part of the costs allocated to R&D in the FM methodology. This implies that a negative adjustment should be made to the output of other products and services and, indirectly, to their associated uses, including final consumption.

Consumption of capital services of the new asset by non-market producers

While the above suggests that capitalisation of R&D implies no contribution to the revised GDP estimate from non-market producers of R&D, because of the identical basis for measurement 'at cost', an additional adjustment needs to be made to account for additional production in these sectors. The rationale for the upward adjustment stems from the fact that by introducing a new intangible asset in the system, the 'at cost' output of these institutions needs to recognise the cost of consuming part of that new asset. This adjustment is not required for market producers because the consumption of R&D services will be reflected (although not separately identified) in the economic profits (gross operating surplus) estimated directly or as a margin.

R&D knowledge stocks and services

The special treatment of consumption of R&D knowledge by non-market producers requires the upfront estimation of R&D knowledge stocks and their depreciation. This will also turn out to be useful in estimating the impact of knowledge accumulation on productivity growth, as discussed further below. There are three main steps required to estimate the services form the new R&D asset.

Deflation of R&D investment

In order to produce constant price series for R&D investment by sectors, it is necessary to calculate an appropriate R&D deflator. The deflators for various subcomponents of R&D expenditure were discussed in an earlier section and the results are summarised in **Figure 1**.

The profile for R&D wages and salaries shows that labour is the most inflationary R&D input, while equipment prices exhibit negative growth, probably reflecting reductions in the cost of computers which are predominantly used for R&D. A steeper profile for the GDP deflator suggests that if the ratio of nominal BERD to GDP stays constant, its constant price equivalent should be increasing. This phenomenon is more accentuated if we look at the behaviour of the implied deflator for R&D output, which is broadly flat over the period. This Paasche chain-linked price deflator for R&D is calculated using estimated rentals of fixed assets instead of payments for new fixed assets. It is referred to as an implied deflator because it is derived from, and consistent with, a chain-linked Laspeyres volume index for R&D output. This article uses this deflator to estimate R&D output and investment volumes.

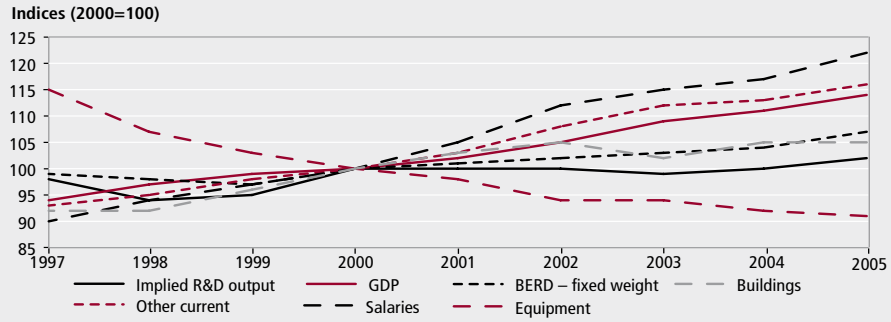
At this stage in the project, quality adjustments for R&D output have not been implemented. This is because the evidence on productivity growth trends in R&D appears to be mixed. In future work, deflation and productivity adjustments would have to be made at a lower level of aggregation, in order to reflect differences in R&D performance across activity sectors in terms of technology, but also market structure. It is plausible that some of the productivity gains could be captured by the R&D workforce, and R&D employers may agree to pay higher wages to retain their control over the knowledge asset.

Compilation of R&D (scientific originals) stocks

Based on constant price series for R&D GFCF, a PIM model with a geometric depreciation rate is used to estimate R&D stocks at the end of each period. This is considered to be a reasonable approximation to the behaviour of the aggregate stock which would certainly exhibit a much more stochastic behaviour at the level of individual 'pieces' of knowledge. Following completion of an R&D project, many individual companies write off a project's costs if it has not been successful, while a successful outcome could in principle lead to the revaluation of the knowledge asset to a much higher level, reflecting the commercial value of the intellectual property. It is of course a subject for future investigation to test whether an aggregate geometric depreciation rate is a reasonable approximation to the knowledge asset value dynamics. Future revisions will also allow for in-year depreciation, as opposed to assuming instant depreciation at the end of each accounting period.

Implementing a PIM estimation of R&D stocks requires a number of assumptions about the depreciation of the stocks. This article applies a depreciation rate of 20 per cent for the business sector's R&D stock, which is consistent with a ten-year service life under a double-declining balance rate. This assumption fits with the upper bound of the estimates by Baruch and Sougiannis (1999) and Ballester *et al* (2004), and is close to the 24 per cent depreciation rate

Figure 1
Deflators for R&D expenditure, components and GDP



Source: Author's calculations on a number of ONS sources

estimated by Schankerman and Pakes (1986), based on patent renewal methods applied to the UK. However, a 2.5 per cent geometric depreciation rate, close to that of buildings, is adopted for assets owned by the government and NPISH sectors on the basis that it is likely to depreciate more slowly than knowledge owned by individual companies. This is due to systematic differences in the type of knowledge produced by non-market producers, which tends to be general as opposed to focused on specific applications. Furthermore, the use of a lower depreciation rate also contributes – in steady state – to a more conservative estimate of the contribution of R&D to non-market output.

The levels of R&D net stocks for corporate, government and NPISH sectors grow over the estimation period 1997 to 2004 at an average rate of 3, 1 and 7 per cent, respectively. Business and government stocks start from very similar levels, approximately £40 billion, while NPISH starts at about £35 billion in 2003 prices. Because of the acute differences in growth rates, the NPISH stock catches up and overtakes the government R&D stock.

Calculation of R&D capital services

Capital services of non-financial assets to the production process are not explicitly mentioned in the 1993 SNA. The OECD defines capital services as inputs that flow to production from a capital asset. For market producers that use their assets, their value is implicitly covered as part of the independently-estimated gross operating surplus. It consists of a return to capital (an opportunity cost), depreciation and a deduction for expected real holding gains. For R&D assets owned by non-market producers, consistency of treatment with other assets requires reflecting their consumption as part of non-market output, gross operating surplus (through capital consumption) and final use as final government or NPISH consumption. Because National Accounts assume a nil net operating surplus for non-market producers, capital services for these sectors are estimated to comprise only depreciation.

Summary of impacts on the 'goods and services account'

The analyses above have provided all the necessary building blocks to evaluate the joint impact of R&D capitalisation and using FM sources to estimate R&D resources and uses. The 'goods and services account' provides the basic framework on which to evaluate the new treatment of R&D as it balances total resources, from output and imports, against all possible uses. A summary of the impacts for the 2004 reference year is provided in **Table 8**. On the resource side, the bridging approach leads to an increase in R&D gross output above £12 billion. Because some of that increase is due to the reallocation of output from other goods and services (OGS) to R&D for non-market producers, a deduction of about £9 billion is imputed for the government and NPISH sectors. A net increase in the output of OGS follows from the inclusion of the consumption of £4 billion of R&D capital services by these sectors. Finally, a small deduction applies to imports reflecting the use of an FM-derived measure as opposed to the BoP figure in the National Accounts.

The impact on demand is split over a wider number of categories. The adjustments to avoid double-counting of non-market output are reflected in reductions in intermediate consumption of OGS and final consumption of government and NPISH, marked as double-counting adjustments. Capitalisation raises R&D investment from zero to close to £20 billion, reflecting cuts to R&D intermediate consumption, identification of own-account R&D output and reductions to final consumption of non-market sectors. Adjustments are also made to eliminate work in progress for R&D in the National Accounts and to record exports from FM sources as opposed to BoP data. By construction, these adjustments not only balance total supply and demand, but also uses and resources by product. To estimate the adjustments to OGS on the supply and use sides, this article imposes the constraint that non-market GVA only increases by the value of R&D capital consumption in the government and NPISH sectors. Further analysis will be required to allow for market output by non-market producers.

Impacts on key economic indicators

This article focuses on a number of key economic indicators to summarise the impact of the capitalisation methodology on the National Accounts. GDP is the headline indicator of economic activity and a primary focus of attention.

Table 9 shows that the overall impact on the current level of GDP ranges from 1.5 to 1.2 per cent, with a slight negative trend over the period. The market sector is responsible for almost two thirds of the overall impact, ranging between 0.8 and 1.1 per cent of GDP. Another economic indicator of interest is the net domestic product (NDP) which equals GDP less consumption of fixed capital. Because business-owned R&D knowledge is a relatively fast-depreciating asset, the impact on NDP is quite small and, in 2004, even negative. Although it may be of concern that R&D has limited direct impact on nominal NDP, which if expressed in real consumption terms is an indicator of the sustainability of consumption opportunities, it should also be noticed that this analysis does not capture the impact of R&D spillovers on such opportunities.

R&D intensity indicators

Many users will also find of interest how the R&D capitalisation methodology impacts on the headline R&D intensity indicator. The results are provided in **Table 10**. The headline GERD to GDP ratio is only affected by changes to the denominator, but the impact is barely noticeable. The new methodology enables the estimation of new R&D indicators that can help provide new insights on the R&D intensity of the UK economy, one of which is a genuine R&D investment share, defined as the proportion of GDP that goes to R&D GFCF.

Table 10 also documents a significant

Table 8
Summary of impacts on the goods and services account, 2004

£ million, current prices

Resources		Uses	
R&D output	12,403	R&D intermediate consumption	–5,274
Output of other goods and services (OGS) (double-counting)	–9,089	Intermediate consumption OGS (double-counting)	–1,363
Output of OGS from non-market consumption of R&D capital services	4,216	R&D gross fixed capital formation	19,407
R&D imports (adjustment from BoP to FM sources)	197	Gross fixed capital formation (other assets)	0
		Changes in inventories (elimination of work in progress)	12
		Final consumption of R&D by NPISH (elimination)	–325
		Final consumption of OGS by NPISH (double-counting)	–5,084
		Final consumption of services from R&D capital by NPISH	1,776
		Government final consumption of OGS (double-counting)	–2,641
		Final consumption of services from R&D capital by government	2,440
		R&D exports (adjustment from BoP to FM sources)	–1,219
Total supply of R&D	12,600	Total demand of R&D	12,600
Total supply of OGS	–4,873	Total demand of OGS	–4,873
Total supply	**7,727**	**Total demand**	**7,727**

Source: Author's calculations on a number of ONS sources

revision to the investment intensity of the UK economy. The share of GFCF over GDP increases by approximately 1.5 percentage points, as R&D now counts for about 9 per cent of total gross investment. This is also reflected in an increase in value of a profit indicator, namely the share of operating surplus (here including mixed income) relative to GDP, and the share of gross savings relative to national disposable income. The impact on both magnitudes is positive at around 1 to 2 percentage points. Capitalisation of R&D expenditure increases relative profits, investment and savings.

Volume GDP growth and impacts on productivity growth

The approach adopted here to evaluate the impact on volume GDP growth calculates a volume index for the net addition to GDP using the R&D implied deflator. The 'new' GDP volume index is a Laspeyres chained-linked index of BB06 GDP volume index (ONS code YBEU) and the estimated adjustment volume index, using their respective nominal shares in the lagged 'new' current price GDP as weights. Annual volume GDP growth is only revised from an average of 2.93 per cent over 1997 to 2004 in *Blue Book* 2006 to 2.91 per cent, while money-GDP growth is revised from 5.46 to 5.41 per cent.

Growth accounting

A final question of interest is how much R&D accumulation has contributed to productivity growth. Growth accounting is a technique designed to attribute changes in the volume of GDP to changes in the volume of various inputs. A weighted index of inputs can be derived to estimate a measure of multi-factor productivity growth, based on the assumption that the contributions of each input are proportional to their share in national income. Although this relies on strong assumptions about the competitive nature of the economy and its production opportunities, it is a powerful tool for analysis (ONS 2007). Failure to control for particular inputs can imply that the growth rate of output steers away from the aggregate growth of inputs and is counted as residual productivity growth. Thus the question is how much capitalising R&D, as set out in the SNA revision, can help reduce this gap.

Additional analysis on this issue has drawn on data reported by Goodridge (2007), also based on *Blue Book* 2006. Over the period, constant price GVA (excluding dwellings) grows at an average rate of 2.8 per cent. Accumulation of other

Table 9
Summary of impacts on current product (GDP)

£ million, current prices

	Gross domestic product (GDP)					Net domestic product (NDP)				
	Blue Book 2006	Satellite account (market only)	Percentage change	Satellite account (all sectors)	Percentage change	Blue Book 2006	Satellite account (market only)	Percentage change	Satellite account (all sectors)	Percentage change
1997	811,194	820,472	*1.144*	823,758	*1.549*	719,259	720,511	*0.174*	720,511	*0.174*
1998	860,796	870,110	*1.082*	873,368	*1.461*	765,745	767,161	*0.185*	767,161	*0.185*
1999	906,567	916,233	*1.066*	919,620	*1.440*	805,512	806,954	*0.179*	806,954	*0.179*
2000	953,227	963,456	*1.073*	967,125	*1.458*	846,855	848,074	*0.144*	848,074	*0.144*
2001	996,987	1,007,165	*1.021*	1,010,958	*1.401*	886,553	887,414	*0.097*	887,414	*0.097*
2002	1,048,767	1,059,404	*1.014*	1,063,311	*1.387*	932,760	933,850	*0.117*	933,850	*0.117*
2003	1,110,296	1,120,428	*0.913*	1,124,437	*1.274*	991,057	991,436	*0.038*	991,436	*0.038*
2004	1,176,527	1,186,479	*0.846*	1,190,695	*1.204*	1,048,100	1,047,990	*–0.010*	1,047,990	*–0.010*

Source: Author's calculations on a number of ONS sources

Table 10
Indicators of R&D intensity and impact of R&D capitalisation on key economic ratios

	GERD/GDP		R&D GFCF/ GDP	GFCF/GDP		Gross operating surplus/GDP		Gross saving/gross national disposable income	
	BB06	Satellite	Satellite	BB06	Satellite	BB06	Satellite	BB06	Satellite
1997	0.018	0.018	0.017	0.165	0.179	0.341	0.351	0.170	0.185
1998	0.018	0.018	0.017	0.176	0.190	0.329	0.338	0.177	0.192
1999	0.019	0.018	0.017	0.172	0.187	0.319	0.329	0.157	0.171
2000	0.019	0.018	0.017	0.169	0.184	0.307	0.317	0.150	0.165
2001	0.018	0.018	0.016	0.166	0.180	0.303	0.313	0.150	0.164
2002	0.018	0.018	0.016	0.165	0.180	0.311	0.321	0.151	0.165
2003	0.018	0.018	0.016	0.161	0.175	0.317	0.326	0.149	0.163
2004	0.017	0.017	0.016	0.165	0.180	0.322	0.330	0.151	0.164

Source: ONS and author's analysis of various sources

capital assets accounts for 1.4 per cent and quality-adjusted labour for 0.8 per cent. R&D accumulation only contributes 0.05 per cent to observed GVA growth, which is mostly the result of a particularly low income share of less than 1 per cent and an average growth of 2 per cent. Thus, the contribution of R&D accumulation to growth is minimal over this period. This result should be interpreted with caution, as the growth accounting exercise only considers the direct contribution from 'owned' R&D knowledge. To the extent that economic performance also depends on the stock of freely available knowledge, the growth accounting exercise can lead to an underestimation of the real contribution of scientific knowledge to growth.

Conclusions and future work

This article has documented the assumptions and methods underpinning a preliminary analysis of the capitalisation of R&D services in the National Accounts, in line with the proposed revision to the 1993 SNA. A bridging approach between Frascati sources and National Accounts methods is considered to be the best practical approach to constructing a new set of satellite accounts. The results suggest that R&D accounts for a substantial part of investment in the economy and that the value of goods and services produced in the economy is higher than estimated by conventional methods. Because investment in R&D has remained fairly stable in recent years, capitalising R&D has no significant impacts on the estimated rate of GDP growth.

The methods and results discussed in this article raise a number of questions that ONS will seek address in the near future. Key priorities for further research include:

- estimating R&D output and consumption by sector of activity, in order to improve consistency and provide the basis for detailed Supply-Use, Input-Output analysis
- investigating in more detail the cost structure of R&D in the non-market sectors and the implications for non-market output and productivity
- exploring the relationship between funding and ownership, identifying the value of grants for R&D
- estimating the statistical distribution of service lives for knowledge assets by type of research and sector of activity
- comparing 'at cost' estimates of R&D knowledge stocks with market valuations of scientific intellectual property
- reconciling different sources on international trade in R&D services and related intellectual property transactions
- updating results with more recent figures and back-casting to provide longer time series and analysis, while assessing the availability of short-term indicators

ONS will also contribute to discussions on the implementation of the SNA revisions, feeding back the views and needs of its users, through its membership of the OECD and Eurostat Task Forces currently being put in place. These will provide more detailed methodological guidance and recommend further development of the underlying statistical sources required to produce satellite accounts.

Notes

1 The Frascati Manual (FM) owes its name to the Italian town where OECD experts in R&D statistics met for the first time in 1963 to set out standard practice on R&D surveys. Over the last 40 years, the FM has been revised on several occasions in order to address emerging challenges to the measurement of human and financial resources devoted to R&D.

2 Currently, it is only when R&D is consumed by non-market producers or by the rest of the world that R&D contributes directly to GVA and GDP. For example, government health expenditure includes expenditure on medical R&D. This is part of non-market health output which is accounted for as government final consumption. R&D also contributes directly to GDP through is impact on the trade position. Since the UK delivers more R&D services to, than it buys from, the rest of the world, the net impact is positive.

3 To reconcile this approach with observed transactions on scientific intellectual property such as patent licensing, the SNA dictates that the capital accounts should include the category of patented entities. These are deemed to be non-produced, intangible assets, as opposed to other produced intangible assets such as mineral exploration rights or artistic originals. In other words, the 1993 SNA decided that there should be no 'scientific originals' within the production boundary, although it agreed that satellite accounts could potentially document on an experimental basis the alternative capitalisation treatment.

4 The 'other changes in the volume of assets' account registers new patents without recording matching liabilities, and writes them off as they expire – as it does when other non-produced assets such as natural resources are depleted. These changes are not related to economic transactions and are difficult to document. Like most other

countries, the UK does not produce this type of accumulation account.

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FEATURE

New LFS questions on economic inactivity

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SUMMARY

The Labour Force Survey introduced two new questions in spring 2005 to find out if someone who is currently inactive is likely to work in the future and when this might be. The reason for adding these new questions is to collect more information from people who are currently inactive on their propensity to work in the future. It is then possible to look at whether these intentions are reflected in their labour market activity, using the longitudinal LFS data sets.

This article gives an indication of the suitability of these new questions and investigates the characteristics of those inactive people who say they think they will definitely work in the future.

The Labour Force Survey (LFS) is a quarterly sample survey of approximately 56,000 households living at private addresses in Great Britain. The survey asks respondents questions about their personal circumstances, of which some determine their economic status. This then identifies if they are active or inactive in the labour market.

This article is the latest in a series of articles on inactivity carried out by the labour market division (see **Box 1**). These earlier articles provide background information on the characteristics of inactive people and then more focused analysis on particular subgroups of interest.

The 2002 Labour Market Framework Review specifically highlighted the importance of getting better information on 'potential' labour supply and labour market slack to improve our understanding of the labour market. This, along with the greater policy focus on reducing inactivity and the links with boosting economic performance, have resulted in the development of a new suite of questions introduced on the LFS in spring 2005. The development of these questions involved qualitative research on the four existing questions on the results inactivity; a technical article summarised the results (Guinea and Betts 2003). See **Box 2** for the complete questions.

Box 1

Previous articles on economic inactivity published in *Labour Market Trends*

Previous *Labour Market Trends* inactivity articles have covered:

- economic inactivity and the labour market, February 2002
- the economically inactive who look after the family or home, June 2002
- patterns of economic activity in older men, June 2002
- economic inactivity in selected countries, November 2002
- the role of working age benefits data in understanding labour supply, July 2003
- life stages of economic inactivity, October 2003, and
- economic inactivity among students, December 2003

Box 2

New LFS questions on inactivity

FUTWK
"Do you think you will work in the future?"
1. Definitely
2. Probably
3. Probably not
4. Definitely not
5. Don't know/can't say

FWKWEN
"When do you think this might be…?"
1. Within the next year
2. More than one year but less than five
3. More than five years
4. Don't know

Economic inactivity

Individuals who are not in work, but do not satisfy all the criteria for ILO unemployed (wanting a job, seeking in the last four weeks and available to start in the next two weeks) are classified as inactive (see **Figure 1**). Clearly, inactivity covers a range of personal circumstances; some of those classed as inactive may have the potential of moving into employment, and it is of interest to try to identify these individuals. For example, a student who does not want a job, or a parent looking for work but unable to start as they cannot find appropriate childcare, are both classed as inactive as is someone who would like to work, but believes there are no suitable jobs available.

Economic inactivity and unemployment

Trends in inactivity and unemployment over the period March 1997 to July 2007 are shown in **Figure 2**. This shows the number of people who are inactive or unemployed as a percentage of the working population (16 to 64 for men and 16 to 59 for women). The inactivity rate for all persons remains relatively constant at around 21.2 per cent, with an increase for men (15.3 per cent to 16.5 per cent) and a decrease for women (28.2 per cent to 26.3 per cent), between March 1997 and July 2007. The unemployment rate for all persons fell from 7.3 per cent to 5.5 per cent over the same period. The trend is the same for both men and women.

Reason for economic inactivity

Respondents are asked several LFS questions to determine their main reason for being economically inactive. The patterns for men and women are very different. **Table 1** gives a gender comparison for economic inactivity by reason. The most common reason for inactivity among women is looking after family/home, at 45.1 per cent; however, this reason only accounts for 6.1 per cent of inactive men. Of inactive men, long-term sick is the most common reason for inactivity, at 35.6 per cent

Economic inactivity and age

Figure 3 shows the proportion of each age group that are inactive for the period March 1997 to July 2007. It shows an increase in inactivity among 16 to 17 year olds, where over half this age group are inactive. A large proportion of this group will be students, with the rise over time largely due to increased participation in further education. There has been a fall in the inactivity rate of the 54 to 59/64 year olds over the period to approximately 26.8 per cent.

Figure 1
Classification of employed, unemployed and economically inactive people in the LFS

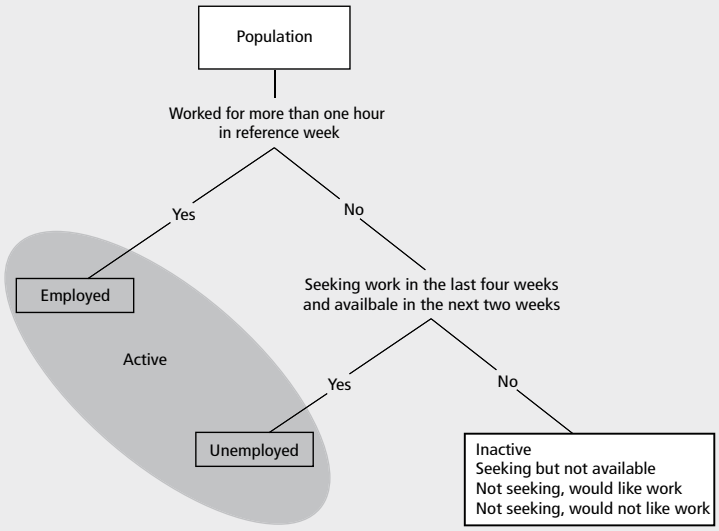
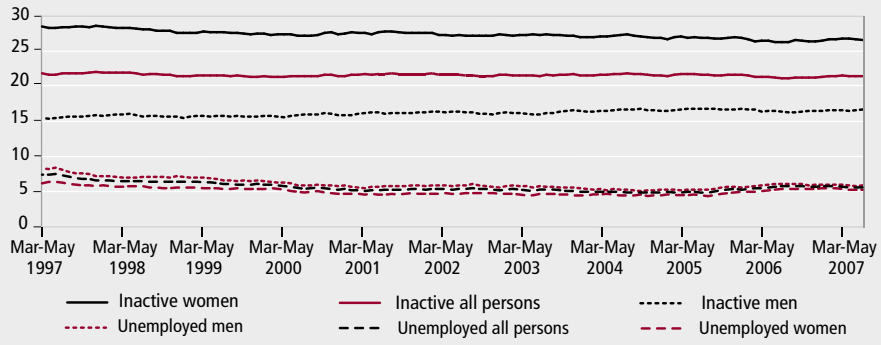


Figure 2
Working age inactivity and unemployment rates, March 1997 to July 2007,[1] seasonally adjusted

United Kingdom
Percentages



Note:

1 Rolling three-month averages.

Source: Labour Force Survey

New questions analysis

The following analysis of the new questions is based on results from the LFS microdata. The microdata are weighted to population estimates published by the Office for National Statistics in February and March 2003, whereas the LFS headline series shown in the previous section of this article incorporate more recent population estimates (published in August and September 2006).

An average of four consecutive quarters have been calculated from the microdata for July to September 2006, October to December 2006, January to March 2007 and April to June 2007, to avoid any seasonality, giving an average for the year to June 2007. The results of the first new question on the likelihood of working in the future are given in **Table 2**. Over half of all respondents said they would definitely or probably work in the future.

In **Table 3**, 95.3 per cent of students think they will definitely work in the future, as do 46.5 per cent of those looking after the family and home. Of the temporary/long-term sick, 43.3 per cent say they think they definitely won't work in the future.

Those who definitely intend to work in the future

It is of great interest to identify the characteristics of the inactive respondents who say they will definitely work in the future. These could feasibly be considered

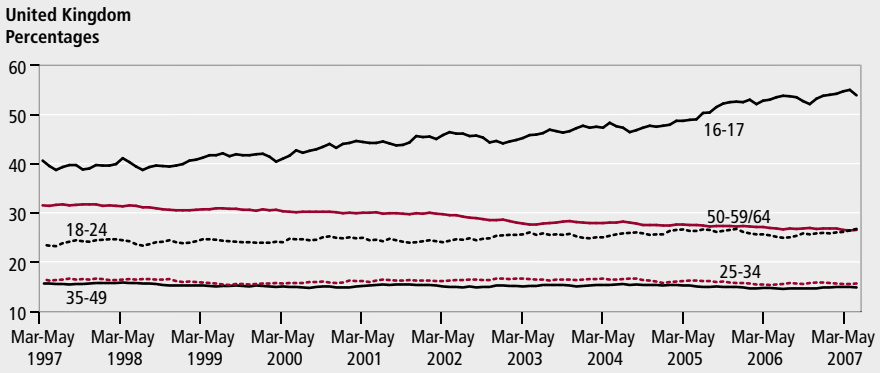
Table 1
Economic inactivity: by reason, May to July 2007

United Kingdom | Thousands and percentages, seasonally adjusted

	Student	Looking after family/home	Temporary sick	Long-term sick	Discouraged workers	Retired	Other	All aged 16 to 59/64
Thousands								
Men	958	197	89	1,144	23	459	346	3,215
Women	929	2,137	106	912	16	165	474	4,738
All persons	1,887	2,333	195	2,056	39	624	820	7,953
Percentage of economically inactive								
Men	*29.8*	*6.1*	*2.8*	*35.6*	*0.7*	*14.3*	*10.8*	*100.0*
Women	*19.6*	*45.1*	*2.2*	*19.2*	*0.3*	*3.5*	*10.0*	*100.0*
All persons	*23.7*	*29.3*	*2.4*	*25.8*	*0.5*	*7.8*	*10.3*	*100.0*

Source: Labour Force Survey

Figure 3
Economic inactivity rates: by age, March 1997 to July 2007[1], seasonally adjusted



Note:

1 Rolling three-month averages.

Source: Labour Force Survey

to be the closest group to the labour force. This category accounted for over 40 per cent of all the inactive people's responses. **Table 4** displays the number of responses broken down by age group and sex, as thousands and percentages. Unsurprisingly, an extremely high proportion for both sexes are aged 16 to 19 or 20 to 24; in general, moving up though the age groups, the fewer people say they will work in the future. This is likely to be due to the combined effect that young people are definitely likely to work in the future as they have their whole working life ahead of them, and the fact that a large proportion of these age groups are students.

Table 2
Economically inactive people of working age: by whether they think they will work in the future, 2007[1]

United Kingdom | Thousands and percentages

	Definitely will work in future	Probably will work in future	Probably won't work in future	Definitely won't work in future	Don't know can't say	Total[2]
Thousands						
Men	1,214	310	302	910	312	3,101
Women	2,182	809	350	826	465	4,688
Total	3,396	1,119	652	1,736	778	7,789
Percentages[3]						
Men	*39.8*	*10.2*	*9.9*	*29.9*	*10.2*	*100.0*
Women	*47.1*	*17.5*	*7.5*	*17.8*	*10.0*	*100.0*
Total	*44.2*	*14.6*	*8.5*	*22.6*	*10.1*	*100.0*

Notes:

1 Average of 12 months ending June 2007.

2 Includes people who did not state whether they think they will work in the future.

3 Base excludes people who did not state whether they think they will work in the future.

Source: Labour Force Survey

Figure 4 shows the breakdown for those economically inactive who think they will definitely work in the future, by main reason for being inactive. This can be compared with the breakdown for the total economically inactive. The key difference is that of the total inactive who said they thought they would definitely work in the future, over 50 per cent are students and only 10.1 per cent are temporary/long-term sick.

The observation that students make up such a large proportion of those who think they will definitely work in the future is not surprising, since students are likely to join the labour market once completing their studies.

Those who definitely intend to work in the future, excluding students

For the reason that a large proportion of students definitely intend to work in the future, they have been excluded from the following analysis of identifying the characteristics of those most likely to join or rejoin the labour market. After students, the next largest inactive group is those looking after the family/home, accounting for approximately 45.8 per cent of inactive women who think they will definitely work in the future and 31.5 per cent of all inactive people who think they will definitely work in the future. The LFS collects information on the main reason for respondents classifying themselves as looking after family/home. **Figure 5** shows this breakdown of inactive people who think they will definitely work in the future, where 74.1 per cent say they are currently inactive because they are caring for a child below school age. This is driven by inactive women, as men make up only a small part of the looking after the family/home group.

Table 3
Economically inactive people of working age: by reason for inactivity and whether they think they will work in the future, 2007[1]

United Kingdom Percentages

	Student	Looking after family/home	Temporary/ long-term sick	Other reason	Total
Definitely will work in future	*95.3*	*46.5*	*10.6*	*26.7*	*44.2*
Probably will work in future	*3.4*	*25.1*	*14.8*	*11.2*	*14.6*
Probably won't work in future	*0.2*	*7.2*	*13.6*	*13.5*	*8.5*
Definitely won't work in future	*0.3*	*10.5*	*43.3*	*39.2*	*22.6*
Don't know/can't say	*0.7*	*10.7*	*17.7*	*9.3*	*10.1*
Total	***100.0***	***100.0***	***100.0***	***100.0***	***100.0***

Note:

1 Average of 12 months ending June 2007.

Source: Labour Force Survey

Table 4
Economically inactive people who think they will definitely work in the future: by age, 2007[1]

United Kingdom Thousands and percentages

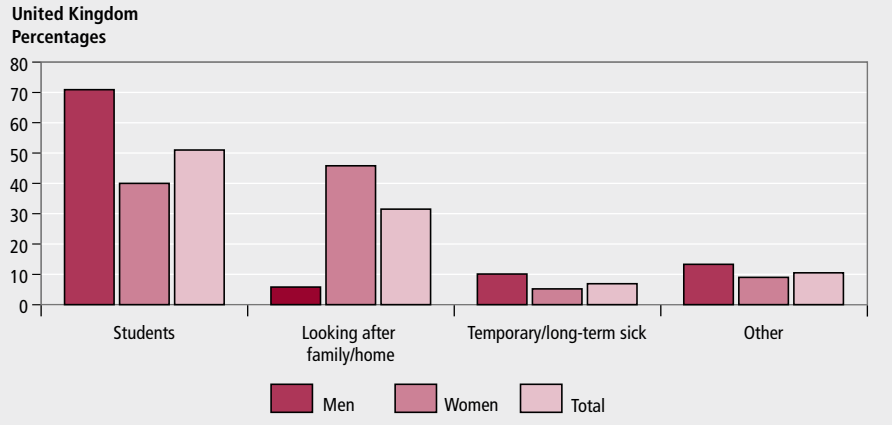
	16–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	All aged 16–59/64
Thousands											
Men	620	257	81	55	57	47	38	23	21	14	1,214
Women	598	413	294	285	274	172	79	43	23	-	2,182
Total	1,219	670	374	340	331	219	117	66	44	14	3,396
Percentages											
Men	*51.1*	*21.2*	*6.6*	*4.5*	*4.7*	*3.9*	*3.1*	*1.9*	*1.7*	*1.2*	*100.0*
Women	*27.4*	*18.9*	*13.5*	*13.1*	*12.6*	*7.9*	*3.6*	*2.0*	*1.1*	-	*100.0*
Total	*35.9*	*19.7*	*11.0*	*10.0*	*9.8*	*6.4*	*3.5*	*1.9*	*1.3*	*0.4*	*100.0*

Note:

1 Average of 12 months ending June 2007.

Source: Labour Force Survey

Figure 4
Economically inactive people who think they will definitely work in the future: by reason for inactivity and sex, 2007[1]



Note:

1 Average of 12 months ending June 2007.

Source: Labour Force Survey

Highest qualifications of those who definitely intend to work in the future

Table 5 again removes the student bias when looking at the breakdown of inactive people who think they will definitely work in the future, by highest qualification, by including a total excluding students. In comparison with the breakdown of all inactive people, those who think they will definitely work in the future have higher qualifications. The proportion of the total economically inactive having no qualifications is high, at 28.9 per cent, and when students are excluded this figure rises to 33.0 per cent.

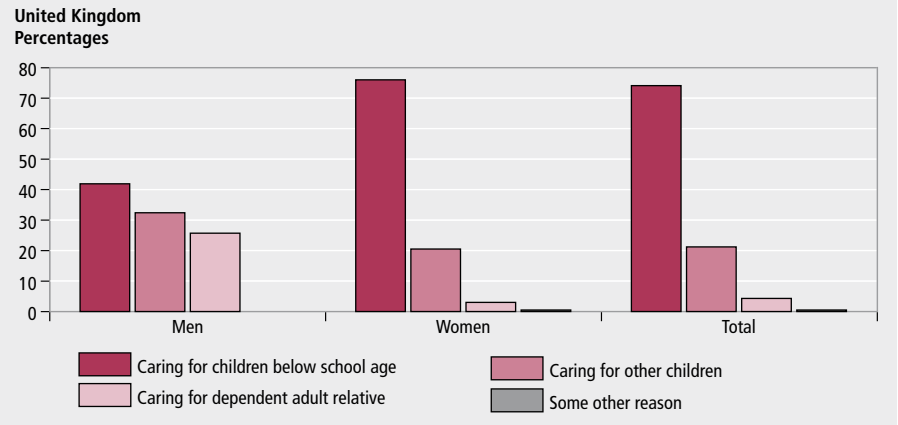
In contrast, the proportion of those inactive people with no qualifications who definitely intend to work in the future is much lower, at 17.5 per cent (and 20.1 per cent when students are excluded). For the looking after the family/home group, GCSE or equivalent had the biggest share of those who think they will definitely work in the future.

Last job characteristics of those who definitely intend to work in the future

As well as personal characteristics, the LFS can be used to investigate the last job characteristics to determine any links between previous and future attachment to the labour market. **Table 6** looks at when a respondent last had a paid job, and also identifies those who have never had a paid job. As students are a special case, figures are presented as percentages both including and excluding students.

From Table 6 there is evidence that those inactive people who have had a paid job most recently are the ones who have the greatest intention to work in the future. The category 'never had a paid job' has the highest proportion; this total, however, is skewed by students who have not had a job before. Excluding students, the category one to five years has the highest proportion of inactive people who think they will definitely work in the future (37.6 per cent).

Figure 5
Inactive people looking after family home who think they will definitely work in the future: by main reason for inactivity, 2006[1]



Note:

1 October to December.

Source: Labour Force Survey

Focusing on the inactive group looking after the family and home, a lower percentage of those who think they will definitely work in the future had never had a job before, 15.0 per cent, compared with the whole looking after the family/home inactive group, where 19.8 per cent had never had a paid job. There is likely to be a link with life stages, as older people are much more likely to have had a job, and these older inactive people could be in the long-term sick group.

Comparison with other LFS questions on economic inactivity

Before the introduction of these new questions, analysts only had the LFS question 'would you like to work at the moment' to try and gauge an inactive person's intention to work in the future. This question is asked only to the inactive not seeking a job, as it is assumed that all those who are seeking a job (but are not able to start) would like to work at the moment. Approximately 74 per cent of the economically inactive said that they would not like a job at the moment. There is an apparent contradiction between the results of this question and the future work question. This is likely to be due to the clause 'at the moment'. From **Figure 6**, it can be seen that a large number of people replied that they would definitely work in the future, despite answering no to the question 'would you like work at the moment'. This suggests that the future work question is a better way of catching those individuals who are likely to work in the future, perhaps when their personal circumstances change.

Table 7 shows further analysis of the supposed contradictory group (the largest bar in Figure 6), those who do not want a job at the moment but definitely intend to work in the future. The figures are displayed as percentages that represent the proportion of a particular age/sex group who are inactive: for example, 56.7 per cent of the 16 and 17 year old inactive men answered the questions in this way. A large proportion of the men are in the two youngest age groups. This is the also true for women, although there are a lot more women intending to work in the future in the age groups up to 39 as well.

For those who think they will work, when in the future do they think this will be

The two new questions can be combined into subgroups. These responses are summarised in **Table 8**. The percentages in the lower part of the table represent the number in each subgroup as a proportion of the total number who answered the question. There, the total is just the overall breakdown of the responses to the second inactivity question, when in the future they think they will work.

The largest individual subgroups are 'definitely won't work in the future' accounting for 22.6 per cent and 'definitely will work in the future – between one and

Table 5
Economically inactive people of working age: by highest qualification, 2007[1]

United Kingdom Percentages[2]

	Degree or equivalent	Higher education	GCE A level or equivalent	GCSE grades A-C or equivalent	Other qualifications	No qualification	Total
Economically inactive people who think they will definitely work in the Future							
Students	*7.8*	*2.9*	*36.7*	*30.7*	*6.8*	*15.0*	*100.0*
Looking after family/home	*10.8*	*5.1*	*15.3*	*31.8*	*17.2*	*19.8*	*100.0*
Temporary/long-term sick	*6.4*	*6.2*	*19.9*	*27.7*	*16.5*	*23.2*	*100.0*
Other	*16.7*	*4.9*	*19.4*	*23.7*	*16.5*	*18.7*	*100.0*
Total	*9.6*	*4.1*	*27.0*	*30.1*	*11.8*	*17.5*	*100.0*
Total excluding students	*11.4*	*5.2*	*16.8*	*29.5*	*16.9*	*20.1*	*100.0*
All economically inactive people							
Students	*7.8*	*2.9*	*36.0*	*30.5*	*7.3*	*15.5*	*100.0*
Looking after family/home	*8.9*	*4.7*	*12.8*	*26.9*	*17.0*	*29.7*	*100.0*
Temporary/long-term sick	*4.5*	*4.9*	*15.8*	*16.1*	*14.4*	*44.3*	*100.0*
Other	*18.6*	*8.4*	*20.2*	*19.4*	*12.1*	*21.3*	*100.0*
Total	*9.1*	*5.0*	*20.5*	*23.3*	*13.1*	*29.1*	*100.0*
Total excluding students	*9.5*	*5.6*	*15.7*	*21.1*	*14.9*	*33.2*	*100.0*

Note:

1 Average of 12 months ending June 2007.
2 Base excludes people who did not know their qualifications.

Source: Labour Force Survey

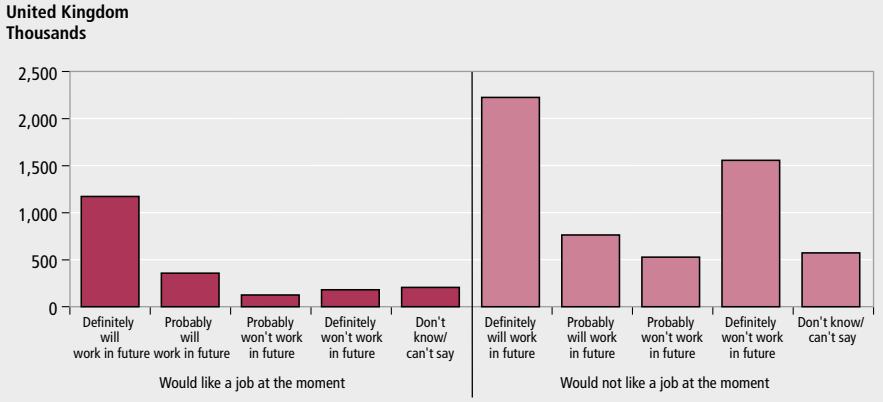
Table 6
Economically inactive people: by time since last paid job, 2007[1]

United Kingdom Percentages

	Less than 1 year	1 year but less than 5 years	5 years or more	Never had a paid job	Total
Economically inactive people who think they will definitely work in the future					
Students	*10.0*	*7.3*	*1.9*	*80.8*	*100.0*
Looking after family/home	*12.6*	*41.2*	*31.3*	*15.0*	*100.0*
Temporary/long-term sick	*23.5*	*40.0*	*24.4*	*12.1*	*100.0*
Other	*35.7*	*25.3*	*10.9*	*28.0*	*100.0*
Total	*14.4*	*22.2*	*13.7*	*49.8*	*100.0*
Total excluding students	*19.0*	*37.6*	*26.0*	*17.3*	*100.0*
All economically inactive people					
Students	*9.7*	*7.4*	*2.1*	*80.8*	*100.0*
Looking after family/home	*8.5*	*30.4*	*41.3*	*19.8*	*100.0*
Temporary/long-term sick	*6.3*	*22.4*	*57.8*	*13.5*	*100.0*
Other	*20.5*	*33.6*	*30.2*	*15.7*	*100.0*
Total	*10.4*	*23.3*	*34.8*	*31.5*	*100.0*
Total excluding students	*10.6*	*28.2*	*44.8*	*16.5*	*100.0*

Note:
1 Average of 12 months ending June 2007.
Source: Labour Force Survey

Figure 6
Economically inactive people and likelihood to work split: by whether they would like work at the moment, 2007[1]



Note:
1 Average of 12 months ending June.
Source: Labour Force Survey

five years', at 22.5 per cent.

Again, these responses can be combined with the reason given for inactivity. Displayed in **Table 9** are the additional time periods for when those who think they will definitely work in the future think this is likely to be. Unsurprisingly, a large proportion of students fall into either the 'definitely – within the next year' or 'definitely – more than one year but less than five years' categories. Of the other category, 19.2 per cent think they will definitely work within the next year. Of those looking after the family/home, 25.7 per cent said they thought they would definitely work in one to five years' time.

Conclusion

This article has highlighted the potential of two new LFS questions to assess an inactive person's likelihood of becoming

Table 7
Economically inactive people of working age, who don't want work at the moment but think they will definitely work in the future: by age and sex, 2007[1]

United Kingdom Thousands and percentages

	16–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	All aged 16–59/64
Thousands											
Men	*449*	*188*	*47*	*25*	*26*	*22*	*16*	*8*	*8*	*4*	*792*
Women	*443*	*292*	*187*	*181*	*171*	*94*	*36*	*19*	*9*	*--*	*1,432*
Total	*891*	*480*	*234*	*206*	*197*	*117*	*51*	*27*	*17*	*4*	*2,224*
Percentages											
Men	*56.7*	*23.7*	*6.0*	*3.1*	*3.2*	*2.8*	*2.0*	*1.0*	*1.0*	*0.5*	*100.0*
Women	*30.9*	*20.4*	*13.0*	*12.7*	*12.0*	*6.6*	*2.5*	*1.3*	*0.6*	*--*	*100.0*
Total	*40.1*	*21.6*	*10.5*	*9.3*	*8.9*	*5.3*	*2.3*	*1.2*	*0.8*	*0.2*	*100.0*

Note:
1 Average of 12 months ending June 2007.
Source: Labour Force Survey

Table 8

Economically inactive people of working age: by whether they think they will work in the future, 2007[1]

United Kingdom — Thousands and percentages

	Within the next year	More than 1 year but less than 5 years	More than 5 years	Don't know	Total[1]
Thousands					
Definitely will work in future	1,121	1,730	307	237	3,396
Probably will work in future	206	510	173	230	1,119
Probably won't work in future	--	--	--	--	652
Definitely won't work in future	--	--	--	--	1,736
Don't know/can't say	--	--	--	--	778
Total[1]	1,342	2,283	508	1,156	7,789
Percentages[2]					
Definitely will work in future	*14.6*	*22.5*	*4.0*	*3.1*	*44.2*
Probably will work in future	*2.7*	*6.6*	*2.3*	*3.0*	*14.6*
Probably won't work in future	--	--	--	--	*8.5*
Definitely won't work in future	--	--	--	--	*22.6*
Don't know/can't say	--	--	--	--	*10.1*
Total	*25.4*	*43.2*	*9.6*	*21.9*	*100.0*

Notes:

1 Average of 12 months ending June 2007.
2 Includes people who did not state whether and/or when they think they will work in the future.
3 Base excludes people who did not state whether and/or when they think they will work in the future.

Source: Labour Force Survey

Table 9

Economically inactive people of working age: by reason for inactivity and whether they think they will work in the future, 2007[1]

United Kingdom — Percentages

	Student	Looking after family/home	Temporary/ long-term sick	Other reason	Total
Definitely will work in future	*95.3*	*46.5*	*10.6*	*26.7*	*44.2*
Within the next year	*24.2*	*12.4*	*6.2*	*19.2*	*14.6*
More than 1 year but less than 5 years	*55.8*	*25.7*	*2.8*	*4.7*	*22.5*
More than 5 years	*10.1*	*5.0*	*0.2*	*0.4*	*4.0*
Don't know	*5.2*	*3.4*	*1.4*	*2.4*	*3.1*
Probably will work in future	*3.4*	*25.1*	*14.8*	*11.2*	*14.6*
Probably won't work in future	*0.2*	*7.2*	*13.6*	*13.5*	*8.5*
Definitely won't work in future	*0.3*	*10.5*	*43.3*	*39.2*	*22.6*
Don't know/can't say	*0.7*	*10.7*	*17.7*	*9.3*	*10.1*
Total	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*

Note:

1 Average of 12 months ending June 2007.

Source: Labour Force Survey

economically active in the future. As well as asking for their likelihood to work in the future, for the first time responses have a time element to uncover when in the future this is likely to be.

The main findings include:

- a large proportion (72 per cent) of people looking after the family/home think they will work in the future
- for the looking after family/home group, 26 per cent said they thought they would definitely work in the future in between one and five years' time
- of those economically inactive who think they will definitely work in the future, approximately 80 per cent have some qualifications
- with respect to years since last paid job, for all economically inactive, 39 per cent have had a paid job in the last five years compared with 57 per cent of those who think they will definitely work in the future

Future work

The new questions on inactivity introduced in the LFS in 2005 summarise people's intentions to work in the future. Work is planned to investigate using the longitudinal LFS questions as to whether these intentions are matched by actual labour market behaviour. Analysis will include looking at inactive individuals who said they expected to work within a year, and see how many are economically active a year later, and conduct further analysis on their characteristics.

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FEATURE

Volume of capital services: estimates for 1950 to 2006

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SUMMARY

Capital services are the measure of capital input that is suitable for analysing and modelling productivity. This article presents experimental capital services estimates for 1950 to 2006 for the whole economy, for the market sector, and for the non-oil sector. The latter is produced for both the whole economy and the market sector, facilitating macroeconomic analyses. Capital services estimates are also presented by eight asset types, expanded from the previous five asset breakdown, and also by detailed industry. Development work has enabled capital services to be published for purchased software and own-account software for the first time. Key features of the estimates in this article include the strong growth in capital services from computers and software in the late 1990s, the recent divergence of capital services and capital stock measures, and also much stronger growth in the service industries than in the production industries over recent years.

To enhance the understanding of the UK's productivity performance, a framework is needed to analyse the relationship between the inputs and outputs of production. Capital and labour are key factors of production, both contributing to the output of the economy, and accurate measurement of these two inputs is essential for accurate measurement of productivity.

Defining capital and measuring its contribution to production has been a contentious issue for both economists and statisticians for many years. Early work in this area includes Jorgenson (1963), the seminal paper on growth accounting by Jorgenson and Griliches (1967), Hall and Jorgenson (1967) on the cost of capital, and the work of Hulten and Wykoff (1981a, 1981b) on the estimation of depreciation rates. More recently there has been a degree of international agreement about the conceptual issues concerning the stocks and flows of capital. The Organisation for Economic Co-operation and Development (OECD) published a manual in 2001 (OECD 2001) covering the measurement of capital stocks and providing practical guidelines for estimation. Work by Oulton and Srinivasan (2003) has also proposed an integrated framework for measuring capital stocks, capital services and depreciation.

Capital services estimates weight together the growth of the net stock of assets with weights that reflect the relative productivity of the different assets that make up the capital stock. These weights are calculated using estimates of rental prices in contrast to the capital stock estimates in the UK National Accounts, which use asset purchase prices as weights. This difference in weights is important in understanding the difference between the two measures of capital. The capital stock estimates in the National Accounts are wealth estimates of the capital stock while capital services are a flow measure that reflects the input of capital into production. This is the reason why capital services are more suitable for analysing and modelling productivity. By definition, a capital asset generates a stream of services that spans more than one accounting period. Capital services are a measure of this flow of services, so measure the actual contribution of the capital stock of assets to the production process in a given year.

This article presents experimental capital services estimates for 1950 to 2006, extending and revising previously published estimates in Wallis (2007). Developments to the estimates are also described and the additional capital services estimates that have been produced are presented.

An accompanying article in this edition of *Economic & Labour Market Review* (Dey-Chowdhury and Goodridge 2007) describes a published set of official quality-adjusted labour input (QALI) estimates for the UK for 1996 to 2006. Alongside the capital services estimates presented in this article, these form the inputs into the multi-factor productivity (MFP) estimates that are now published annually by the Office for National Statistics (ONS) and are next due

for publication in early 2008.

Asset breakdown for capital services

The main development since Wallis (2007) is the level of asset detail. Previously, capital services were published with a five-asset breakdown (buildings, plant and machinery including purchased software, vehicles, intangibles including own-account software, and computers). In this article, capital services are published for eight assets (see **Table 1** for details). The revision of own-account software in *Blue Book 2007* (see Chamberlin, Clayton and Farooqui (2007) for details) has meant that it is now possible to treat own-account software as a separate asset when estimating capital services. It has also been possible to treat purchased software as a separate asset by separating it from plant and machinery.

Previously capital services estimates were published for the fixed asset intangibles as defined in the UK National Accounts. Sufficient data now exist to publish estimates for the three separate assets that comprise intangibles in the National Accounts: mineral exploration, own-account software and copyright and licence costs for artistic and literary originals (see **Box 1**).

There has been recent literature on how much the UK invests in a more broadly-defined range of intangible assets (see Giorgio Marrano and Haskel (2006) and Giorgio Marrano, Haskel and Wallis (2007) for more details). This work extends the definition of intangible capital asset to include innovative property (including research and development), brand equity, firm-specific human capital, and organisational capital. As these are not yet recognised as produced assets in the System of National Accounts, estimates of capital services are not provided here for these other types of intangibles. Galindo-Rueda (2007) shows some of the work in which ONS is currently involved in incorporating research and development (R&D) as an asset into the UK National Accounts.

Table 1
Developments in the asset breakdown for capital services

UK National Accounts (asset breakdown of raw data used to calculate capital services)	Previous capital services asset breakdown	Current capital services asset breakdown
Buildings	Buildings	Buildings
Vehicles	Vehicles	Vehicles
Intangibles (including own-account software)	Intangibles (including own-account software)	Own-account software Copyright and licence costs for artistic and literary originals Mineral exploration
Plant and machinery including computers and purchased software	Plant and machinery including purchased software Computers	Plant and machinery Purchased software Computers

Box 1
Intangible fixed assets

The National Accounts Concepts, Sources and Methods manual explains that the produced intangible fixed asset category in the UK National Accounts comprises three main asset types. Previously it was not possible to produce estimates for these individual assets but this article does so for the first time. The three types of intangible assets are described below:

- mineral exploration covers the costs of drilling and all related activities (for example, the costs of relevant surveys). The investment in this knowledge asset is independent of whether the outcome of drilling is successful or not
- own-account software refers to software that is developed in-house and not intended for final sale, but for internal use. This is unlike purchased software, for which there is a market transaction. It also includes the creation of software originals intended for subsequent reproduction. Revised estimates of own-account software were included in the UK National Accounts in *Blue Book* 2007
- copyright and licence costs for artistic and literary originals refer to artistic output that is recorded, which encompasses, for example, expenditure on original films, sound recordings, and manuscripts. These expenditures relate to both the physical original and the copyright attached to it

Market sector and non-oil capital services series

The market sector capital services series is published again and is consistent with the definitions used in Marks (2007) and with the experimental market sector labour productivity measures that are now published by ONS. As such, the capital services estimates could be used together with the ONS market sector output data in productivity analysis of the market sector.

In addition, two new series are also included in this article: non-oil capital services for both the whole economy and the market sector. HM Treasury use non-oil gross value added (GVA) as their preferred measure of output in the analysis of the UK economy's trend growth. Although output from the oil and gas sector affects total output, it is considered to have 'little direct impact on the sustainable levels of employment and non-oil economic activity.' The publication of these non-oil capital services estimates should assist with analysis of the UK economy.

Estimation methodology

The four main stages in the estimation of capital services can be summarised as:

- using the Perpetual Inventory Method (PIM) to calculate a net stock series from a history of constant price investment series
- pricing the services from each asset using an estimated rental for each asset
- generating weights, using the estimated rentals and net stock series, which reflect the input of each asset into production, and
- combining the net stock growth using the estimated weights to give capital services growth estimates

The methodology used to estimate capital services is described in detail in Wallis (2005) and in *The ONS Productivity Handbook* (ONS 2007). There have been two changes, the most substantial of which is to allow for a more detailed asset breakdown. A new method has been developed in order to separate both computers and purchased software from the raw plant and machinery data from the National Accounts, which includes these

Box 2
Rental prices

The main difference between the UK National Accounts measure of capital stock and the capital services estimates presented here is how the net stock estimates are weighted. Capital stocks are weighted using asset purchase prices while capital services are weighted using asset rental prices.

The rental price is sometimes referred to as the user cost of capital and essentially measures the price a user would have to pay to hire the asset for one time period. It is estimated in the conventional way using the Hall-Jorgenson formula for the cost of capital:

$$r^{i}_{at} = T_{at}\,[\delta^{i}_{a} \bullet p^{i}_{at} + R_{t}p^{i}_{a,t-1} - (p^{i}_{at} - p^{i}_{a,t-1})]$$

where is r^{i}_{at} the rental price of an asset, T_{at} is the tax-adjustment factor, p is the price of an asset, δ is the rate of depreciation, and R is the rate of return.

The rental price consists of three components:

- depreciation of the asset (the $\delta^{i}_{a} \bullet p^{i}_{at}$ term)
- nominal rate of return (the $R_{t}p^{i}_{a,t-1}$ term), and
- change in the purchase price of the asset (the $(p^{i}_{at} - p^{i}_{a,t-1})$ term)

In addition, an adjustment is made to take account of taxes on profits and subsidies to investment. Depreciation refers to the fact that assets lose value over time, due to wear and tear as well as anticipated obsolescence, and so if an asset is to be leased out, then the rental price will need to cover this loss in value. This is why the rental price is positively related with the depreciation term of the user cost formula. The more the asset depreciates, the greater its rental price will be.

Likewise, a change in the asset price has a direct effect on the rental price an owner of an asset would charge for renting out the asset as it represents a capital gain or loss for the owner. If the market price of the asset has fallen over the year, then the rental price will be higher to compensate the owner of the asset for this price fall (that is, the capital loss). This is the case with computers, where prices have fallen markedly in recent years. In terms of a capital stock measure, it means computers will be given less weight. However, it means that, all other things being equal, the rental price of computers will be higher and hence be given more weight in a capital services measure.

The rate of return is not directly observed and so has to be modelled. It is estimated by assuming that the gross operating surplus (or profit) is completely exhausted by all the produced assets in the economy. It is often interpreted as being equal to the risk-free rate of interest plus some risk premium.

two assets. The method is described in detail below.

The other change is to the calculation of the rental rates (see **Box 2** for more details), and specifically the rate of return component. This is not directly observed and so is modelled endogenously by assuming that the entire operating surplus in the economy is exhausted in remunerating the services from these fixed capital assets (net of the surplus that is attributable to dwellings). Dwellings are not modelled as part of the productive capital stock as they do not represent capital input into the production function. Due to the volatility of the rate of return series, it has been decided that these should be smoothed and so a three-period moving average of the estimated yearly rate of return is used instead.

Data

Before describing the methodology for the separate treatment of computers and purchased software, it is useful to outline the sources being used. The data used to estimate capital services are the same as those underpinning the UK National Accounts capital stock estimates and are consistent with *Blue Book* 2007. The data set consists of a long time series of constant price investment flows, classified by industry, alongside their respective life length means and price deflators.

Maintaining consistency with *Blue Book* 2007 means that the capital services estimates presented here are ideal for MFP work, as they are consistent with the output measures such as GVA in the UK National Accounts.

The asset breakdown of the raw investment series is:

- buildings
- copyright and licence costs for artistic and literary originals
- mineral exploration
- own-account software
- plant and machinery including computers and purchased software
- vehicles

In addition, a series for purchased software is available, based on Chamberlin, Clayton and Farooqui (2007).

In *Blue Book* 2007, own-account software was revised. Previously, the lack of data meant that treating own-account software as a separate asset was not possible. However, current price investment data now are available as well as an accompanying price deflator and life length mean.

In order to treat computers and purchased software as separate assets, they have to be separated from investment in plant and machinery and the associated price deflators have to be adjusted to account for this. It should be noted that, although an appropriate life length is used for computers in the National Accounts (currently assumed to be five years), the capital stock estimates do not separately deflate computers. Purchased software is currently treated as part of plant and machinery in the National Accounts; it is not separately deflated and is subject to the general life length for all plant and machinery.

For all assets, current investment is taken as the starting stock for the first year in which the investment series is available. For buildings, plant and machinery, vehicles, and intangibles, the investment series starts well before 1950 (as early as 1828 for some of the buildings series) and so any initial conditions problems can be ignored. For the other assets for which data start after 1950, sensitivity analysis showed that, except for the first few years, the capital services estimates were insensitive to different methods for calculating the starting stock.

For this reason, the first few years of each series have been dropped.

Treating computers and purchased software as separate assets

Due to the relative price of computers and purchased software falling rapidly, and their economic lives being much shorter than those of most other types of plant and machinery, the treatment of computers and purchased software as separate assets is important. The methodology used to calculate capital services will give more weight to assets for which the rental price is high in relation to the asset price, which will be the case for computers and purchased software.

In order to treat computers as a separate asset, a time series of constant price investment flows is needed, together with an appropriate life length mean and a price deflator. The former is not currently available from the UK National Accounts but is included as part of plant and machinery. The basis for estimating computer investment here is the current price computer investment available in the most recent supply-use analysis. In this case, the supply-use analysis is consistent with *Blue Book* 2006. Capital investment data can be obtained from Table 6 in the supply-use tables, which shows gross fixed capital formation (GFCF) by 57 industries. Current price computer investment can be obtained from here (product 69). As the most recent supply-use tables only cover the period 1992 to 2004, a previous supply-use table for 1984 was used in order to get a series covering the period 1984 to 2006, with the unavailable years being interpolated (and extrapolated for 2005 and 2006).

As noted above, a life length mean for computers is already available in the UK National Accounts and so this is used here, with a double-declining balance method used to give the depreciation rate (see Wallis 2005).

The computers producer price index (PPI) is used as the computer deflator (ONS code PQEK), which is available from 1986. The computer deflator for 1984 and 1985 has been estimated by projecting backwards the 1986 to 1987 growth rate of this PPI. An alternative is to use the growth in the US computer deflator for these two years. This alternative has an insignificant effect on the results presented here. Using the US deflator for the entire period instead of the UK one also has an insignificant impact on the estimates. Combining the current price computer investment, obtained using the supply-use tables, and the computer deflator, constant price computer investment can be generated as required for estimating capital services.

Purchased software investment data are now available back to 1970, making it possible to split out purchased software investment data from the plant and machinery investment data series. However, both series are in current price form and need to be deflated to construct historical constant price investment data. A UK purchased software deflator is not yet incorporated into UK National Accounts; therefore, when producing capital services estimates, a US-based software deflator (Parker and Grimm (2000)) has been used. This deflator is adjusted to take into account price level differences between the US and UK.

The estimation of a purchased software investment series enables plant and machinery excluding computers and purchased software to be derived as a residual. However, these are in current prices, whereas a constant price series is required in order to create the net stock measure needed for capital services.

In order to construct a constant price estimate, an appropriate deflator is required. The plant and machinery deflator in the UK National Accounts has to be adjusted to take account of the treatment of computers and purchased software as separate assets. It is not appropriate to use the existing PPI for plant and machinery which is used in the UK National Accounts, since this includes an element capturing price changes in computers.

An implied deflator was previously inferred using a method that constrains total investment of plant and machinery, computers and purchased software to UK National Accounts totals (in both current and constant prices). However, in producing the estimates shown here, an alternative approach is used. The new method removes the computer deflator (PQEK) from the existing UK National Accounts plant and machinery deflator as it is no longer included in the series to be deflated; this is achieved using available data on the plant and machinery PPI weights. There is currently no PPI for software investment included in the UK National Accounts plant and machinery deflator series; this element therefore does not need to be excluded before deflating the new plant and machinery excluding computers and purchased software series.

Capital services estimates

This section presents capital services estimates for the whole economy, for the market sector, and for the non-oil sector, by eight asset types and also by detailed industry. It provides a 57-industry breakdown, consistent with the most recent supply-use analysis. A six-industry breakdown is also presented that is consistent with the industry breakdown at which the ONS QALI measure is published (Dey-Chowdhury and Goodridge 2007), to enable MFP analyses at this six-industry level.

In most cases, estimates are available for the period 1950 to 2006. Due to space limitations, not all available data are presented here. A full set of results including downloadable data tables is available at www.statistics.gov.uk/statbase/product.asp?vlnk=14205

Capital services in the UK

Wallis (2007) covers in detail the reasons that explain the profile of the growth rate in capital services seen in **Figure 1**. Periods of modest growth coincide with UK recessions (1973 to 1975, 1979 to 1982, the early 1990s) while pick-ups in the growth rate can in part be explained by economic phenomena. For example, the strong growth seen in the 1990s is a result of high levels of investment in information and communications technology (ICT).

Figure 1 also shows annual growth in the net capital stock measures published in the UK National Accounts. The series is the growth in total net stock excluding dwellings, as dwellings are not modelled as part of the productive capital stock. Although measuring different concepts, the close fit of the two series is not surprising since they are both based on the same underlying data sources.

The differences in these two series can be attributed to three main factors:

- the weighting of net stock growth by rental prices in the capital services estimates as opposed to asset prices in the National Accounts estimates
- the separate treatment of computers, purchased software and own-account software for capital services, and
- the use of a geometric depreciation rate when constructing the capital services estimates instead of an arithmetic depreciation rate

It is the use of a geometric rather than an arithmetic depreciation rate that causes

the divergence between the official National Accounts net capital stock measures and the net stock measures used in producing estimates of capital services.

While the growth rates in the stock- and service-based measures of capital both peak in 1998, there is a marked divergence during the late 1990s. This is due to the effect computers, purchased software and own-account software have on the capital services estimates.

Capital services account better for the input contribution of computers, own-account and purchased software than a capital stock estimate. During the 1990s there were large levels of capital investment in ICT assets. The weights used to calculate estimates of capital services are based on two components: the level of net stock and the rental price. The increase in capital investment in computers, own-account and purchased software during this period was reflected in increased levels of net stock for these assets, increasing their share in the whole economy capital services estimates. The other factor driving this divergence is the use of rental prices to weight the net stock. The period of high levels of ICT investment also saw the prices of ICT assets fall sharply. The UK National Accounts measures of capital stock are wealth-based estimates as they are weighted by asset prices, meaning that the fall in prices is reflected in a fall in the weight attributed to ICT assets. However, the rapid fall in prices of computers is reflected in a rise in the rental price for ICT assets (see Box 2). This combination of increased investment in these assets and falling prices makes the share of computers, own-account software and purchased software in the whole economy capital services estimates grow over time and makes capital services grow more rapidly.

An interesting way to look at the divergence of the National Accounts wealth-based measures of capital stock and capital services is as volume indices. **Figure 2** shows that there is a clear divergence between the volume of capital services and the volume of capital stock after 1980, especially after 1990. This divergence is being driven by the shift towards short-lived and more productive assets, such as computers, for which the flow of capital services is high. The standard capital stock measure does not adequately capture this shift and so understates growth in the productive input of capital in the UK economy, especially after 1990.

Figure 1
Annual growth in capital stock and capital services

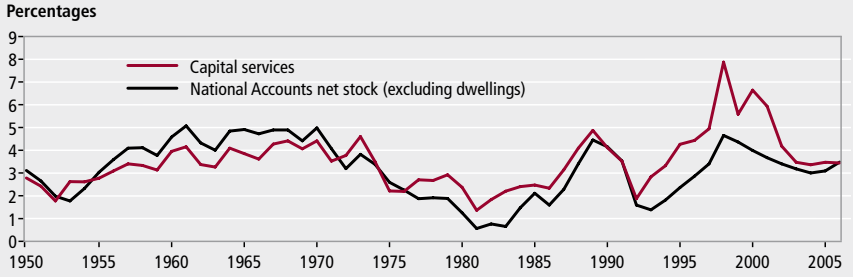


Figure 2
Volume index of capital stock and capital services

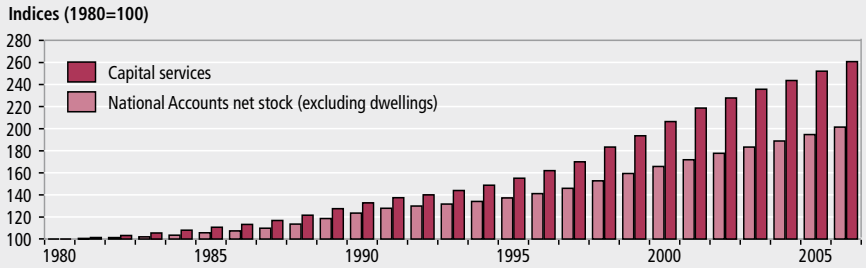
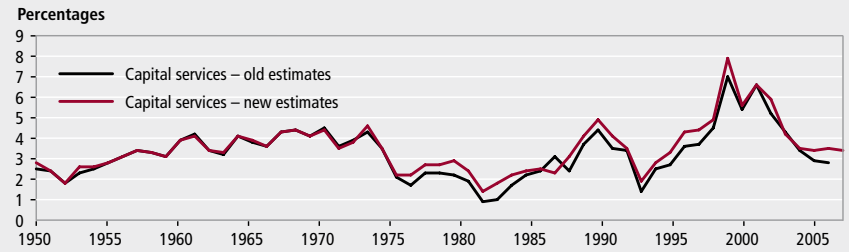


Figure 3
Annual growth in capital services: new and previous estimates



Revisions since previous release

Revisions to capital services estimates since Wallis (2007) are due to a combination of revisions to the underlying constant price investment series and the new methodological changes explained above. A full revisions analysis is not shown here due to the large number of series being presented. However, **Figure 3** shows the new estimates of whole economy capital services growth against the previously published estimates. It can be seen that the revisions are relatively small in magnitude and are predominantly to post-1976 estimates only, when capital services for own-account software are first documented. Estimates of capital services growth for purchased software begin in 1981, which additionally explain the revisions seen post-1981.

Market sector capital services

Productivity and other macroeconomic analyses often focus on the market sector rather than the whole economy. The measurement of the market sector is of importance to policy makers as the market sector better reflects the balance of demand and supply pressures of the UK economy. It also assists making international comparisons of productivity (the US only publishes estimates of market sector productivity), undertaking growth accounting analysis, or when estimating and analysing business cycles. In response to user needs, ONS began publishing experimental estimates of market sector productivity in 2007.

Figure 4 shows the volume of market

sector capital services relative to the whole economy. The market sector here is consistent with the definition of the National Accounts market sector value added measure, making it suitable for use in market sector growth accounting analysis. It is clear that market sector capital services have been growing faster than for the whole economy. The main reason behind this divergence is that the market sector has been investing more heavily in ICT assets than the non-market sector.

Non-oil capital services

This article marks the first time that capital estimates have been published for the non-oil sector. Macroeconomic analysts are interested in examining the non-oil sector, as output from the oil sector is considered to have little direct impact on the sustainable level of employment and non-oil economic activity

Figure 5 plots the annual growth rates in capital services for the non-oil sector and the whole economy. The two growth rates follow each other very closely for the period 1950 to 2006, which reflects that assets in the oil and gas extraction industry are a small part of total assets in the UK economy. There is a slight divergence in the growth rates between 1975 and 1985, where the annual growth rate in non-oil capital services is slower than that observed in the whole economy. This period saw large capital investment in the oil and gas extraction industry as new oil reserves were found in the mid-1970s. These high levels of investment contributed to fast capital services growth in the industry over the period.

Figure 4
Volume index of whole economy and market sector capital services

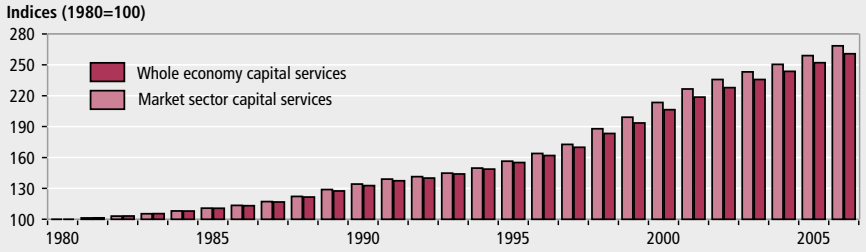


Figure 5
Annual growth of capital services in the non-oil sector

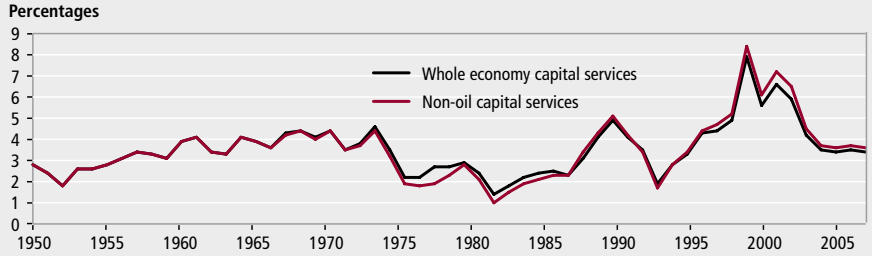
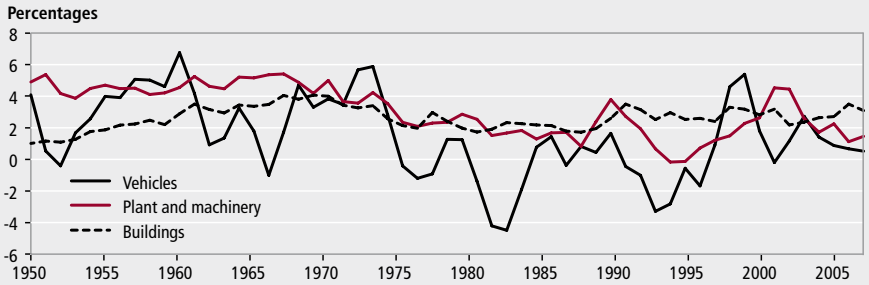


Figure 6
Annual growth in capital services: by asset type



Capital services by asset type

Figure 6 shows annual growth in capital services by asset type for buildings, plant and machinery and vehicles. Growth in capital services for the ICT assets is not shown, as capital services from computers and purchased software grew much faster than other assets, especially in the late 1990s. This is shown in the next subsection. Some of the more interesting analytical points to note are:

- the 1950s and 1960s saw strong and relatively stable growth in capital services for all assets for which data are available
- growth in capital services from buildings is relatively stable over the period in comparison with the growth in capital services for other asset types
- for all assets there is a downturn in capital services growth in the mid-1970s, driven by a fall in the net stock in many industries over this period
- after 1985 there is a clear increase in the variability of the growth rate of capital services
- capital services growth rates are subdued for all assets during the recession in the early 1990s
- negative capital services growth only occurs for vehicles, and the periods of sustained negative capital services growth occur during the period following the oil shocks of the 1970s and the recessions in the early 1980s and the early 1990s

Although not plotted in Figure 6, negative capital services have been observed for mineral exploration since the early 1990s. These capital services data have not been previously published but are interesting as they are the only asset to have experienced a sustained period of negative growth over the last 15 years. This reflects the fact that there have been very low levels of capital investment in mineral exploration, as large amounts of these resources have now been exhausted in the UK.

Figure 7 shows the volume of capital services from computers, own-account software and purchased software relative to the volume of whole economy capital services. The volume index of computers

increases to over 3,000 in 2006 from 100 in 1987, while the volume index of whole economy capital services (all assets) increases to just over 200 by 2006. For purchased software, the volume index has increased to over 2,000 in 2006. This explains the divergence seen in Figure 2 between the wealth-based National Accounts measures of net stock and capital services. The reason that the growth in capital services from computers and purchased software is not driving up whole economy (all assets) capital services more is that these two assets still only account for a 10 per cent share of profits (see **Figure 8**). Growth in own-account software capital services is much less pronounced as, although investment in own-account software has increased quite rapidly, the deflator has not fallen as it has for computers and purchased software. The reason for this is that the deflator is based on the average wage index of software-related employees whose wage has increased over the period. This means that the rental price, all things being equal, is lower for own-account software than it is for computers and purchased software which saw large price falls.

Table 2 summarises capital services growth by asset type for selected periods. The periods chosen are cyclical peak-to-peak and the table shows average annual growth over these periods. Interesting points to note are:

- average annual growth in capital services from buildings is similar in all time periods
- average annual growth in capital services from plant and machinery is similar in all time periods, although slightly subdued in the 1990 to 2000 period
- capital services growth from vehicles has been relatively weak in all periods (although there was a pick-up in growth for the period 2000 to 2006): this is due to weak capital stock growth and possibly reflects the impact of high oil prices and the two oil shocks
- capital services from mineral exploration grew very rapidly in the period 1973 to 1979, reflecting exploration of North Sea oil, and since 1990 has experienced strong negative growth
- capital services growth from computers and purchased software was stronger in the run-up to the millennium than it has been since, possibly reflecting overinvestment in the earlier period in response to the feared 'millennium bug'

The average growth rates presented here for plant and machinery are significantly lower for the period 1979 to 2000 when compared with the results presented in Wallis (2007). It is important to note that in previous articles, the capital services data for plant and machinery included purchased software whereas this has been separated out in these new estimates. This implies that, previously, it was growth in capital services for purchased software driving the growth in plant and machinery (as defined in Wallis (2007)). However, this pattern has reversed for the period 2000 to 2006, illustrating the marked slowdown in capital services growth for purchased software. For the period 1990 to 2000, the average annual growth rate in capital services for purchased software was over 20 per cent. This compares with an average growth rate of around 5 per cent since 2000.

Likewise, it is now possible to understand what was driving the average annual growth rate in intangibles as presented in Wallis (2007). In this previous article, the average annual growth rate for intangibles was weak for the period 1990 to 2005. Table 2 shows that there was relatively strong growth in capital services for both own-account software and artistic and literary originals during this period, but these were offset by the very strong negative growth rate in mineral exploration.

Figure 7
Volume index of whole economy, computers, own-account software and purchased software capital services

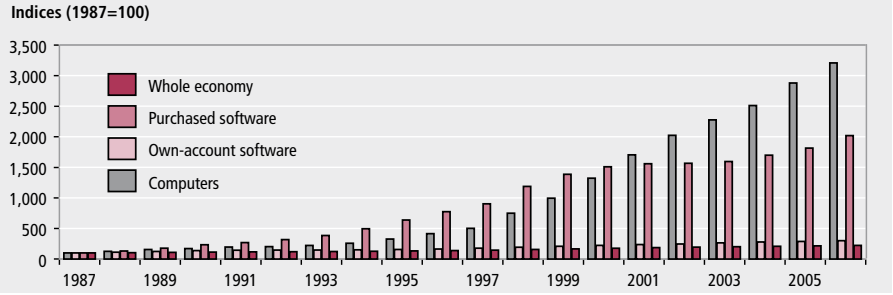


Table 2
Average annual growth rates of capital services: by asset type

Percentages

	1973–79	1979–90	1990–2000	2000–06
Buildings	2.3	2.2	2.9	2.7
Computers	n/a	n/a	23.3	16.1
Copyright and licence costs for artistic and literary originals	11.2	5.5	5.2	3.3
Mineral exploration	12.8	7.0	–5.7	–8.8
Plant and machinery	2.6	2.0	1.5	2.3
Own account software	n/a	10.7	4.9	5.1
Purchased software	n/a	30.1	20.7	5.0
Vehicles	0.5	–0.7	0.3	1.2

Capital services by industry

Capital services estimates have been produced at both 57-industry and six-industry levels. The 57-industry breakdown is consistent with the most recent supply-use analysis. The six-industry breakdown is consistent with the industry breakdown for which the ONS QALI measure is published (Dey-Chowdhury and Goodridge 2007). These are the capital services estimates used in the ONS MFP analysis, which will be next updated in early 2008.

Table 3 shows growth in capital services by industry for selected periods. As in Table 2, the periods chosen are cyclical peak-to-peak and the table shows average annual growth over these periods. Also included are estimates for aggregate production industries and aggregate service industries, as well as medians and 25th and 75th percentiles.

Interesting points to note from Table 3 are:

- in all periods, the average annual growth rate of capital services is higher for aggregate service industries than for aggregate production industries, which is consistent with the fact that GVA growth has been fastest for services
- production industries saw their

strongest growth in capital services in the period 1973 to 1979, and this was followed by much weaker growth in latter periods – as low as 0.3 per cent in the period 2000 to 2006

- average annual growth of capital service in the service industries has been stronger in each period, rising from 2.8 per cent in the period 1973 to 1979 to 6.0 per cent in the period 2000 to 2006
- all service industries saw positive average annual growth in capital services in the periods 1990 to 2000 and 2000 to 2005 while in all periods some production industries saw negative average annual growth in capital services
- the medians and 25th and 75th percentiles show that average annual growth is much more dispersed in the service industries than in the production industries
- over the two most recent periods, computer services and auxiliary financial services saw the strongest growth in capital services, while the agriculture-based industries saw the largest fall in capital services, reflecting the changing nature of the UK economy with a very strong financial sector and a weaker manufacturing and agricultural sector
- industries that are large users of ICT assets, such as computer services and research and development, showed the strongest average annual growth in capital services

Also included in Table 3 are average annual growth rates of GVA for the production and service industries. It is interesting to note that the increase in capital services growth in the service industries over time was matched by stronger growth in service industry GVA, as might be expected, and also that growth in capital services was faster than growth in GVA in all periods. In contrast, production industry GVA growth averaged 1.3 per cent in the first three periods, then declining to negative average annual growth in the latest period.

Table 4 shows annual growth in the volume of capital services for the six industries for which the QALI estimates are published. The data are less informative than in Table 3 as they hide much of the variation across lower levels of industry disaggregation. However, these are the estimates used in the ONS MFP work, as QALI is currently only available at this industry-level breakdown.

Table 3
Average annual growth rates in capital services: by industry

Percentages

Industry	1973–79	1979–90	1990–2000	2000–06
Production industries				
Agriculture	1.3	–0.1	2.9	–1.8
Forestry	1.0	4.8	–1.6	–1.5
Fishing	1.6	–6.7	–6.4	–5.5
Coal extraction	3.1	0.5	–4.4	–4.2
Oil and gas extraction	28.3	5.6	0.7	–2.3
Other mining and quarrying	0.5	–1.5	–1.6	–0.6
Food products and beverages	3.6	2.6	2.0	1.5
Tobacco products	2.6	0.2	2.4	–1.4
Textiles	–0.2	–1.8	–0.1	–3.4
Wearing apparel and fur products	0.6	–0.8	0.7	–3.6
Leather goods and footwear	n/a	n/a	3.1	–2.5
Wood and wood products	2.5	–1.4	0.9	1.8
Pulp, paper and paper products	n/a	19.1	13.0	0.8
Printing and publishing	3.1	2.6	3.0	1.2
Coke, refined petroleum and nuclear fuel	0.2	2.8	0.3	–1.9
Chemicals and chemical products	2.8	2.0	3.3	–0.5
Rubber and plastic products	2.7	2.6	5.0	–1.1
Other non–metallic mineral products	7.2	6.4	2.2	1.3
Basic metals	1.5	–2.9	–0.8	–1.6
Metal products	2.1	0.3	3.0	2.3
Machinery and equipment	3.1	0.3	1.5	–1.0
Office machinery and computers	6.4	9.9	8.4	–1.2
Electrical machinery	2.4	0.0	2.9	–2.3
Radio, TV and communication equipment	n/a	17.8	10.1	–6.6
Medical and precision instruments	4.7	4.5	12.7	3.6
Motor vehicles	3.7	3.2	3.5	0.0
Other transport equipment	1.2	2.4	0.4	5.6
Other manufacturing	3.0	2.0	5.7	3.2
Recycling	n/a	9.2	0.3	7.0
Electricity and gas	–0.1	0.3	0.3	1.5
Water	0.5	3.6	9.5	8.8
Construction	2.2	1.3	2.6	7.6
All production industries	2.7	1.6	2.1	0.3
25th percentile	1.1	0.1	0.3	–2.0
50th percentile	2.4	2.0	2.3	–0.8
75th percentile	3.1	4.0	3.4	1.6
Production industries GVA	1.3	1.3	1.3	–0.8
Service industries				
Motor vehicle distribution and repairs, fuel	n/a	14.9	7.8	8.8
Wholesale distribution	4.9	4.4	7.3	3.9
Retail distribution	4.9	4.9	6.5	6.8
Hotels and restaurants	4.2	5.1	6.3	5.6
Land transport and transport via pipelines	1.1	–0.3	0.9	2.2
Water transport	–4.3	–8.1	7.3	1.2
Air transport	3.0	–3.5	14.4	7.0
Ancillary transport services	2.1	3.1	8.6	12.6
Post and telecommunications	2.5	1.6	9.1	3.7
Financial intermediation	5.2	11.4	4.7	3.2
Insurance and pension funds	10.0	12.2	4.2	2.2
Auxiliary financial services	n/a	n/a	10.7	21.1
Real estate activities	3.2	5.7	4.4	10.8
Renting of machinery, etc.	16.5	9.7	11.3	6.5
Computer services	n/a	25.1	27.6	19.1
Research and development	n/a	17.8	17.7	6.0
Other business services	11.6	15.9	12.8	8.0
Public administration and defence	1.8	2.5	2.7	3.7
Education	1.9	1.2	2.7	7.7
Health and social work	5.3	5.8	4.8	5.4
Sewage and sanitary services	5.7	3.0	3.2	5.8
Membership organisations	n/a	13.9	7.3	7.7
Recreational services	5.1	6.4	7.4	6.8
Other service activities	n/a	15.2	7.1	9.6
All service industries	2.8	3.9	6.1	6.0
25th percentile	2.2	2.8	4.6	3.9
50th percentile	4.5	5.7	7.3	6.6
75th percentile	5.3	13.1	9.5	8.2
Service industries GVA	1.8	2.5	3.2	3.3

Table 4
Annual growth in the volume of the capital services: by aggregate industries

Percentages

Industry		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Agriculture, hunting, forestry, fishing, mining and quarrying, utilities	A, B, C, E	*0.5*	*0.6*	*–0.7*	*–0.2*	*0.0*	*0.3*	*–0.4*	*0.1*	*–1.1*	*1.0*
Manufacturing	D	*3.9*	*4.5*	*2.1*	*2.0*	*1.9*	*–0.7*	*–0.1*	*–1.1*	*0.0*	*–0.2*
Construction	F	*6.0*	*4.3*	*7.4*	*6.6*	*3.6*	*13.7*	*8.6*	*12.2*	*3.0*	*4.2*
Wholesale and retail trade, hotels and restaurants, transport storage and communication	G, H, I	*9.5*	*11.4*	*8.5*	*10.2*	*10.6*	*7.0*	*4.5*	*2.5*	*3.2*	*3.4*
Financial intermediation, real estate, renting and business activities	J, K	*4.5*	*18.8*	*12.8*	*13.8*	*9.3*	*7.6*	*5.5*	*7.7*	*8.9*	*9.6*
Public administration and defence, education, health and social work, other social and personal services and extra-territorial activities	L, M, N, O, P, Q	*3.7*	*4.1*	*5.1*	*5.9*	*6.5*	*5.8*	*6.6*	*6.4*	*3.7*	*2.4*

The results support the discussion above regarding production versus service industries. The first three industries cover production and, in general, capital services growth is lower than for the last three industries, which cover services. However, the 2006 estimates show stronger growth in agriculture, hunting, forestry, fishing, mining and quarrying, utilities – with annual growth rising to 1.0 per cent from –1.1 per cent in 2005. There was also a pick-up in capital services for construction.

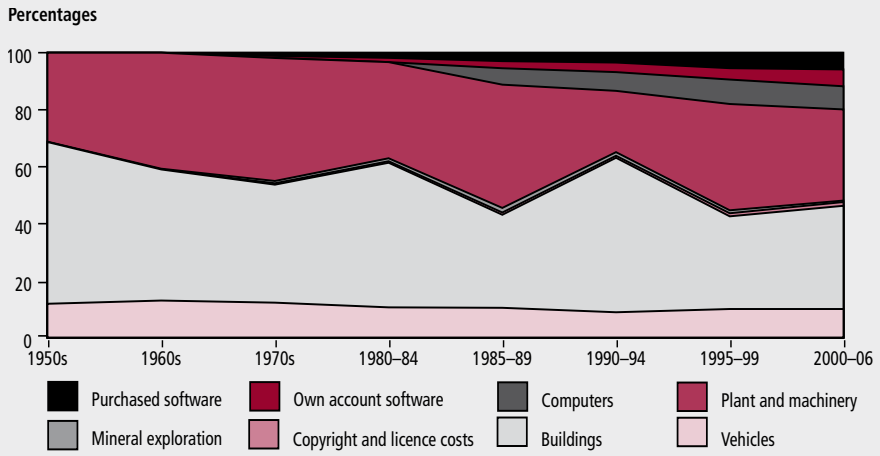
There were also significant upward revisions to the capital services estimates for financial services, reflecting the separate treatment of purchased and own-account software. Financial intermediation, real estate, renting and business activities showed the fastest growth in capital services in Wallis (2007), which reflected the strong growth in investment, with computer investment making up a significant proportion of the total for this industry. The upward revisions presented here are driven by the separate treatment of purchased and own-account software. These data indicate that there has been strong growth in purchased software, in which this industry invested heavily.

Profit shares

The weight of each asset or industry in calculating whole economy capital services is the share of gross operating surplus attributable to each asset or to each industry. These are usually referred to as profit shares. The time profile of the profit shares by asset over the period 1950 to 2006 is shown in Figure 8.

Figure 8 shows that the composition of profit shares has changed substantially since the 1950s. The share of buildings, while still the largest, has fallen, while that of vehicles has remained fairly constant.

Figure 8
Profit shares: by asset, 1950–2006



The share of plant and machinery has been more variable, increasing in the 1960s and 1970s, falling considerably during the period 1990 to 1994, before returning to a level similar to the 1950s by 2000 to 2006. Most interesting is the rise in the profit share of the ICT assets. The profit share of computers has increased each period, culminating in a share of 8 per cent in the period 2000 to 2006. Likewise, the profit shares for own-account and purchased software have steadily increased from the 1970s. The profit shares of both these assets in the period 2000 to 2006 are 6 per cent. The cumulative share of ICT assets (computers, purchased and own-account software) increased to 20 per cent in the period 2000 to 2006 from zero in the 1960s.

Table 5 shows profit shares by industry for selected years. Those shown are 1973, 1979, 1990, 2000 and 2006 for ease of comparison with the capital services growth estimates presented in Table 3.

Interesting points to note from Table 5 are:

- the profit share of production industries falls from 53 per cent in 1973 to 31 per cent in 2006
- in contrast, the profit share of service industries increases from 47 per cent in 1973 to 69 per cent in 2006, reflecting the shift in the UK economy from manufacturing to services
- in 1973, electricity and gas is the industry with the largest profit share (13 per cent), while in 2006 it is public administration and defence (9 per cent)
- industries with the largest increases in profit share include real estate activities, recreational services and other business services
- industries with the largest falls in profit share include electricity and gas, basic metals and agriculture (all production industries).

Conclusion

This article presented experimental estimates of the capital services growth for the whole economy, for the market sector,

Table 5
Profit shares: by industry

Percentages

Industry	1973	1979	1990	2000	2006
Production industries					
Agriculture	4.1	4.7	3.7	3.3	2.1
Forestry	0.0	0.0	0.1	0.1	0.1
Fishing	0.3	0.1	0.1	0.0	0.0
Coal extraction	1.5	1.5	1.5	0.6	0.5
Oil and gas extraction	0.8	3.6	5.8	5.3	4.1
Other mining and quarrying	1.3	1.3	0.7	0.4	0.3
Food products and beverages	3.5	3.3	2.8	2.4	1.9
Tobacco products	0.2	0.2	0.1	0.1	0.1
Textiles	1.9	1.6	0.7	0.7	0.4
Wearing apparel and fur products	0.5	0.4	0.3	0.2	0.1
Leather goods and footwear	0.0	0.0	0.0	0.0	0.0
Wood and wood products	0.5	0.5	0.3	0.3	0.2
Pulp, paper and paper products	0.0	0.1	0.3	0.6	0.3
Printing and publishing	2.1	2.2	2.1	1.9	1.7
Coke, refined petroleum and nuclear fuel	1.4	1.4	1.4	1.0	0.8
Chemicals and chemical products	5.5	5.6	3.4	3.3	2.4
Rubber and plastic products	1.0	1.0	0.7	1.0	0.7
Other non-metallic mineral products	0.5	0.7	0.8	0.6	0.6
Basic metals	3.2	3.3	1.4	1.0	0.8
Metal products	1.5	1.5	1.0	1.0	0.8
Machinery and equipment	2.6	2.8	2.0	1.7	1.2
Office machinery and computers	0.2	0.2	0.3	0.3	0.2
Electrical machinery	1.5	1.9	0.8	0.7	0.5
Radio, TV and communication equipment	0.0	0.4	0.8	1.0	0.5
Medical and precision instruments	0.2	0.3	0.2	0.4	0.3
Motor vehicles	2.5	2.3	1.7	1.8	1.5
Other transport equipment	0.9	0.9	0.8	0.8	0.8
Other manufacturing	0.3	0.3	0.3	0.4	0.3
Recycling	0.0	0.1	0.1	0.1	0.1
Electricity and gas	12.8	9.8	7.2	6.1	4.6
Water	0.3	0.2	0.7	1.1	1.4
Construction	2.1	2.5	1.4	1.3	1.7
All production industries	53.4	54.8	43.7	39.4	30.8
Service industries					
Motor vehicle distribution and repairs, fuel	0.0	0.2	0.5	0.7	1.0
Wholesale distribution	2.2	2.9	2.9	3.2	2.7
Retail distribution	4.2	4.5	4.4	4.5	5.9
Hotels and restaurants	1.4	1.7	1.7	1.9	2.9
Land transport and transport via pipelines	4.7	4.5	4.6	3.3	3.5
Water transport	4.1	2.2	0.6	0.4	0.4
Air transport	1.1	1.0	0.6	1.7	2.1
Ancillary transport services	0.6	0.8	1.5	2.0	3.2
Post and telecommunications	5.7	4.9	5.0	7.6	5.6
Financial intermediation	2.4	2.5	4.4	3.3	3.1
Insurance and pension funds	0.4	0.9	1.8	1.2	2.0
Auxiliary financial services	0.0	0.0	0.4	0.6	0.9
Real estate activities	1.2	2.0	2.4	2.1	5.6
Renting of machinery, etc.	0.7	1.9	1.9	3.3	3.1
Computer services	0.0	0.0	0.4	1.3	1.2
Research and development	0.0	0.0	0.2	0.5	0.5
Other business services	0.6	0.9	3.3	5.0	4.2
Public administration and defence	10.3	6.7	12.2	7.6	9.0
Education	3.3	3.2	1.6	2.3	3.0
Health and social work	1.0	1.1	1.0	2.0	1.9
Sewage and sanitary services	0.5	0.5	1.7	2.0	2.4
Membership organisations	0.0	0.1	0.2	0.2	0.3
Recreational services	1.9	2.5	2.8	3.5	4.2
Other service activities	0.0	0.1	0.3	0.4	0.3
All service industries	46.6	45.2	56.3	60.6	69.2

and for the non-oil sector, by eight asset types and also by detailed industry. The main results include the strong growth in capital services from computers and purchased software and much stronger growth in the service industries than in the production industries over recent years. There has also been a clear shift in the profit share from other assets to ICT assets and also from production industries to service industries.

The divergence between the volume of capital services and the volume of capital stock after 1980, especially after 1990, has also been highlighted. This divergence is being driven by the shift towards shorter-lived and more productive assets such as computers and purchased software, for which the estimated flow of capital services is high. It is important to recognise this divergence when considering UK productivity. Capital services and not capital stock should be used when conducting productivity analysis.

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FEATURE

Quality-adjusted labour input: estimates for 1996 to 2006

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SUMMARY

Estimates of quality-adjusted labour input are improved measures of labour's input to production and are therefore more suitable for analysing and modelling productivity than standard volume measures of hours or workers. The estimates incorporate both the quantity and quality components of hours worked. This article presents experimental quality-adjusted labour input estimates for 1996 to 2006 for the UK and for a broad six-industry breakdown. Recent development work has also allowed quality-adjusted labour input estimates to be published for the market sector.

To enhance the understanding of the UK's productivity performance, a framework is needed to analyse the relationship between the inputs and outputs of the production function. Capital and labour are key factors of production, both contributing to the output of the economy, and accurate measurement of these two inputs is essential for accurate measurement of productivity.

In recent years, the Office for National Statistics (ONS) has developed a measure of labour input that explicitly recognises the heterogeneity of labour and the differences in the level and composition of skills among individual workers. Standard measures of labour productivity contain no adjustments to reflect such quality differences, implicitly assuming that the composition of labour does not vary over time.

This article presents experimental quality-adjusted labour input (QALI) estimates for 1996 to 2006, revising estimates previously published in Goodridge (2006) and extending all the series by an additional year. The underlying assumption of QALI is that differences in the productive capacity of workers are reflected in their relative wages. QALI is estimated by exploring such differences along observable characteristics of workers that may reveal differences in skill, namely age, sex, educational attainment and industry. The estimates presented are for the UK whole economy and a broad six-industry breakdown, as presented in previous articles. Recent developments mean that QALI is now also produced for the market sector.

An accompanying article in this edition of *Economic & Labour Market Review* (Wallis and Dey-Chowdhury 2007) describes a published set of the volume index of capital services estimates (VICS) for the UK for 1950 to 2006. QALI and VICS form the inputs to annual ONS multi-factor productivity (MFP) estimates, next due for publication in early 2008.

Theory

The purpose of producing QALI is to attempt to measure the true contribution of labour to the production function more accurately. There are essentially two components to labour: quantity (standard aggregation of hours or workers) and quality (labour composition). Changes in the volume of actual labour input not only reflect changes in the actual quantity of labour supplied but also changes in its quality.

The quarterly ONS Productivity First Release publishes estimates of output per worker and output per hour worked. The latter is seen as the superior measure, as data on hours worked gives a better indication of the actual quantity of labour input by accounting for differences in working patterns. This is sometimes referred to as the time dimension of labour. However, there is still an underlying assumption that labour is a homogeneous input, that is, any worker makes the same contribution to output as any other worker.

Labour productivity measures have traditionally defined labour input as

the sum of hours worked by employees, proprietors and unpaid workers. As a result an hour worked by a highly experienced surgeon and an hour worked by a newly hired teenager at a fast food restaurant are treated as equal amounts of labour. – OECD (2001)

QALI attempts to address this issue by taking account of workers observable characteristics to adjust for quality and the heterogeneity of labour.

Estimation methodology

According to the literature, there are two primary approaches that can be used to quality-adjust estimates of labour input, both of which require workers to be categorised according to characteristics that may reflect differences in skill or marginal productivity.

These two models are:

- the Bureau of Labour Statistics (BLS) method
- the Jorgenson approach

The BLS method uses regression techniques to estimate the proportion of the average wage of different worker types that is explained by variables such as sex, age, educational attainment and industry, which are modelled as the determinants of quality. The regression also includes other control variables which are believed to be determinants of wages but not quality (for example, controlling for occupational differences). This enables the calculation of wage-based weights for different worker types, which can then be used in the quality-adjustment process.

ONS has adopted the Jorgenson approach, where the number of hours worked are differentiated into n types of worker (h_1 to h_n) according to their characteristics – the vector of variables that would be used as explanatory variables in the BLS method. The labour characteristics are broken down into the following groups:

- eight levels of qualification attainment
- six age groups
- two sexes
- six industries

Therefore, hours worked are broken down into 576 (8*6*2*6) worker types. The hours of each worker type contribute to total labour input L through a function g as shown below in equation (1):

$$L = g(h_1, h_2, \ldots h_n) \quad (1)$$

Following the OECD (2001) methodology, the growth of quality-adjusted hours can be represented with a Törnqvist index (see **Box 1**), as shown below in equation (2):

$$\Delta \log L(t) = \sum_i \left[\frac{w_i(t) + w_i(t-1)}{2} \right] \Delta \log h_i(t) \quad (2)$$

According to economic theory and under assumptions of competitive markets and constant returns to scale, different types of labour are hired up to the point where their marginal cost (or wage) is equal to their marginal revenue product. Therefore, in equation (2), the growth of hours worked is effectively weighted by that worker type's marginal productivity. The weight is the average of the share of the wage bill for that worker type in the current and base period and in aggregate the weights sum to one. By weighting hours worked by the average wage for that worker type, the assumption that an hour worked by the most unproductive worker makes the same contribution to output as an hour worked by the most productive worker is removed.

One of the primary reasons for producing QALI is its use in MFP analysis. Since the other input into MFP, VICS, and the National Accounts gross value added (GVA) measure are calculated as Laspeyres indices, then QALI is also produced in this form. The formula for calculating QALI on a Laspeyres basis is provided below in equation (3):

$$\frac{L(t)}{L(t-1)} = \sum_i w_i(t-1) \left[\frac{h_i(t)}{h_i(t-1)} \right] \quad (3)$$

If the user is primarily interested in the evolution of human capital and the development of the skill base in the UK economy, then the Törnqvist-based results should be used. These provide a more accurate and representative measure of the quality component of labour. Differences between the Laspeyres and Törnqvist indices are discussed below in **Box 1**.

Labour characteristics

In order to produce estimates of QALI, it is necessary to categorise workers into different worker types, where these

Box 1
Index numbers

The main feature of the Törnqvist index is that the weight used is an average of the weight in the current and base period. This is why the Törnqvist index is regarded as better measuring the quality component of labour. These data are more suitable if the user is primarily interested in the evolution of human capital in the UK economy. It therefore tends to be used on historic data sets as current period information is needed to weight the series.

The main feature of a Laspeyres index is that the weights used are taken from the base period. Therefore, if the index has a base of t-n, then hours will be aggregated for all periods using weights from the period t-1. However, if the index is chain-linked, then the weight will be taken from the previous period (t-1). Chain-linking simply means updating the weights, so for each period the base used is the weight from the previous period.

The Laspeyres series should ideally be used for MFP purposes as both GVA and VICS are calculated as Laspeyres indices.

Another difference between the Laspeyres and Törnqvist index is that the latter is calculated geometrically rather than arithmetically. This means that the Törnqvist index is a weighted, geometric average of its components, making it a better and more representative measure.

It is not appropriate to produce a quarterly Laspeyres index for QALI because the series is seasonal and, when chained quarter on quarter, fails a property known as 'time reversal'. This means that if hours worked increase, but in a subsequent quarter decrease back to a previous level, then the index will fail to decrease all the way back to that level and instead return to a slightly higher level. This is a well-known property and is one of the reasons that the Törnqvist index is preferred.

categories reflect differences in quality between workers.

The primary data source for QALI is the Labour Force Survey (LFS). The LFS currently covers approximately 53,000 households every quarter and has been running since 1973, and since 1992 on a quarterly basis. However, due to breaks in the qualification variable, QALI is only produced from 1996 onwards.

The longitudinal nature of the LFS means that QALI can be produced as a time series, facilitating analyses on the evolution of human capital and how this has impacted on productivity in the UK. The LFS is a rich source of information containing data on the necessary variables required for quality adjustment. Compiling such a data set has been an issue for other countries who have not had a single data source rich enough in content to quality-adjust measures of hours worked (McNaughton 2006).

Based on the data available from the LFS, the categories chosen are the age, sex, and educational attainment of the worker, and the industry in which they work. **Table 1** shows the breakdown of these variables.

Table 1
Labour characteristics

Educational attainment	Age groups	Sex	Industry	Industry description
Higher degree	16–19	Male	ABCE	Agriculture, hunting, forestry, fishing, mining and quarrying, utilities
NVQ5 (excluding higher degree)	20–29	Female	D	Manufacturing
NVQ4	30–39		F	Construction
NVQ3	40–49		GHI	Wholesale and retail trade, hotels and restaurants, transport, storage and communications.
NVQ2	50–59		JK	Financial intermediation, real estate, renting and business activities
NVQ1	60 plus		LMNOPQ	Public administration and defence, education, health and social work, other social and personal services, and extra-territorial activities
Other qualifications				
No qualifications				

Educational attainment

Educational attainment, measured as the highest qualification attained, is used a proxy for skills. Qualifications either act as a signal to employers that workers are capable of a certain level of ability or they formally provide specific skills to meet job requirements. This category is the prime driver of the QALI index. Eight qualification levels are used because the more levels that are included, the greater the adjustment for quality. However there is a trade-off between the amount of quality adjustment and the constraints of the sample size.

Because of the growth in the number of people undertaking higher degrees, the expectation of continued growth in such qualifications, and their association with higher wages and salaries, this group has been separated out of the NVQ5 category and included as a stand-alone qualification level.

Age

Age is included as a proxy for work experience. Data on actual work experience are not readily available for the UK, so proxy measures have to be used. This is obviously imperfect, as it takes no account of workers who have been inactive or unemployed for any period of time. Some studies have attempted to measure years of potential work experience (Reilly, Milne and Zhao 2005) rather than use age as a proxy, where potential work experience is modelled as being equal to the age of the worker minus five and the number of years of education received.

Potential work experience = Age – 5 – years of education

This is based on the assumption that people start school at the age of five, and that they find work immediately after leaving school or university. A further adjustment is made for females to account for maternity leave by subtracting the number of children they have from the above expression. This assumes that a mother takes one year off work to look after each child, the strength of which is difficult to test. Therefore, this is a measure of potential work experience, which can diverge from actual work experience depending on periods of economic activity. However, since the adjustments are made on the basis of assumptions with no actual measure of leave or inactivity, there are few differences between the methods. Although a measure of actual work experience would be preferable, current QALI estimates are based on age as a proxy.

However, whether age or potential work experience is used, the assumption is that, in general, older workers are more productive because of their greater level of work experience. This is the reason why older workers tend to receive greater compensation for their labour. Alternatively it has been suggested that younger workers may be more dynamic, innovative, and less set in their ways (Bell, Burriel-Llombart and Jones 2005). However, if this is true, then provided the labour market is competitive, these workers will be paid their marginal product and growth in hours will be weighted accordingly.

Sex

Sex is included as a characteristic because of the persistent pay differential that exists between males and females. Although sex itself is not a driver of quality, a gap exists between the wages of men and women when all other characteristics (age, educational attainment and industry) are held constant. This gap may represent unobserved characteristics in the data such as an increased tendency to take career breaks or to fulfil part-time posts that are not as well paid. If so, the importance of the sex characteristic can be attributed to age being an imperfect proxy for experience.

An alternative explanation is that the pay differential represents discrimination in the labour market. If this is the case, then the assumption that workers are paid their marginal product is violated, resulting in hours' growth being weighted incorrectly. The quality adjustment will then carry a downward bias.

Industry

Industry is used as a characteristic because of the inherent differences in skill and productivity between industries. This

also allows growth in hours to be split according to industry, making it possible to conduct MFP analysis by sector. The industry categories chosen are very broad, firstly because industry is self-reported in the LFS, which can lead to an inaccuracy of response, and secondly because of small sample sizes for some individual sectors. While it would be preferable to produce QALI at a more disaggregated industry level, to enable more detailed economic analyses, previous analyses (Holmwood *et al* 2005) have shown that this results in the underlying data being stretched too far, increasing the standard errors and level of noise in the data. However it may be possible to make further developments here once the LFS has been linked to the Inter-Departmental Business Register (IDBR), which will improve the quality of the industry breakdown and remove some volatility.

Data issues

Another issue is the prevalence of proxy responses in the LFS data set. Approximately 30 per cent of responses to the LFS are proxy responses, meaning that they are responses given by another household member on the respondent's behalf. This may give rise to bias, resulting from potentially lower-quality responses with less accurate information. As a check, the adjustment process was carried out on personal responses only and the relationship between adjusted and unadjusted hours remained the same. Therefore, it was decided to leave proxy responses in the data set so as not to reduce the sample size any further and avoid problems grossing to population totals. In addition, no restrictions were placed on outliers, meaning that the full LFS sample was used.

A further issue encountered in production was the break in the LFS longitudinal data. The LFS has historically been based on seasonal quarters (see **Box 2**). However, since 2005 Q1, the LFS has also been published on a calendar quarter basis (the last seasonal data set published was Summer 2006). Whereas previous estimates of QALI were published as seasonal quarters, it was not possible to extend the series on this basis as the complete set of data is not available. Therefore, there is a break in each series between 2004 and 2005 where the period moves from Autumn 2004 to 2005 Q1. This issue will be resolved in the next update of QALI (scheduled for late 2008) when a full back series of calendar quarter data will be available. This switch will be a methodological improvement achieving greater consistency with the compensation of employees data to which the wage component of QALI is scaled, as well as the VICS and GVA data it is used alongside in MFP analysis.

A few possibilities were available to deal with this issue. One of the more straightforward options would have been to average across previous seasonal quarter-based data to map it onto a calendar quarter basis, where the weights used would reflect the overlap of months between calendar and seasonal quarters (that is, two-thirds and one-third). Another option would have been to reallocate the observations from the seasonal quarter data sets into calendar quarters using the date of the interview, and then rescaling the weights used.

It was decided at this stage not to directly address this discontinuity mainly because the productivity data to which QALI is scaled (productivity hours and productivity jobs), used to calculate the estimates of output per hour worked and output per job in the Productivity First Release, make no adjustment for the seasonal-calendar quarter switch, implicitly assuming that 2004 Q4 data is the same as Autumn 2004. Therefore, in the interim, the same approach has been used for QALI until a full calendar quarter back series is made available in 2008, when this discontinuity in the series will be removed.

One further issue encountered in the production of these results is the change in the HIQUAL variable between 2004 and 2005. The HIQUAL variable in the LFS microdata measures the highest educational qualification of the respondent and is the main driver of QALI. There were changes to the qualifications questions in 2005, meaning that when estimates were calculated on a calendar quarter basis, many had answered on a 2004 basis and therefore individuals have no data for the 2005 question. ONS standard procedure meant that not all the information on qualifications was brought forward from the previous quarter, causing a break in the HIQUAL data. In the data presented in the article, it was decided to interpolate an estimate for 2005 Q1 data based on previous data. However, for future publications, it is likely that these missing data can be imputed and allocated across the 576 different worker types.

Consistency: National Accounts and productivity estimates

For QALI to be used in productivity analysis, it must be consistent with UK National Accounts and ONS headline productivity measures. To ensure this, components of QALI are scaled to National Accounts and productivity data. Specifically:

Box 2

Seasonal and calendar quarters

Quarterly LFS data were first published in Spring 1992 and, until Summer 2006, were based on seasonal quarters. Two of the main reasons for this were:

- many activities associated with the labour market occur seasonally and follow the pattern of the school year. This was more of a factor when the LFS first started, as students in England and Wales could leave school at Easter provided they were 16 by the end of January
- the public holidays of Christmas, New Year and Easter cause particular problems (it is a difficult time for interviewing and extra time is allowed to obtain interviews; Easter does not always fall in the same calendar quarter, while it does always fall in the spring quarter)

For 2005, the LFS is available on both a calendar quarter and seasonal quarter basis. In mid-2006, it was decided to only publish calendar quarter data. It is possible to average across previous seasonal quarterly data to obtain a proxy of the data on a calendar quarter basis, where the weights used reflect the overlap of months between calendar and seasonal quarters.

Seasonal quarter	Months	Calendar quarter	Months
Winter	December – February	Q1	January – March
Spring	March – May	Q2	April – June
Summer	June – August	Q3	July – September
Autumn	September – November	Q4	October – December

- LFS gross weekly pay is scaled to National Accounts 'compensation of employees'
- actual hours worked are scaled to 'productivity hours' (the denominator in the ONS headline productivity measure)
- total jobs are scaled to 'productivity jobs' (the denominator in the other ONS headline productivity measure)

As well as ensuring consistency with National Accounts, the scaling process also improves the data and methodology. Ideally, growth in hours would be weighted by the share in total labour compensation for each worker type. However, these data are not available from the LFS, which only provides information on wages and salaries, while compensation of employees also includes bonuses, income-in-kind and employers' contributions. Therefore, scaling to compensation of employees improves the LFS data.

Another issue is the treatment of the self-employed. Since the LFS does not collect information on wages of the self-employed, they are imputed using the wages of the employed (of the same worker type). For instance, if a self-employed male who is 40 to 49 years of age, with an educational attainment of NVQ4, works in the manufacturing industry, then it is assumed that he earns the same hourly wage as his employee counterpart. In the National Accounts, the earnings of the self-employed are encapsulated in the series 'mixed income', so called because it contains the incomes that accrue to both capital and labour. Ideally, the imputed wage for the self-employed would be scaled to the labour component of mixed income. However, with no information to apportion mixed income into its component parts, it is scaled to compensation of employees as the best alternative available.

Market sector estimates

The major development since the last publication of QALI is the new market sector series. Productivity and other macroeconomic analyses often focus on the market sector rather than the whole economy, as it offers a better reflection of the balance of demand and supply pressures in the economy. Therefore, its measurement is of great importance to policy makers and researchers alike.

The market sector results published in this article for the first time are comparable with the whole economy estimates, and are consistent with the definitions used in Marks (2007) and with the experimental market sector labour productivity measures that are now published in the Productivity First Release. They will be used in conjunction with market sector estimates for VICS to produce MFP estimates for the market sector as well as the whole economy. These data are scaled to compensation of employees for the market sector and the market sector productivity data used in the Productivity First Release.

Results

This section presents quality-adjusted estimates of labour input for the whole economy, the market sector and selected industries in the form of a Törnqvist index, as these data are more suitable for assessing the quality component of labour. A full set of results is available at www.statistics.gov.uk/statbase/product.asp?vlnk=14206

The QALI results can be compared with the unadjusted series, which is just a standard aggregation of hours represented in index form. The difference between the two is the quality adjustment or 'labour composition'.

Whole economy

Figure 1 shows the effect of scaling the data to National Accounts compensation of employees and the headline productivity data. Scaling improves the methodology in producing estimates of QALI. Ideally, growth in hours worked for each worker type would be weighted by the share of total labour compensation for that worker type. While there are data available from the LFS on wages and salaries, they do not measure total labour compensation. There are also quality issues with earnings data from the LFS, as with all household surveys, the quality is dependent upon respondents accurately recalling their earnings. Respondents often only remember their earnings after tax, and bonuses are not recorded that accurately. These issues are compounded by the large degree of proxy responses. By scaling these data to the compensation of employees data from the National Accounts, which measures wages and salaries, bonuses, income-in-kind, and both employee and employers insurance contributions, a more accurate measure of total labour compensation is obtained. The jobs and hours data are scaled to the productivity jobs and productivity hours data to improve responses on jobs and hours, particularly at industry level.

As can be seen, the seasonal-calendar quarter break, and breaks in the HIQUAL variable, have caused volatility and discontinuity in the unscaled series, which are then smoothed out via the scaling process. However, the trend and relationship between quality-adjusted and unadjusted hours worked remains. Comparing the adjusted hours with the unadjusted hours, a similar upward trend can be seen in both sets of data at the whole economy level. It can be seen from Figure 1 that there has been growth in both the quantity and quality component of labour in the UK economy. The results show that, in 2006, there is a quality adjustment of approximately three to four index points, and this adjustment has grown over the period that the series is available, suggesting that the level of human capital in the labour force is increasing.

For the new 2006 data, the divergence between the adjusted and unadjusted hours has increased slightly. This shows that growth in adjusted hours was marginally stronger than in unadjusted hours.

Adjusted and unadjusted hours are still falling in industry D, manufacturing, which is to be expected as the manufacturing sector has been declining over this period. The fall in the relative size of manufacturing output has been reflected in a fall in hours worked in the sector. Growth in hours,

Figure 1
The impact of scaling, whole economy measures, Törnqvist index

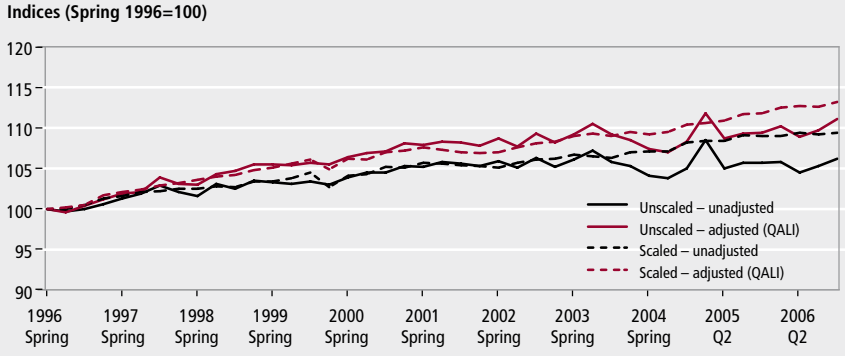


Figure 2
Comparison of Törnqvist index with LFS First Release

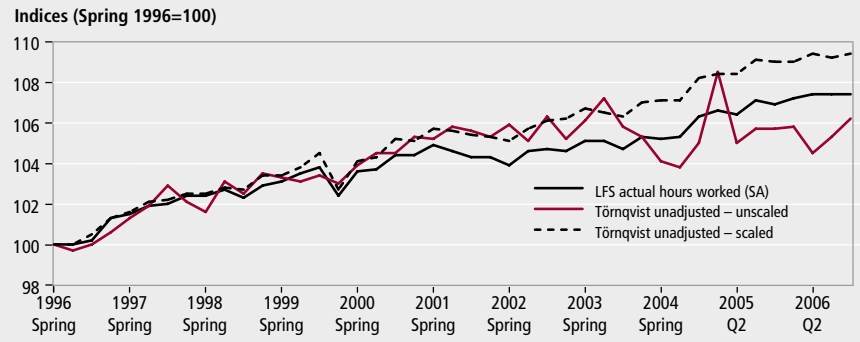
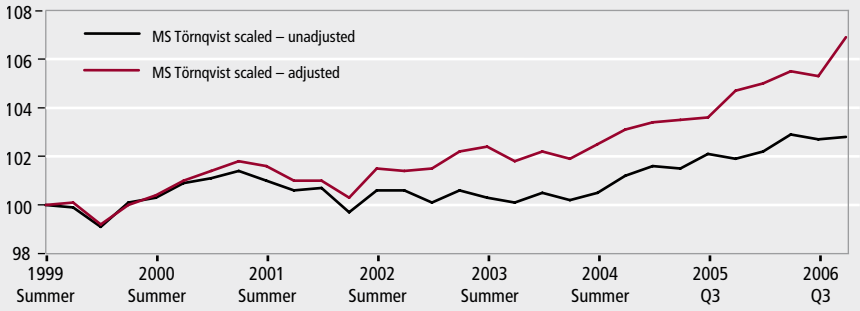


Figure 3
Market sector QALI, scaled, Törnqvist index



adjusted and unadjusted, has continued in 2006 in industries ABCE (since the trough in 2002 Q4), F and JK (see Table 1 for industry definitions). The biggest quality adjustments have occurred in JK and LMNOPQ (note that there was a fall in 2006 Q4, though, in LMNOPQ). The results show that, in 2006, there is a quality adjustment of approximately nine index points in JK, and seven to eight in LMNOPQ.

Figure 2 presents a comparison of the whole economy, unscaled and scaled, unadjusted Törnqvist series, with actual hours worked from the LFS First Release. The latter are used to produce the headline productivity measure of GVA per hour worked, but have been indexed here (Spring 1996=100) to make them comparable with the QALI data. Since the data in the LFS First Release are quarterly, they have only been compared with the Törnqvist index. Differences in the headline hours worked data and the LFS microdata reflect the fact the headline data are weighted more frequently, and the presence of non-responses in the microdata.

The series follow very similar trends and contain the same turning points. Whereas the QALI and the standard aggregate hours data follow a similar path from 1996 to 2001, there is a slight divergence in the two measures afterwards. In the unscaled data, there does seem to be a break in the series which coincides with the switch from seasonal to calendar quarters (from 2004 to 2005). However, scaling these data to the compensation of employees and productivity data removes these spikes in the data series, and it is these scaled data that are used for productivity analysis.

Market sector

The main development to the QALI estimates since Goodridge (2006) is the new market sector series. Productivity and other macroeconomic analyses often focus on the market sector rather than the whole economy. The measurement of the market sector is of importance to policy makers, as it better reflects the balance of demand and supply pressures in the UK economy. It also supports the comparison of headline measures of productivity on an international basis (the US only publishes estimates of market sector productivity), growth accounting analysis, and estimating and analysing the business cycle. In response to user needs, ONS began publishing experimental estimates of market sector productivity in 2007.

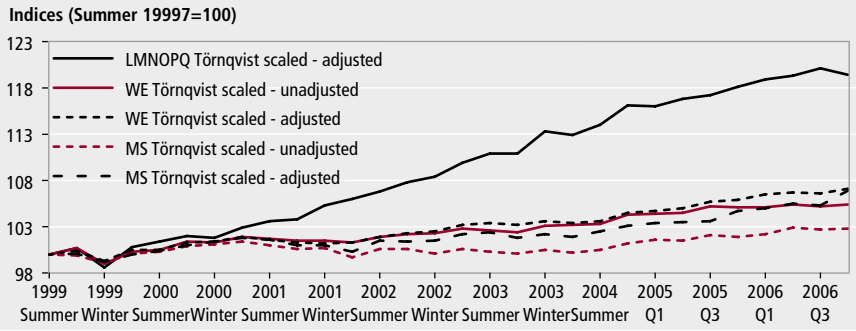
Figure 3 shows the growth in adjusted and unadjusted hours for the market sector. Unlike the whole economy, this series does not go as far back as 1996, but starts in 1999. It can be seen from Figure 3 that the quality component of labour has been increasing in the market sector, with the adjusted hours growing at a significantly faster rate than the unadjusted hours. The results show that, in 2006, there is a quality adjustment of approximately four index points, and this adjustment has grown over the period that the series is available, suggesting that the level of human capital in the market sector is increasing.

Figure 4 compares the quality-adjusted estimates of labour in the market sector with the corresponding data for the whole economy. QALI for the whole economy has been re-indexed so that it is comparable with the market sector estimates.

The growth of hours worked (that is, the unadjusted hours data) is less in the market sector than in the whole economy, which is likely to be reflecting the large increase in employment in the public sector. Whereas this is not synonymous with the non-market sector, a large proportion of industry LMNOPQ is non-market. The striking feature of Figure 4 is that when the hours worked are adjusted, the market sector data are almost at the same level as the adjusted hours for the whole economy. This implies that the level of human capital in the market sector is increasing at a faster rate than the whole economy, suggesting that the more skilled workers are becoming relatively more concentrated in the market sector.

The large increase in QALI for the market sector at the end of 2006 is likely to be due to a combination of different factors. There has been a shift of employment from the public services industries to the market sector. This can be seen in Figure 4, where the rise in the QALI index for the market sector is matched by a fall in the QALI index for LMNOPQ. This meant there was a significant rise in employee jobs in the market sector in 2006 Q4 resulting in a greater number of hours worked in the market sector. It is not possible to deduce from these data whether this represents a one-off rise in employment in the market sector, or if it is a change in trend. It should be possible to answer this with the publication of 2007 data next year. There is also the issue of bonuses, which tend to be paid in the final quarter of the calendar year. These are more prevalent to the market sector (primarily business and financial services). Since QALI is scaled to non-seasonally adjusted compensation of employees data, it is possible that this is causing the rise in QALI in the market sector for 2006. Although QALI data are seasonally adjusted, the break from seasonal

Figure 4
Market sector and whole economy QALI, scaled, Törnqvist index



to calendar quarters may mean that the seasonal adjustment is not fully accounting for seasonality in the data as previously bonuses were paid across autumn and winter, whereas they are now concentrated in Q4. The seasonal-calendar quarter switch also reduces the effectiveness of the seasonal adjustment in general. Again this issue will be resolved when a full back series of calendar quarters is made available.

Revisions

The revisions presented here compare the new published QALI results with those presented in Goodridge (2006). These revisions are due to three reasons:

- in these results, the 2005 data are based on calendar quarters whereas they were based on seasonal quarters in Goodridge (2006)
- in terms of the scaled QALI data, any revisions to the compensation of employees and headline productivity data would also result in revisions to the QALI data presented here, and
- the seasonal adjustment is being applied to data with different end points

Next steps

One of the main issues with the QALI estimates presented here is the known discontinuity in the time series resulting from the switch from seasonal to calendar quarters. There are plans for a complete back series of calendar quarter data sets to be made available during 2008, which will mean that the next set of QALI to be published should be based on a continuous time series that is consistent with both VICS and GVA data (as well as the scaling data), improving the quality of future MFP estimates from 2009.

There is an ongoing project which aims to link the LFS to the IDBR. This will address the issue of the LFS industry classification, which is self-reported, producing different results from the National Accounts. This issue is also discussed in Holmwood *et al* (2005). If successful, this should increase the reliability of the breakdown of data and may enable the industry breakdown to be expanded further, without introducing a significant level of noise into the estimates.

There is also an ongoing review of the methodology of compensation of employees, which is part of the National Accounts re-engineering programme (Holmwood *et al* 2005). When completed, the results should improve the industry allocation of the series and provide more insight into the current inconsistencies between National Accounts and the LFS. The next publication of QALI aims to include these results.

Conclusions

This article presented experimental estimates of quality-adjusted labour input for the whole economy, for the market sector and for a broad six-industry breakdown. The key features of the estimates are that accounting for quality in the input of labour is of importance, and that for the whole economy and the market sector, using unadjusted hours underestimates the input of labour to production. Interestingly, the quality of labour has been growing at a faster rate in the market sector than the whole economy, implying that there are more skilled workers in the market sector.

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Methods explained

Methods explained is a quarterly series of short articles explaining statistical issues and methodologies relevant to ONS and other data. As well as defining the topic areas, the notes explain why and how these methodologies are used. Where relevant, the reader is also pointed to further sources of information.

Forecasting

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SUMMARY

The Office for National Statistics (ONS) often makes use of forecasts in the production of its statistical outputs. The purpose of this article is to outline the contexts where forecasts are required, to describe the techniques used and to examine some of the issues faced by ONS when forecasting.

The Office for National Statistics (ONS) regularly uses forecasts in the production of its monthly and quarterly outputs. There are two main reasons for this:

- to estimate current data that are not yet available, and
- to assist in the estimation of trends and seasonally adjusted data

The first reason arises from the desire to publish estimates of monthly or quarterly series as quickly as possible. Users of these short-term statistics want early notification of recent information on the outputs that interest them, for planning and policy purposes. This is particularly important for the main economic series, such as the Index of Production (IoP) and the Index of Services (IoS), that are used in the management of the UK economy. The next section provides more details on the use of forecasting in this context.

The second reason arises because many changes in statistics from month to month or quarter to quarter relate to the time of the year or other calendar-related effects and do not necessarily indicate anything new or unexpected. Increases in retail sales in the months before Christmas or increases in holidays taken in the summer months or over the Easter holiday period (March or April) are examples of these seasonal effects. To help users interpret statistics that are seasonal, ONS usually publishes seasonally adjusted estimates and in some instances trends, so that users do not have to worry about the seasonality. As the seasonally adjusted estimate contains irregular movements, the trend estimate can provide a useful indicator of underlying movements in a time series. Forecasting is used to improve estimation of these trends and seasonally adjusted estimates for the most recent periods. The section on seasonal adjustment and trend estimation provides more details on the use of forecasting in this context.

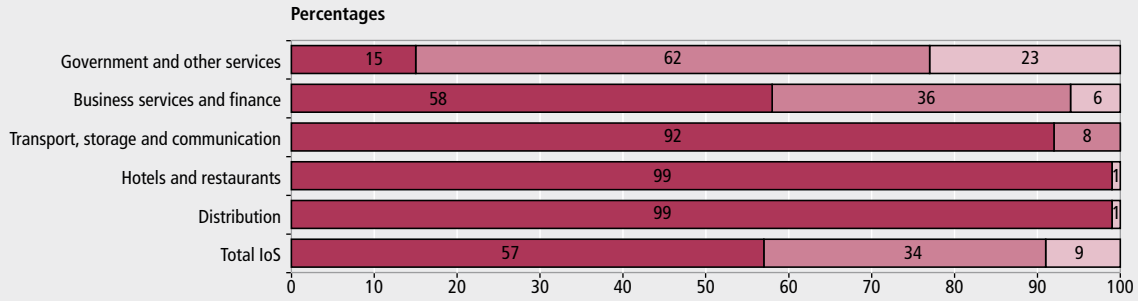
The section on revisions describes some of the problems which can arise when using forecasts and what ONS does to resolve these problems and the final section presents a brief conclusion.

Data not yet available

ONS produces its statistics from data obtained from a wide variety of surveys and administrative data sources. Collecting and processing these data takes time and the time taken depends on several factors, such as the complexity of the data requirements, the methods and sources used to obtain the data, and the availability of the data at source. If ONS were to wait until all the required data had been received, the publication of its statistics would be too late to be useful, as well as violating timeliness requirements laid down by the European statistics regulator, Eurostat.

As a compromise between early release of statistics and completeness of data, ONS therefore forecasts incomplete data up to the most recent reference period. This inevitably means that accuracy is less for the earliest estimates than for the more mature estimates with more complete data. For example, the preliminary estimate of

Figure 1
Percentage breakdown of periodicity of data within the Index of Services and its component sectors



quarterly gross domestic product (GDP) is published around 25 days after the end of the reference quarter. According to Skipper (2005), only 44 per cent of this estimate is based on actual data.

However, the data content rises over time as the increasing availability of source data allows forecasts to be replaced by real data. For example, when the output, income and expenditure measure of GDP is published around 55 days after the end of the reference quarter, the data content has risen to 67 per cent. This rises further to 80 per cent with the publication of the Quarterly National Accounts, around 80 days after the quarter.

Within overall GDP, the early availability of data varies by industry. For many industries, data exist at the time of the preliminary estimate of GDP for the first two months of the quarter and it is only the third month that needs to be forecast. This applies to the IoP and the Index of Distribution. At the other extreme, some industries depend on annual data sources and the forecasting lag may be as long as two years. Such long forecasting lags are dominated by the non-market sector (government and other services), where output is relatively stable (as in health and education, for example) and forecasts are therefore reasonably accurate, even over long time periods

Figure 1 shows the periodicity of the data sources used to construct the IoS, which forms the largest part of GDP and which most depends on the use of forecasting.

For the purpose described above, the forecasting method most commonly used within ONS is the Holt-Winters method, described briefly in **Box 1**. However, this is set to change with the introduction of modernised systems (Hussain *et al* 2007).

Seasonal adjustment and trend estimation

To assist in the interpretation of time series data, the standard practice is to assume that each estimated value may be interpreted as comprising three components: 'trend', 'seasonal' and 'irregular', the last of which representing such things as random error or occasional disturbances. To estimate the trend and seasonal components, ONS uses the statistical software package X-12-ARIMA (Findley *et al* 1998). The irregular component is then the residual after the trend and seasonal components are removed.

The X-12-ARIMA package estimates the trend and seasonal components by taking weighted averages of the original data, where the weights are symmetrically distributed around the period for which the trend or seasonal component is being estimated. ONS's seasonal adjustment experts choose the number of weights (that is, the time span over which averaging is applied) and the weights themselves so as to provide the best possible match to the characteristics of the series, according to a specified set of criteria. The time span over which averaging is applied depends on the stability of the series and the weights are designed to produce the best possible estimates of trend and seasonal components, under the assumption of independent irregular components.

For estimates of points near to either end of the series, however, it is not possible to use symmetric weights because there are not enough observed values to apply the weights to. For the most recent period, for example, there are no observed values after that period and it is obviously impossible to apply symmetric weights to these unobserved values. The X-11 method – the iterative application of moving averages used to estimate the trend, seasonal and irregular components in X-12-ARIMA (Ladiray and Quenneville 2001) – therefore uses asymmetric moving averages to estimate the trend and seasonal components at either end of the series.

The use of asymmetric moving averages can lead to significant revisions at the current end of the series as the implied forecast is replaced by new data (Dagum 1982). This is unfortunate because it is the most recent values that users are interested in. To improve trend and seasonally adjusted estimates for recent periods, ONS therefore

Box 1
Holt-Winters method of forecasting

A simple and popular method of forecasting is to use 'exponential weighting'. In this method, the forecast value ($\hat{y}_{t+1}$) for the $(t+1)^{th}$ period is obtained as a weighted average of the observed values $\{y_s: s = 1 \text{ to } t\}$ for periods 1 to t, where the weight for each period is a fixed proportion of the weight for the following period. This means that, moving from recent periods to earlier periods, the weights decline exponentially.

The following equation summarises this process:

$$\hat{y}_{t+1} = (1-\alpha)\sum_{s=1}^{t}\alpha^{t-s}y_s + \alpha^t y_0 \qquad (1)$$

where the parameter α ($0<\alpha<1$) determines the degree to which the forecast value is responsive to changes in the observed data and y_o is an assumed initial value (usually, y_o is set equal to y_1). If α is close to *0*, the forecast value will change rapidly in response to changes in the observed values. If α is close to 1, the forecast value will be more stable, around a long-term average. Because of these properties, α is often referred to as the 'smoothing parameter'.

The appropriate value to choose for α depends on the nature of the series to be forecast. If the series fluctuates erratically around a constant value, setting α close to 1 is more appropriate. If each successive observed value is very similar to the preceding one, setting α close to 0 is more appropriate.

However, if the observed data exhibit an increasing or decreasing trend, as they often do, the exponentially weighted forecast will lag behind the actual values. To resolve this problem, Holt (1957) proposed the application of the exponential weighting method not only to the observed values $\{y_t\}$ but also to their differences $\{y_t-y_{t-1}\}$. The forecast value for period $t+1$ is then equal to the forecast level plus the forecast increase between periods t and t-1.

Winters (1960) elaborated this method to incorporate seasonal factors, whereby each seasonal component is also forecast using Holt's method. The resultant Holt-Winters method is too complicated to allow an explicit formula for the forecast, as with equation (1) for the exponential weighting method. Instead, forecast values are developed recursively, based on the previous forecast value and the most recent observed value. For example, equation (1) may be written:

$$\hat{y}_{t+1} = \alpha\hat{y}_t + (1-\alpha)y_t \qquad \text{where} \qquad \hat{y}_t = (1-\alpha)\sum_{s=1}^{t-1}\alpha^{t-1-s}y_s + \alpha^{t-1}y_0$$

The Holt-Winters method is based on a set of such recursive formulae for the various components. The loss of the simplicity compared to the exponential weighting method is more than offset by the increased responsiveness to changes in data series and greater forecasting accuracy.

Smoothing parameters for the Holt-Winters method are chosen to minimise the forecasting errors from the application of the method to past data.

Box 2

Autoregressive integrated moving average (ARIMA) models

ARIMA models are a very general type of model that provide a great deal of flexibility and are useful for forecasting in a large variety of situations. The models, in general, have three components, although there are circumstances when not all the components are needed. The three components are: autoregression (AR), integration (I) and moving average (MA).

Autoregression

The essential assumption underlying an autoregressive model for a time series $\{y_t\}$ is that each observed value is a linear function of previous observed values (up to a defined, maximum lag) plus a random error. An AR model with a maximum lag p (referred to as the order of the model) is denoted as an AR(p) model, for which the algebraic expression is:

$$y_t = \rho_1 y_{t-1} + \rho_2 y_{t-2} + ... + \rho_p y_{t-p} + \varepsilon_t \qquad (2)$$

where the $\{p_t\}$ are constants and ε_t is the random error term.

Moving average

The essential assumption underlying a moving average model is that each observed value is a random error plus a linear function of the random errors for previous observed values (up to a defined, maximum lag). An MA model with a maximum lag q is denoted as an MA(q) model, for which the algebraic expression is:

$$y_t = \varepsilon_t + \theta_1 \varepsilon_{t-1} + \theta_2 \varepsilon_{t-2} + ... + \theta_q \varepsilon_{t-q} \qquad (3)$$

where the $\{\theta_t\}$ are constants.

A mixture of these two models is denoted as an ARMA (p,q) model, for which the algebraic expression is:

$$y_t = \rho_1 y_{t-1} + \rho_2 y_{t-2} + ... + \rho_p y_{t-p} + \varepsilon_t + \theta_1 \varepsilon_{t-1} + \theta_2 \varepsilon_{t-2} + ... + \theta_q \varepsilon_{t-q} \qquad (4)$$

A general rule of thumb is that a low-order AR model will give rise to a high-order MA process and vice versa. Therefore, low-ordered ARMA models are capable of adequately representing a large number of different data processes.

Integration

Another assumption underlying both AR and MA models is that the observed values are 'stationary' – that is, the means and variances of the random errors are constant over time. Most time series which occur in practice, however, exhibit trends, increasing or decreasing (or both) over time. To resolve this problem, the ARIMA model is applied instead to differences between successive observed values or, if necessary, differences between the differences up to whatever order is required to produce a stationary series. This differencing process is known as 'integration' and the resultant, integrated model is denoted is ARIMA (p,d,q), where d is the order of differencing. The most common value for d is 1 and it is extremely rare for a value of d greater than 2 to be required.

The airline model

The most frequently used ARIMA model, within ONS, is the ARIMA(0,1,1)(0,1,1) process, often referred to as the 'airline model' because of its use in forecasting numbers of airline passengers in the early years of the theoretical development of these models (Box and Jenkins 1976). This model is expressed algebraically as:

$$y_t - y_{t-1} - y_{t-12} + y_{t-13} = \varepsilon_t - \theta_1 \varepsilon_{t-1} - \theta_{12} \varepsilon_{t-12} + \theta_{13} \varepsilon_{t-13} \qquad (5)$$

Holt's method, also described in Box 1, is a special case of the ARIMA(0,2,2) model.

Seasonal adjustment

X-12-ARIMA uses a regARIMA framework which combines ARIMA with regression modelling for effects such as outliers, level shifts, holiday effects and trading day effects, to enhance the original estimate. The regression modelling is referred to as prior adjustment. This process of prior adjustment and forecasting of the original estimate provides more robust estimates of the trend and seasonal components which are derived by the X-11 method (Findley *et al* 1998).

Data transformation

Sometimes it is necessary to apply a transformation to the series prior to forecasting to stabilise the variance so that it meets the assumptions of weak stationarity required for ARIMA modelling. The most commonly used transformation for series in ONS is a log transformation, which implies that there is a multiplicative relationship between the components of a time series.

Forecasting

Because of the complexity of ARIMA models, forecasting is applied using a recursive process similar to that described for the Holt-Winters method in Box 1. The models are fitted to the observed data and the estimated parameters are used to apply the recursive model (like those specified in equations (2) to (5)) to past data to produce the required forecasts. Forecasts for more than one period into the future will use both actual past data, where it is available, and forecasts for earlier periods as inputs into the forecasting equation.

Model selection

Given the number of series that are seasonally adjusted and forecast it is not possible to manually select appropriate ARIMA models for every series. Therefore automatic model selection is used to choose the order of an ARIMA model. Two model selection procedures can be used in X-12-ARIMA. The first is based on the model selection criteria used by X-11-ARIMA (Dagum 1988), while the second is based on the automatic modelling used in TRAMO (Gomez and Maravall 2000).

utilises the forecasting capabilities of X-12-ARIMA (Findley *et al* 1998). Typically these forecasts project one year ahead and should reduce the size of revisions. The method used for forecasting is based on an autoregressive integrated moving average (ARIMA) model, described in **Box 2**.

Revisions

An inevitable consequence of using forecast values is the occurrence of revisions to seasonally adjusted and trend estimates when actual estimates of the original series appear. Forecast values are only 'best estimates' based on data available at the time, and the corresponding observed values usually turn out to be different, sometimes very different, because of such causes as random error in the estimates or changes in the economy. As the weighted averages for trends and seasonal factors include the forecast period, errors in forecast values can produce revisions to previous periods, depending on the weights used (although revisions to early periods tend to be smaller).

A previous article in *Economic & Labour Market Review*, Mainwaring and Skipper (2007), presented an analysis of revisions to the output measure of gross domestic product, GDP(O). This analysis identified that 33 per cent of revisions in 2005–06 were attributable to the taking on of new data, thereby amending previous estimates or replacing forecasts by actual estimates. The article did not separate off the contribution from replacing forecasts, but a more detailed analysis has identified that this accounts for 6 per cent of all revisions (the remaining 27 per cent being accounted for by adjustments to previous estimates). This relatively small proportion may be due to the relative stability of those series which are forecast, as described earlier.

A further 6 per cent of revisions were attributable to replacement of the implicit forecast values described earlier by actual estimates. This proportion is also relatively small, which may be due to the relative stability of the economy in recent years.

A much greater proportion of revisions, 18 per cent, are attributable to the seasonal adjustment annual review. This review, conducted by Time Series Analysis Branch, determines certain parameters used to obtain the seasonally adjusted estimate, such as the ARIMA model and the length of filters used in the X-11 method. Changes to parameters can cause revisions, which are important to ensure that the seasonally adjusted and trend estimates are informed by the most up-to-date information. It should be noted that the identification of revisions due to the annual seasonal adjustment review is not precise, as they are confounded by revisions to the original estimate as well as additional data points.

Although not all of the changes arising from annual reviews are attributable to forecasting errors, it is clear that they are a substantial cause of revisions (up to 30 per cent of revisions in the example above). To reduce the impact of forecasting errors, it is important to ensure that the most appropriate forecasting methodology is used. Time Series Analysis Branch are currently running a project exploring the nature of revisions with respect to the seasonal adjustment process. Also, as part of the National Accounts re-engineering project, the Holt-Winters method for forecasting estimates when data are not yet available will be replaced by the use of appropriate ARIMA models (Hussain *et al* 2007).

Conclusions

Currently, ONS uses a mixture of Holt-Winters and ARIMA models to extend time series. As part of the process of statistical modernisation, which includes National Accounts re-engineering, the forecasting procedures will change with all forecasting being done by ARIMA models. Annual series will use an ARIMA (0,2,2) process which gives similar results to non-seasonal Holt-Winters. Quarterly and monthly series will be forecast using the ARIMA model adopted for the purpose of seasonal adjustment. The justification for these new approaches to forecasting (and seasonal adjustment) were recently presented at the 27th International Symposium on Forecasting Conference in New York (see Hussain *et al* 2007).

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Key time series

National accounts aggregates

Last updated: 23/11/07

Seasonally adjusted

	£ million		Indices (2003 = 100)						
	At current prices		Value indices at current prices		Chained volume indices			Implied deflators[3]	
	Gross domestic product (GDP) at market prices	Gross value added (GVA) at basic prices	GDP at market prices[1]	GVA at basic prices	Gross national disposable income at market prices[2]	GDP at market prices	GVA at basic prices	GDP at market prices	GVA at basic prices
	YBHA	ABML	YBEU	YBEX	YBFP	YBEZ	CGCE	YBGB	CGBV
2001	1,003,297	889,063	89.7	89.5	93.7	95.3	95.6	94.1	93.6
2002	1,055,793	937,323	94.4	94.3	97.1	97.3	97.3	97.0	97.0
2003	1,118,245	993,507	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2004	1,184,296	1,051,934	105.9	105.9	103.4	103.3	103.3	102.6	102.5
2005	1,233,976	1,096,629	110.3	110.4	104.3	105.2	105.2	104.9	104.9
2006	1,301,914	1,157,136	116.4	116.5	106.5	108.2	108.2	107.7	107.6
2001 Q1	247,905	219,532	88.7	88.4	93.1	94.9	95.3	93.5	92.7
2001 Q2	249,597	220,901	89.3	88.9	93.4	95.0	95.3	94.0	93.3
2001 Q3	251,028	222,536	89.8	89.6	94.4	95.6	95.8	94.0	93.6
2001 Q4	254,767	226,094	91.1	91.0	94.1	95.9	96.0	95.0	94.9
2002 Q1	259,054	229,737	92.7	92.5	95.9	96.4	96.5	96.1	95.9
2002 Q2	262,774	233,372	94.0	94.0	96.2	97.0	96.9	96.9	97.0
2002 Q3	265,836	236,103	95.1	95.1	98.3	97.7	97.6	97.4	97.4
2002 Q4	268,129	238,111	95.9	95.9	98.2	98.2	98.1	97.7	97.7
2003 Q1	272,953	242,612	97.6	97.7	99.4	98.8	98.8	98.9	98.9
2003 Q2	277,119	246,427	99.1	99.2	98.9	99.3	99.3	99.8	99.9
2003 Q3	281,996	250,492	100.9	100.9	100.0	100.4	100.4	100.4	100.5
2003 Q4	286,177	253,976	102.4	102.3	101.7	101.5	101.6	100.9	100.7
2004 Q1	288,912	256,106	103.3	103.1	101.9	102.2	102.2	101.1	100.9
2004 Q2	295,066	262,094	105.5	105.5	103.2	103.1	103.2	102.3	102.3
2004 Q3	297,941	264,732	106.6	106.6	103.0	103.5	103.5	102.9	103.0
2004 Q4	302,377	269,002	108.2	108.3	105.4	104.1	104.2	103.9	104.0
2005 Q1	303,996	270,082	108.7	108.7	104.1	104.4	104.4	104.2	104.1
2005 Q2	307,306	273,158	109.9	110.0	105.4	104.8	104.9	104.9	104.8
2005 Q3	308,515	273,676	110.4	110.2	103.5	105.4	105.4	104.7	104.5
2005 Q4	314,159	279,713	112.4	112.6	104.1	106.1	106.2	106.0	106.1
2006 Q1	318,171	283,047	113.8	114.0	105.2	106.9	107.0	106.4	106.5
2006 Q2	321,860	285,937	115.1	115.1	107.0	107.8	107.8	106.8	106.8
2006 Q3	329,009	292,359	117.7	117.7	107.1	108.5	108.6	108.5	108.4
2006 Q4	332,874	295,793	119.1	119.1	106.7	109.4	109.5	108.8	108.8
2007 Q1	337,877	299,867	120.9	120.7	108.9	110.3	110.4	109.6	109.4
2007 Q2	344,321	305,937	123.2	123.2	110.1	111.2	111.3	110.8	110.7
2007 Q3	348,509	310,291	124.7	124.9		112.0	112.1	111.3	111.5
Percentage change, quarter on corresponding quarter of previous year[4]									
2001 Q1	*5.0*	*5.3*	*5.1*	*5.4*	*3.3*	*2.9*	*2.9*	*2.1*	*2.2*
2001 Q2	*4.6*	*5.0*	*4.6*	*5.0*	*3.2*	*2.3*	*2.1*	*2.3*	*2.8*
2001 Q3	*4.1*	*4.5*	*4.2*	*4.6*	*3.1*	*2.4*	*1.9*	*1.8*	*2.6*
2001 Q4	*4.8*	*5.2*	*4.7*	*5.2*	*3.7*	*2.0*	*1.6*	*2.7*	*3.6*
2002 Q1	*4.5*	*4.6*	*4.5*	*4.6*	*3.0*	*1.6*	*1.3*	*2.8*	*3.5*
2002 Q2	*5.3*	*5.6*	*5.3*	*5.7*	*3.0*	*2.1*	*1.7*	*3.1*	*4.0*
2002 Q3	*5.9*	*6.1*	*5.9*	*6.1*	*4.1*	*2.2*	*1.9*	*3.6*	*4.1*
2002 Q4	*5.2*	*5.3*	*5.3*	*5.4*	*4.4*	*2.4*	*2.2*	*2.8*	*3.0*
2003 Q1	*5.4*	*5.6*	*5.3*	*5.6*	*3.6*	*2.5*	*2.4*	*2.9*	*3.1*
2003 Q2	*5.5*	*5.6*	*5.4*	*5.5*	*2.8*	*2.4*	*2.5*	*3.0*	*3.0*
2003 Q3	*6.1*	*6.1*	*6.1*	*6.1*	*1.7*	*2.8*	*2.9*	*3.1*	*3.2*
2003 Q4	*6.7*	*6.7*	*6.8*	*6.7*	*3.6*	*3.4*	*3.6*	*3.3*	*3.1*
2004 Q1	*5.8*	*5.6*	*5.8*	*5.5*	*2.5*	*3.4*	*3.4*	*2.2*	*2.0*
2004 Q2	*6.5*	*6.4*	*6.5*	*6.4*	*4.3*	*3.8*	*3.9*	*2.5*	*2.4*
2004 Q3	*5.7*	*5.7*	*5.6*	*5.6*	*3.0*	*3.1*	*3.1*	*2.5*	*2.5*
2004 Q4	*5.7*	*5.9*	*5.7*	*5.9*	*3.6*	*2.6*	*2.6*	*3.0*	*3.3*
2005 Q1	*5.2*	*5.5*	*5.2*	*5.4*	*2.2*	*2.2*	*2.2*	*3.1*	*3.2*
2005 Q2	*4.1*	*4.2*	*4.2*	*4.3*	*2.1*	*1.6*	*1.6*	*2.5*	*2.4*
2005 Q3	*3.5*	*3.4*	*3.6*	*3.4*	*0.5*	*1.8*	*1.8*	*1.7*	*1.5*
2005 Q4	*3.9*	*4.0*	*3.9*	*4.0*	*–1.2*	*1.9*	*1.9*	*2.0*	*2.0*
2006 Q1	*4.7*	*4.8*	*4.7*	*4.9*	*1.1*	*2.4*	*2.5*	*2.1*	*2.3*
2006 Q2	*4.7*	*4.7*	*4.7*	*4.6*	*1.5*	*2.9*	*2.8*	*1.8*	*1.9*
2006 Q3	*6.6*	*6.8*	*6.6*	*6.8*	*3.5*	*2.9*	*3.0*	*3.6*	*3.7*
2006 Q4	*6.0*	*5.7*	*6.0*	*5.8*	*2.5*	*3.1*	*3.1*	*2.6*	*2.5*
2007 Q1	*6.2*	*5.9*	*6.2*	*5.9*	*3.5*	*3.2*	*3.2*	*3.0*	*2.7*
2007 Q2	*7.0*	*7.0*	*7.0*	*7.0*	*2.9*	*3.2*	*3.2*	*3.7*	*3.7*
2007 Q3	*5.9*	*6.1*	*5.9*	*6.1*		*3.2*	*3.2*	*2.6*	*2.9*

Notes:

Source: Office for National Statistics

1 "Money GDP".
2 This series is only updated once a quarter, in line with the full quarterly national accounts data set.
3 Based on chained volume measures and current price estimates of expenditure components of GDP.
4 For index number series, these are derived from the rounded figures shown in the table.

Gross domestic product: by category of expenditure

Last updated: 23/11/07

£ million, chained volume measures, reference year 2003, seasonally adjusted

	Domestic expenditure on goods and services at market prices											
	Final consumption expenditure			Gross capital formation								
	Households	Non-profit institutions[1]	General government	Gross fixed capital formation	Changes in inventories[2]	Acquisitions less disposals of valuables	Total	Exports of goods and services	Gross final expenditure	*less* imports of goods and services	Statistical discrepancy (expenditure)	Gross domestic at product market prices
	ABJR	HAYO	NMRY	NPQT	CAFU	NPJR	YBIM	IKBK	ABMG	IKBL	GIXS	ABMI
2001	653,326	27,155	217,359	178,203	5,577	342	1,082,333	277,694	1,360,205	294,449	0	1,066,217
2002	676,833	27,130	224,868	184,701	2,289	183	1,116,239	280,593	1,396,862	308,706	0	1,088,108
2003	697,160	27,185	232,699	186,700	3,983	–37	1,147,690	285,397	1,433,087	314,842	0	1,118,245
2004	721,434	27,327	240,129	197,655	4,597	–42	1,191,099	299,289	1,490,388	335,703	0	1,154,685
2005	732,005	28,167	246,527	200,654	3,611	–354	1,210,610	323,749	1,534,359	359,626	1,183	1,175,916
2006	746,358	29,875	251,724	217,085	1,236	66	1,246,344	357,110	1,603,454	394,860	793	1,209,387
2001 Q1	161,204	6,873	53,609	44,158	1,675	–26	267,565	71,295	339,027	73,841	0	265,267
2001 Q2	162,333	6,788	53,894	44,888	1,793	202	270,071	69,333	339,452	73,937	0	265,573
2001 Q3	164,239	6,762	54,600	45,017	1,726	30	272,481	67,921	340,353	73,327	0	267,163
2001 Q4	165,550	6,732	55,256	44,140	383	136	272,216	69,145	341,373	73,344	0	268,214
2002 Q1	167,588	6,762	55,756	44,562	1,059	66	275,814	69,440	345,256	75,709	0	269,595
2002 Q2	168,803	6,756	56,288	45,610	409	48	277,926	71,533	349,504	78,367	0	271,044
2002 Q3	169,715	6,793	56,429	46,422	520	62	280,004	71,056	351,089	78,006	0	273,034
2002 Q4	170,727	6,819	56,395	48,107	301	7	282,495	68,564	351,013	76,624	0	274,435
2003 Q1	171,828	6,843	57,099	46,805	–477	-8	282,249	72,662	354,921	78,836	0	276,082
2003 Q2	174,146	6,779	57,684	46,131	–635	94	284,342	70,610	354,945	77,283	0	277,686
2003 Q3	175,140	6,790	58,445	45,964	2,223	–68	288,498	70,334	358,825	78,089	0	280,743
2003 Q4	176,046	6,773	59,471	47,800	2,872	–55	292,601	71,791	364,396	80,634	0	283,734
2004 Q1	178,197	6,830	59,969	49,353	–439	112	294,023	73,389	367,412	81,648	0	285,764
2004 Q2	180,362	6,805	59,530	49,159	1,042	–90	296,808	74,861	371,670	83,313	0	288,357
2004 Q3	181,032	6,826	60,002	49,832	1,047	–96	298,644	75,097	373,741	84,300	0	289,441
2004 Q4	181,843	6,866	60,628	49,311	2,947	32	301,624	75,942	377,565	86,442	0	291,123
2005 Q1	182,466	7,005	60,858	49,393	1,894	–158	301,458	75,952	377,410	85,898	253	291,764
2005 Q2	182,306	6,987	61,613	49,334	797	86	301,122	79,576	380,698	87,920	300	293,078
2005 Q3	183,174	7,042	61,885	50,642	853	–201	303,394	82,357	385,751	91,483	320	294,588
2005 Q4	184,059	7,133	62,171	51,285	67	–81	304,636	85,864	390,500	94,325	310	296,486
2006 Q1	184,161	7,356	62,857	52,461	434	–128	307,140	93,587	400,727	102,053	225	298,899
2006 Q2	186,443	7,437	62,612	53,305	–196	233	309,834	96,083	405,917	104,796	202	301,323
2006 Q3	186,861	7,511	62,919	54,766	1,707	–29	313,735	83,629	397,364	94,220	186	303,330
2006 Q4	188,893	7,571	63,336	56,553	–709	–10	315,635	83,811	399,446	93,791	180	305,835
2007 Q1	190,133	7,629	63,631	57,170	272	73	318,908	83,998	402,905	94,848	203	308,260
2007 Q2	191,562	7,701	63,850	56,635	851	327	320,925	84,126	405,051	94,469	204	310,787
2007 Q3	193,483	7,758	64,033	57,558	1,786	49	324,667	86,439	411,107	98,196	205	313,116

Percentage change, quarter on corresponding quarter of previous year

2001 Q1	*2.1*	*3.9*	*1.8*	*3.0*		*2.8*	*9.7*	*4.3*	*9.0*	*2.9*
2001 Q2	*2.9*	*0.6*	*1.6*	*5.5*		*3.2*	*3.0*	*3.1*	*6.1*	*2.3*
2001 Q3	*3.4*	*–1.6*	*2.8*	*3.7*		*3.0*	*1.0*	*2.6*	*3.6*	*2.3*
2001 Q4	*4.0*	*–3.0*	*3.3*	*–1.6*		*2.7*	*–1.6*	*1.7*	*0.7*	*2.1*
2002 Q1	*4.0*	*–1.6*	*4.0*	*0.9*		*3.1*	*–2.6*	*1.8*	*2.5*	*1.6*
2002 Q2	*4.0*	*–0.5*	*4.4*	*1.6*		*2.9*	*3.2*	*3.0*	*6.0*	*2.1*
2002 Q3	*3.3*	*0.5*	*3.3*	*3.1*		*2.8*	*4.6*	*3.2*	*6.4*	*2.2*
2002 Q4	*3.1*	*1.3*	*2.1*	*9.0*		*3.8*	*–0.8*	*2.8*	*4.5*	*2.3*
2003 Q1	*2.5*	*1.2*	*2.4*	*5.0*		*2.3*	*4.6*	*2.8*	*4.1*	*2.4*
2003 Q2	*3.2*	*0.3*	*2.5*	*1.1*		*2.3*	*–1.3*	*1.6*	*–1.4*	*2.5*
2003 Q3	*3.2*	*0.0*	*3.6*	*–1.0*		*3.0*	*–1.0*	*2.2*	*0.1*	*2.8*
2003 Q4	*3.1*	*–0.7*	*5.5*	*–0.6*		*3.6*	*4.7*	*3.8*	*5.2*	*3.4*
2004 Q1	*3.7*	*–0.2*	*5.0*	*5.4*		*4.2*	*1.0*	*3.5*	*3.6*	*3.5*
2004 Q2	*3.6*	*0.4*	*3.2*	*6.6*		*4.4*	*6.0*	*4.7*	*7.8*	*3.8*
2004 Q3	*3.4*	*0.5*	*2.7*	*8.4*		*3.5*	*6.8*	*4.2*	*8.0*	*3.1*
2004 Q4	*3.3*	*1.4*	*1.9*	*3.2*		*3.1*	*5.8*	*3.6*	*7.2*	*2.6*
2005 Q1	*2.4*	*2.6*	*1.5*	*0.1*		*2.5*	*3.5*	*2.7*	*5.2*	*2.1*
2005 Q2	*1.1*	*2.7*	*3.5*	*0.4*		*1.5*	*6.3*	*2.4*	*5.5*	*1.6*
2005 Q3	*1.2*	*3.2*	*3.1*	*1.6*		*1.6*	*9.7*	*3.2*	*8.5*	*1.8*
2005 Q4	*1.2*	*3.9*	*2.5*	*4.0*		*1.0*	*13.1*	*3.4*	*9.1*	*1.8*
2006 Q1	*0.9*	*5.0*	*3.3*	*6.2*		*1.9*	*23.2*	*6.2*	*18.8*	*2.4*
2006 Q2	*2.3*	*6.4*	*1.6*	*8.0*		*2.9*	*20.7*	*6.6*	*19.2*	*2.8*
2006 Q3	*2.0*	*6.7*	*1.7*	*8.1*		*3.4*	*1.5*	*3.0*	*3.0*	*3.0*
2006 Q4	*2.6*	*6.1*	*1.9*	*10.3*		*3.6*	*–2.4*	*2.3*	*–0.6*	*3.2*
2007 Q1	*3.2*	*3.7*	*1.2*	*9.0*		*3.8*	*–10.2*	*0.5*	*–7.1*	*3.1*
2007 Q2	*2.7*	*3.5*	*2.0*	*6.2*		*3.6*	*–12.4*	*–0.2*	*–9.9*	*3.1*
2007 Q3	*3.5*	*3.3*	*1.8*	*5.1*		*3.5*	*3.4*	*3.5*	*4.2*	*3.2*

Notes:

1 Non-profit institutions serving households (NPISH).
2 This series includes a quarterly alignment adjustment.

Source: Office for National Statistics

Labour market summary

Last updated: 14/11/07

United Kingdom (thousands), seasonally adjusted

All aged 16 and over

	All	Total economically active	Total in employment	Unemployed	Economically inactive	Economic activity rate (%)	Employment rate (%)	Unemployment rate (%)	Economic inactivity rate (%)
	1	2	3	4	5	6	7	8	9
All persons	MGSL	MGSF	MGRZ	MGSC	MGSI	MGWG	MGSR	MGSX	YBTC
Jul-Sep 2005	47,892	30,284	28,834	1,450	17,608	*63.2*	*60.2*	*4.8*	*36.8*
Jul-Sep 2006	48,282	30,758	29,044	1,714	17,524	*63.7*	*60.2*	*5.6*	*36.3*
Oct-Dec 2006	48,381	30,793	29,102	1,691	17,587	*63.6*	*60.2*	*5.5*	*36.4*
Jan-Mar 2007	48,479	30,759	29,053	1,705	17,720	*63.4*	*59.9*	*5.5*	*36.6*
Apr-Jun 2007	48,577	30,814	29,154	1,660	17,763	*63.4*	*60.0*	*5.4*	*36.6*
Jul-Sep 2007	48,675	30,889	29,223	1,667	17,786	*63.5*	*60.0*	*5.4*	*36.5*
Male	MGSM	MGSG	MGSA	MGSD	MGSJ	MGWH	MGSS	MGSY	YBTD
Jul-Sep 2005	23,225	16,398	15,537	861	6,827	*70.6*	*66.9*	*5.3*	*29.4*
Jul-Sep 2006	23,446	16,682	15,685	997	6,764	*71.2*	*66.9*	*6.0*	*28.8*
Oct-Dec 2006	23,501	16,674	15,707	967	6,827	*71.0*	*66.8*	*5.8*	*29.0*
Jan-Mar 2007	23,555	16,689	15,714	975	6,866	*70.9*	*66.7*	*5.8*	*29.1*
Apr-Jun 2007	23,610	16,732	15,782	950	6,878	*70.9*	*66.8*	*5.7*	*29.1*
Jul-Sep 2007	23,664	16,750	15,800	950	6,915	*70.8*	*66.8*	*5.7*	*29.2*
Female	MGSN	MGSH	MGSB	MGSE	MGSK	MGWI	MGST	MGSZ	YBTE
Jul-Sep 2005	24,667	13,886	13,297	589	10,781	*56.3*	*53.9*	*4.2*	*43.7*
Jul-Sep 2006	24,836	14,076	13,359	717	10,760	*56.7*	*53.8*	*5.1*	*43.3*
Oct-Dec 2006	24,880	14,119	13,395	724	10,761	*56.7*	*53.8*	*5.1*	*43.3*
Jan-Mar 2007	24,924	14,069	13,339	730	10,854	*56.4*	*53.5*	*5.2*	*43.6*
Apr-Jun 2007	24,967	14,082	13,372	710	10,885	*56.4*	*53.6*	*5.0*	*43.6*
Jul-Sep 2007	25,011	14,140	13,423	717	10,871	*56.5*	*53.7*	*5.1*	*43.5*

All aged 16 to 59/64

	All	Total economically active	Total in employment	Unemployed	Economically inactive	Economic activity rate (%)	Employment rate (%)	Unemployment rate (%)	Economic inactivity rate (%)
	10	11	12	13	14	15	16	17	18
All persons	YBTF	YBSK	YBSE	YBSH	YBSN	MGSO	MGSU	YBTI	YBTL
Jul-Sep 2005	37,106	29,189	27,763	1,425	7,917	*78.7*	*74.8*	*4.9*	*21.3*
Jul-Sep 2006	37,384	29,538	27,854	1,685	7,845	*79.0*	*74.5*	*5.7*	*21.0*
Oct-Dec 2006	37,436	29,569	27,899	1,670	7,867	*79.0*	*74.5*	*5.6*	*21.0*
Jan-Mar 2007	37,488	29,534	27,853	1,681	7,954	*78.8*	*74.3*	*5.7*	*21.2*
Apr-Jun 2007	37,540	29,576	27,944	1,632	7,964	*78.8*	*74.4*	*5.5*	*21.2*
Jul-Sep 2007	37,592	29,620	27,978	1,642	7,972	*78.8*	*74.4*	*5.5*	*21.2*
Male	YBTG	YBSL	YBSF	YBSI	YBSO	MGSP	MGSV	YBTJ	YBTM
Jul-Sep 2005	19,207	16,024	15,173	851	3,183	*83.4*	*79.0*	*5.3*	*16.6*
Jul-Sep 2006	19,387	16,268	15,285	983	3,119	*83.9*	*78.8*	*6.0*	*16.1*
Oct-Dec 2006	19,430	16,267	15,307	960	3,162	*83.7*	*78.8*	*5.9*	*16.3*
Jan-Mar 2007	19,472	16,280	15,314	965	3,193	*83.6*	*78.6*	*5.9*	*16.4*
Apr-Jun 2007	19,515	16,316	15,379	937	3,199	*83.6*	*78.8*	*5.7*	*16.4*
Jul-Sep 2007	19,558	16,318	15,378	940	3,240	*83.4*	*78.6*	*5.8*	*16.6*
Female	YBTH	YBSM	YBSG	YBSJ	YBSP	MGSQ	MGSW	YBTK	YBTN
Jul-Sep 2005	17,899	13,165	12,590	574	4,734	*73.5*	*70.3*	*4.4*	*26.5*
Jul-Sep 2006	17,996	13,270	12,569	702	4,726	*73.7*	*69.8*	*5.3*	*26.3*
Oct-Dec 2006	18,006	13,301	12,592	709	4,705	*73.9*	*69.9*	*5.3*	*26.1*
Jan-Mar 2007	18,015	13,254	12,538	716	4,762	*73.6*	*69.6*	*5.4*	*26.4*
Apr-Jun 2007	18,025	13,260	12,565	695	4,765	*73.6*	*69.7*	*5.2*	*26.4*
Jul-Sep 2007	18,035	13,302	12,601	701	4,733	*73.8*	*69.9*	*5.3*	*26.2*

Notes:

Relationship between columns: 1 = 2 + 5; 2 = 3 + 4; 6 = 2/1; 7 = 3/1; 8 = 4/2;
9 = 5/1; 10 = 11 + 14; 11 = 12 + 13; 15 = 11/10; 16 = 12/10; 17 = 13/11; 18 = 14/10
The Labour Force Survey is a survey of the population of private households, student halls of residence and NHS accommodation.

Source: Labour Force Survey, Office for National Statistics
Labour Market Statistics Helpline: 01633 456901

Prices

Last updated: 13/11/07

Percentage change over 12 months

	Consumer prices						Not seasonally adjusted, except for series PLLW, RNPE and RNPF Producer prices			
	Consumer prices index (CPI)			Retail prices index (RPI)			Output prices		Input prices	
	All items	CPI excluding indirect taxes (CPIY)[1]	CPI at constant tax rates (CPI-CT)	All items	All items excluding mortgage interest payments (RPIX)	All items excluding mortgage interest payments and indirect taxes (RPIY)[2]	All manufactured products	Excluding food, beverages, tobacco and petroleum products	Materials and fuels purchased by manufacturing industry	Excluding food, beverages, tobacco and petroleum products
	D7G7	EL2S	EAD6	CZBH	CDKQ	CBZX	PLLU[3]	PLLW[3]	RNPE[3]	RNPF[3]
2003 Jan	1.3			2.9	2.7	2.9	1.3	0.9	1.7	–2.2
2003 Feb	1.6			3.2	3.0	3.1	1.5	1.1	2.5	–2.0
2003 Mar	1.5			3.1	3.0	3.2	2.1	1.3	0.8	–1.5
2003 Apr	1.4			3.1	3.0	2.9	1.6	1.3	–1.3	–0.6
2003 May	1.3			3.0	2.9	2.7	1.1	1.2	–0.1	–0.2
2003 Jun	1.1			2.9	2.8	2.7	1.1	1.2	0.0	–1.2
2003 Jul	1.3			3.1	2.9	2.8	1.3	1.3	0.6	–0.5
2003 Aug	1.4			2.9	2.9	2.7	1.5	1.2	1.9	0.0
2003 Sep	1.4			2.8	2.8	2.7	1.4	1.4	1.3	1.0
2003 Oct	1.4			2.6	2.7	2.4	1.5	1.3	2.5	1.2
2003 Nov	1.3			2.5	2.5	2.1	1.7	1.4	4.6	1.7
2003 Dec	1.3	1.1	1.1	2.8	2.6	2.2	1.8	1.5	2.0	0.4
2004 Jan	1.4	1.5	1.3	2.6	2.4	2.0	1.6	1.4	–0.3	0.0
2004 Feb	1.3	1.3	1.1	2.5	2.3	1.9	1.6	1.5	–0.8	–0.4
2004 Mar	1.1	1.1	1.0	2.6	2.1	1.7	1.4	1.5	0.8	–0.1
2004 Apr	1.1	1.1	1.0	2.5	2.0	1.8	1.8	1.3	2.9	–0.1
2004 May	1.5	1.4	1.3	2.8	2.3	2.2	2.5	1.4	5.6	0.6
2004 Jun	1.6	1.5	1.4	3.0	2.3	2.3	2.6	1.4	3.8	1.3
2004 Jul	1.4	1.4	1.2	3.0	2.2	2.0	2.6	1.7	3.9	1.8
2004 Aug	1.3	1.3	1.1	3.2	2.2	2.0	2.8	2.2	4.6	2.4
2004 Sep	1.1	1.0	0.9	3.1	1.9	1.7	3.1	2.3	8.1	3.6
2004 Oct	1.2	1.2	1.1	3.3	2.1	2.0	3.5	2.9	9.0	4.6
2004 Nov	1.5	1.4	1.4	3.4	2.2	2.2	3.5	3.0	6.4	4.5
2004 Dec	1.7	1.7	1.6	3.5	2.5	2.5	2.9	2.5	4.0	4.0
2005 Jan	1.6	1.7	1.5	3.2	2.1	2.0	2.6	2.6	9.7	7.5
2005 Feb	1.7	1.7	1.6	3.2	2.1	2.0	2.7	2.5	11.0	8.2
2005 Mar	1.9	2.0	1.8	3.2	2.4	2.3	2.9	2.4	11.1	7.4
2005 Apr	1.9	2.0	1.9	3.2	2.3	2.3	3.3	2.6	10.1	7.0
2005 May	1.9	2.0	1.8	2.9	2.1	2.2	2.7	2.5	7.6	6.7
2005 Jun	2.0	2.2	1.9	2.9	2.2	2.2	2.5	2.2	11.8	7.4
2005 Jul	2.3	2.5	2.3	2.9	2.4	2.5	3.1	2.2	13.9	8.6
2005 Aug	2.4	2.6	2.3	2.8	2.3	2.3	3.0	1.9	12.8	7.5
2005 Sep	2.5	2.6	2.4	2.7	2.5	2.5	3.3	2.1	10.5	5.7
2005 Oct	2.3	2.5	2.3	2.5	2.4	2.3	2.6	1.4	8.9	7.0
2005 Nov	2.1	2.3	2.1	2.4	2.3	2.3	2.3	1.3	13.6	9.6
2005 Dec	1.9	2.1	1.8	2.2	2.0	2.0	2.4	1.7	17.9	12.1
2006 Jan	1.9	2.1	1.9	2.4	2.3	2.3	2.9	1.7	15.8	10.2
2006 Feb	2.0	2.1	2.0	2.4	2.3	2.3	2.9	1.7	15.0	10.6
2006 Mar	1.8	1.9	1.7	2.4	2.1	2.2	2.5	1.9	13.0	10.0
2006 Apr	2.0	2.1	2.0	2.6	2.4	2.3	2.5	2.2	15.3	10.0
2006 May	2.2	2.3	2.2	3.0	2.9	2.8	3.1	2.4	13.6	8.6
2006 Jun	2.5	2.6	2.4	3.3	3.1	3.2	3.4	2.9	11.1	8.7
2006 Jul	2.4	2.4	2.3	3.3	3.1	3.2	2.9	2.5	10.6	8.3
2006 Aug	2.5	2.6	2.4	3.4	3.3	3.4	2.7	2.3	8.0	7.9
2006 Sep	2.4	2.6	2.3	3.6	3.2	3.3	1.9	2.2	5.4	7.4
2006 Oct	2.4	2.7	2.3	3.7	3.2	3.3	1.6	2.6	4.6	6.3
2006 Nov	2.7	3.0	2.6	3.9	3.4	3.6	1.8	2.5	3.6	4.9
2006 Dec	3.0	3.2	2.9	4.4	3.8	3.9	2.2	2.4	2.5	3.1
2007 Jan	2.7	2.9	2.6	4.2	3.5	3.7	2.2	2.5	–2.1	1.5
2007 Feb	2.8	2.9	2.6	4.6	3.7	3.9	2.3	2.7	–1.1	1.4
2007 Mar	3.1	3.1	2.9	4.8	3.9	4.0	2.7	2.8	0.7	2.4
2007 Apr	2.8	2.9	2.6	4.5	3.6	3.7	2.4	2.4	–0.9	1.9
2007 May	2.5	2.6	2.3	4.3	3.3	3.4	2.4	2.2	1.2	3.6
2007 Jun	2.4	2.5	2.2	4.4	3.3	3.3	2.5	2.1	2.4	3.3
2007 Jul	1.9	2.0	1.7	3.8	2.7	2.6	2.5	2.2	0.4	1.2
2007 Aug	1.8	1.9	1.6	4.1	2.7	2.6	2.4	2.4	0.7	1.9
2007 Sep	1.8	1.7	1.6	3.9	2.8	2.8	2.8	2.2	6.7	3.4
2007 Oct	2.1	1.9	1.8	4.2	3.1	3.0	3.8	2.3	8.5	2.9

Notes:

Source: Office for National Statistics

1 The taxes excluded are VAT, duties, insurance premium tax, air passenger duty and stamp duty on share transactions.
2 The taxes excluded are council tax, VAT, duties, vehicle excise duty, insurance premium tax and air passenger duty.
3 Derived from these identification (CDID) codes.

NOTES TO TABLES

Identification (CDID) codes

The four-character identification code at the top of each alpha column of data is the ONS reference for that series of data on our time series database. Please quote the relevant code if you contact us about the data.

Conventions

Where figures have been rounded to the final digit, there may be an apparent slight discrepancy between the sum of the constituent items and the total shown. Although figures may be given in unrounded form to facilitate readers' calculation of percentage changes, rates of change, etc, this does not imply that the figures can be estimated to this degree of precision as they may be affected by sampling variability or imprecision in estimation methods.

The following standard symbols are used:

..	not available
-	nil or negligible
P	provisional
–	break in series
R	revised
r	series revised from indicated entry onwards

CONCEPTS AND DEFINITIONS

Labour Force Survey 'monthly' estimates

Labour Force Survey (LFS) results are three-monthly averages, so consecutive months' results overlap. Comparing estimates for overlapping three-month periods can produce more volatile results, which can be difficult to interpret.

Labour market summary

Economically active

People aged 16 and over who are either in employment or unemployed.

Economically inactive

People who are neither in employment nor unemployed. This includes those who want a job but have not been seeking work in the last four weeks, those who want a job and are seeking work but not available to start work, and those who do not want a job.

Employment and jobs

There are two ways of looking at employment: the number of people with jobs, or the number of jobs. The two concepts are not the same as one person can have more than one job. The number of people with jobs is measured by the Labour Force Survey (LFS) and includes people aged 16 or over who do paid work (as an employee or self-employed), those who have a job that they are temporarily away from, those on government-supported training and employment programmes, and those doing unpaid family work. The number of jobs is measured by workforce jobs and is the sum of employee jobs (as measured by surveys of employers), self-employment jobs from the LFS, people in HM Forces, and government-supported trainees. Vacant jobs are not included.

Unemployment

The number of unemployed people in the UK is measured through the Labour Force Survey following the internationally agreed definition recommended by the ILO (International Labour Organisation) – an agency of the United Nations.

Unemployed people:

- are without a job, want a job, have actively sought work in the last four weeks and are available to start work in the next two weeks, or
- are out of work, have found a job and are waiting to start it in the next two weeks

Other key indicators

Claimant count

The number of people claiming Jobseeker's Allowance benefits.

Earnings

A measure of the money people receive in return for work done, gross of tax. It includes salaries and, unless otherwise stated, bonuses but not unearned income, benefits in kind or arrears of pay.

Productivity

Whole economy output per worker is the ratio of Gross Value Added (GVA) at basic prices and Labour Force Survey (LFS) total employment. Manufacturing output per filled job is the ratio of manufacturing output (from the Index of Production) and productivity jobs for manufacturing (constrained to LFS jobs at the whole economy level).

Redundancies

The number of people who:

- were not in employment during the reference week, and
- reported that they had been made redundant in the month of, or the two calendar months prior to, the reference week

plus the number of people who:

- were in employment during the reference week, and
- started their job in the same calendar month as, or the two calendar months prior to, the reference week, and
- reported that they had been made redundant in the month of, or the two calendar months prior to, the reference week

Unit wage costs

A measure of the cost of wages and salaries per unit of output.

Vacancies

The statistics are based on ONS's Vacancy Survey of businesses. The survey is designed to provide comprehensive estimates of the stock of vacancies across the economy, excluding those in agriculture, forestry and fishing. Vacancies are defined as positions for which employers are actively seeking recruits from outside their business or organisation. More information on labour market concepts, sources and methods is available in the *Guide to Labour Market Statistics* at www.statistics.gov.uk/about/data/guides/LabourMarket/default.asp

Directory of online tables

The tables listed below are available as Excel spreadsheets via weblinks accessible from the main *Economic & Labour Market Review* (ELMR) page of the National Statistics website. Tables in sections 1, 3, 4 and 5 replace equivalent ones formerly published in *Economic Trends*, although there are one or two new tables here; others have been expanded to include, as appropriate, both unadjusted/seasonally adjusted, and current price/chained volume measure variants. Tables in sections 2 and 6 were formerly in *Labour Market Trends*. The opportunity has also been taken to extend the range of dates shown in many cases, as the online tables are not constrained by page size.

In the online tables, the four-character identification codes at the top of each data column correspond to the ONS reference for that series on our time series database. The latest data sets for the old *Economic Trends* tables and the Labour Market Statistics First Release tables are still available on this database via the 'Time Series Data' link on the National Statistics main web page. These data sets can also be accessed from links at the bottom of each section's table listings via the 'Data tables' link in the individual ELMR edition pages on the website.

Weblink: www.statistics.gov.uk/elmr/12_07/data_page.asp

Title	Frequency of update	Updated since last month
UK economic accounts		
1.01 National accounts aggregates	M	✔
1.02 Gross domestic product and gross national income	M	✔
1.03 Gross domestic product, by category of expenditure	M	✔
1.04 Gross domestic product, by category of income	M	✔
1.05 Gross domestic product and shares of income and expenditure	M	✔
1.06 Income, product and spending per head	Q	.
1.07 Households' disposable income and consumption	M	✔
1.08 Household final consumption expenditure	M	✔
1.09 Gross fixed capital formation	M	✔
1.10 Gross value added, by category of output	M	✔
1.11 Gross value added, by category of output: service industries	M	✔
1.12 Summary capital accounts and net lending/net borrowing	Q	.
1.13 Private non-financial corporations: allocation of primary income account	Q	.
1.14 Private non-financial corporations: secondary distribution of income account and capital account	Q	.
1.15 Balance of payments: current account	M	✔
1.16 Trade in goods (on a balance of payments basis)	M	✔
1.17 Measures of variability of selected economic series	Q	.
1.18 Index of services	M	✔
Selected labour market statistics		
2.01 Summary of Labour Force Survey data	M	✔
2.02 Employment by age	M	✔
2.03 Full-time, part-time and temporary workers	M	✔
2.04 Public and private sector employment	Q	.
2.05 Workforce jobs	Q	.
2.06 Workforce jobs by industry	Q	.
2.07 Actual weekly hours of work	M	✔
2.08 Usual weekly hours of work	M	✔
2.09 Unemployment by age and duration	M	✔
2.10 Claimant count levels and rates	M	✔
2.11 Claimant count by age and duration	M	✔
2.12 Economic activity by age	M	✔
2.13 Economic inactivity by age	M	✔
2.14 Economic inactivity: reasons	M	✔
2.15 Educational status, economic activity and inactivity of young people	M	✔
2.16 Average earnings – including bonuses	M	✔
2.17 Average earnings – excluding bonuses	M	✔
2.18 Productivity and unit wage costs	M	✔
2.19 Regional labour market summary	M	✔

Weblink: www.statistics.gov.uk/elmr/12_07/data_page.asp

2.20	International comparisons	M	✔
2.21	Labour disputes	M	✔
2.22	Vacancies	M	✔
2.23	Vacancies by industry	M	✔
2.24	Redundancies: levels and rates	M	✔
2.25	Redundancies: by industry	Q	✔
2.26	Sampling variability for headline labour market statistics	M	✔

Prices

3.01	Producer and consumer prices	M	✔
3.02	Harmonised Indices of Consumer Prices: EU comparisons	M	✔

Selected output and demand indicators

4.01	Output of the production industries	M	✔
4.02	Engineering and construction: output and orders	M	✔
4.03	Motor vehicle and steel production	M	✔
4.04	Indicators of fixed investment in dwellings	M	✔
4.05	Number of property transactions	M	✔
4.06	Change in inventories	Q	•
4.07	Inventory ratios	Q	•
4.08	Retail sales, new registrations of cars and credit business	M	✔
4.09	Inland energy consumption: primary fuel input basis	M	✔

Selected financial statistics

5.01	Sterling exchange rates and UK reserves	M	✔
5.02	Monetary aggregates	M	✔
5.03	Counterparts to changes in money stock M4	M	✔
5.04	Public sector receipts and expenditure	Q	•
5.05	Public sector key fiscal indicators	M	✔
5.06	Consumer credit and other household sector borrowing	M	•
5.07	Analysis of bank lending to UK residents	M	✔
5.08	Interest rates and yields	M	✔
5.09	A selection of asset prices	M	✔

Further labour market statistics

6.01	Working-age households	A	•
6.02	Local labour market indicators by unitary and local authority	Q	✔
6.03	Employment by occupation	Q	✔
6.04	Employee jobs by industry	M	✔
6.05	Employee jobs by industry division, class or group	Q	•
6.06	Employee jobs by region and industry	Q	•
6.07	Key productivity measures by industry	M	✔
6.08	Total workforce hours worked per week	Q	•
6.09	Total workforce hours worked per week by region and industry group	Q	•
6.10	Job-related training received by employees	Q	✔
6.11	Unemployment rates by previous occupation	Q	✔

Weblink: www.statistics.gov.uk/elmr/12_07/data_page.asp

6.12	Average Earnings Index by industry: excluding and including bonuses	M	✔
6.13	Average Earnings Index: effect of bonus payments by main industrial sector	M	✔
6.14	Median earnings and hours by main industrial sector	A	•
6.15	Median earnings and hours by industry section	A	•
6.16	Index of wages per head: international comparisons	M	✔
6.17	Regional Jobseeker's Allowance claimant count rates	M	✔
6.18	Claimant count area statistics: counties, unitary and local authorities	M	✔
6.19	Claimant count area statistics: UK parliamentary constituencies	M	✔
6.20	Claimant count area statistics: constituencies of the Scottish Parliament	M	✔
6.21	Jobseeker's Allowance claimant count flows	M	✔
6.22	Number of previous Jobseeker's Allowance claims	Q	•
6.23	Interval between Jobseeker's Allowance claims	Q	✔
6.24	Average duration of Jobseeker's Allowance claims by age	Q	•
6.25	Vacancies by size of enterprise	M	✔
6.26	Redundancies: re-employment rates	Q	✔
6.27	Redundancies by Government Office Region	Q	✔
6.28	Redundancy rates by industry	Q	✔
6.29	Labour disputes: summary	M	✔
6.30	Labour disputes: stoppages in progress	M	✔

Notes

A Annually
Q Quarterly
M Monthly

More information

Time series are available from www.statistics.gov.uk/statbase/tsdintro.asp
Subnational labour market data are available from www.statistics.gov.uk/statbase/Product.asp?vlnk=14160 and www.nomisweb.co.uk
Labour Force Survey tables are available from www.statistics.gov.uk/statbase/Product.asp?vlnk=14365
Annual Survey of Hours and Earnings data are available from www.statistics.gov.uk/StatBase/Product.asp?vlnk=13101

Contact points

Recorded announcement of latest RPI
020 7533 5866
rpi@ons.gsi.gov.uk

Labour Market Statistics Helpline
01633 456901
labour.market@ons.gsi.gov.uk

Earnings Customer Helpline
01633 819024
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National Statistics Customer Contact Centre
0845 601 3034
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Skills and Education Network
024 7682 3439
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Department for Children, Schools and Families Public Enquiry Unit
0870 000 2288

For statistical information on

Average Earnings Index (monthly)
01633 819024

Claimant count
01633 456901

Consumer Prices Index
020 7533 5874

Earnings
Annual Survey of Hours and Earnings
01633 819024

Basic wage rates and hours for manual workers with a collective agreement
01633 819008

Low-paid workers
01633 819024
lowpay@ons.gsi.gov.uk

Labour Force Survey
01633 456901
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Economic activity and inactivity
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Employment
Labour Force Survey
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labour.market@ons.gsi.gov.uk

Employee jobs by industry
01633 812318

Total workforce hours worked per week
01633 812766
productivity@ons.gsi.gov.uk

Workforce jobs series – short-term estimates
01633 812318
workforce.jobs@ons.gsi.gov.uk

Labour costs
01633 819024

Labour disputes
01633 819205

Labour Force Survey
01633 456901
labour.market@ons.gsi.gov.uk

Labour Force Survey Data Service
01633 655732
lfs.dataservice@ons.gsi.gov.uk

New Deal
0114 209 8228

Productivity and unit wage costs
01633 812766

Public sector employment
General enquiries
020 7533 6178

Source and methodology enquiries
01633 812362

Qualifications (Department for Children, Schools and Families)
0870 000 2288

Redundancy statistics
01633 456901

Retail Prices Index
020 7533 5874
rpi@ons.gsi.gov.uk

Skills (Department for Innovation, Universities & Skills)
0870 001 0336
Skill needs surveys and research into skill shortages
0870 001 0336

Small firms (BERR)
Enterprise Directorate
0114 279 4439

Subregional estimates
01633 812038

Annual employment statistics
annual.employment.figures@ons.gsi.gov.uk

Annual Population Survey, local area statistics
020 7533 6130

Trade unions (BERR)
Employment relations
020 7215 5934

Training
Adult learning – work-based training (DWP)
0114 209 8236

Employer-provided training (Department for Innovation, Universities & Skills)
0870 001 0336

Travel-to-Work Areas
Composition and review
020 7533 6114

Unemployment
01633 456901

Vacancies
Vacancy Survey: total stocks of vacancies
020 7533 6162

ONS economic and labour market publications

ANNUAL

Financial Statistics Explanatory Handbook

2007 edition. Palgrave Macmillan, ISBN 1-4039-9783-7. Price £45.

www.statistics.gov.uk/products/p4861.asp

Foreign Direct Investment (MA4)

2005 edition

www.statistics.gov.uk/products/p9614.asp

Input-Output analyses for the United Kingdom

2006 edition

www.statistics.gov.uk/products/p7640.asp

Research and development in UK businesses (MA14)

2005 edition

www.statistics.gov.uk/statbase/product.asp?vlnk=165

Share Ownership

2006 edition

www.statistics.gov.uk/products/p930.asp

United Kingdom Balance of Payments (Pink Book)

2007 edition. Palgrave Macmillan, ISBN 978-1-4039-9397-7. Price £49.50.

www.statistics.gov.uk/products/p1140.asp

United Kingdom National Accounts (Blue Book)

2007 edition. Palgrave Macmillan, ISBN 978-1-4039-9398-4. Price £49.50.

www.statistics.gov.uk/products/p1143.asp

First releases

- Annual survey of hours and earnings
- Foreign direct investment
- Gross domestic expenditure on research and development
- Low pay estimates
- Regional gross value added
- Share ownership
- UK Business enterprise research and development
- Work and worklessness among households

QUARTERLY

Consumer Trends

2007 quarter 2

www.statistics.gov.uk/products/p242.asp

United Kingdom Economic Accounts

2007 quarter 2. Palgrave Macmillan, ISBN 978-0-230-52619-8. Price £32.

www.statistics.gov.uk/products/p1904.asp

UK trade in goods analysed in terms of industry (MQ10)

2007 quarter 3

www.statistics.gov.uk/products/p731.asp

First releases

- Balance of payments
- Business investment
- GDP preliminary estimate
- Government deficit and debt under the Maastricht Treaty (six-monthly)
- International comparisons of productivity (six-monthly)
- Internet connectivity
- Investment by insurance companies, pension funds and trusts
- Productivity
- Profitability of UK companies
- Public sector employment
- Quarterly National Accounts
- UK output, income and expenditure

MONTHLY

Financial Statistics

November 2007. Palgrave Macmillan, ISBN 978-0-230-52594-8. Price £45.

www.statistics.gov.uk/products/p376.asp

Focus on Consumer Price Indices

October 2007

www.statistics.gov.uk/products/p867.asp

Monthly review of external trade statistics (MM24)

October 2007

www.statistics.gov.uk/products/p613.asp

Producer Price Indices (MM22)

October 2007

www.statistics.gov.uk/products/p2208.asp

First releases

- Consumer price Indices
- Index of production
- Index of services
- Labour market statistics
- Labour market statistics: regional
- Producer prices
- Public sector finances
- Retail sales
- UK trade

OTHER

The ONS Productivity Handbook: a statistical overview and guide

Palgrave Macmillan, ISBN 978-0-230-57301-7. Price £55.

www.statistics.gov.uk/about/data/guides/productivity/default.asp

Labour Market Review

2006 edition. Palgrave Macmillan, ISBN 1-4039-9735-7. Price £40.

www.statistics.gov.uk/products/p4315.asp

National Accounts Concepts, Sources and Methods

www.statistics.gov.uk/products/p1144.asp

Sector classification guide (MA23)

www.statistics.gov.uk/products/p7163.asp

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List is provisional and subject to change.

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Multi-factor productivity analysis