Office for National Statistics

Economic & Labour Market Review

Volume 4, Number 11

Edition No.: **November 2010**

Editor: **Graeme Chamberlin**

Office for National Statistics

November 2010

ISSN 1751–8334

A National Statistics publication

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About us

The Office for National Statistics

The Office for National Statistics (ONS) is the executive office of the UK Statistics Authority, a non-ministerial department which reports directly to Parliament. ONS is the UK government's single largest statistical producer. It compiles information about the UK's society and economy, and provides the evidence-base for policy and decision-making, the allocation of resources, and public accountability. The Director-General of ONS reports directly to the National Statistician who is the Authority's Chief Executive and the Head of the Government Statistical Service.

The Government Statistical Service

The Government Statistical Service (GSS) is a network of professional statisticians and their staff operating both within the Office for National Statistics and across more than 30 other government departments and agencies.

Contacts

This publication

For information about the content of this publication, contact ELMR team
Email: elmr@ons.gsi.gov.uk

Other customer enquiries

ONS Customer Contact Centre
Tel: 0845 601 3034
International: +44 (0)845 601 3034
Minicom: 01633 815044
Email: info@statistics.gsi.gov.uk
Fax: 01633 652747
Post: Room 1.101, Government Buildings,
Cardiff Road, Newport, South Wales NP10 8XG
www.ons.gov.uk

Media enquiries

Tel: 0845 604 1858
Email: press.office@ons.gsi.gov.uk

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Economic & Labour Market Review

Volume 4, Number 11
November 2010

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In brief

Public consultation on the ONS statistical work programme

The Office for National Statistics is seeking views to help determine the shape of its future statistical work programme. The budget reductions announced as part of the 2010 Comprehensive Spending Review, amounting to a 17.4 per cent real reduction to the resource baseline over the next four years, mean that ONS has to consider where savings can be found.

ONS aims to review its working practices, statistical outputs and services to meet the challenge of a reducing budget. In carrying out this exercise three central principles will be observed:

- maintain the quality of key economic and social statistics
- continue to fill statutory obligations in terms of the statistical outputs required to meet international and domestic requirements, and
- preserve investment in the core infrastructure required to produce statistical outputs

ONS produces a large number of outputs that are not required by statute and given the reduction in the ONS's budget it will be necessary to reduce the resources available for some of these. However, many of these outputs are also important for government policy, private sector decision making and academic research, so it is important that statistical outputs continue to reflect users' priorities.

The consultation, open from 1 November 2010 to 24 December 2010 asks:

- What ONS outputs you use and how you use them?
- The impact of possible reductions in various areas of ONS work

Responses will be analysed with the new work programme published alongside the ONS business plan in Spring 2011

Further information
www.ons.gov.uk/about/consultations/work-programme-consultation/index.html

Contact
stakeholderconsultation@ons.gsi.gov.uk

ONS Director General speaks at the Statistics Users' Forum

Stephen Penneck, Director General of the Office for National Statistics, addressed the annual conference of the Statistics Users' Forum, hosted by the Royal Statistical Society on 27 October

2010. His speech ‘Measuring recession and recovery – the role of official statistics’ covered three main themes:

- methodological issues arising from the turbulence in the economy
- gaps in the measurement and coverage of economic statistics identified by ONS and how the ONS is acting to reduce them
- how ONS has sought to convey a better understanding of its figures and what they signify during the downturn and in the subsequent recovery

Much of the content was drawn from research and analysis recently published in the Economic & Labour Market Review (ELMR).

The robustness of early estimates of Gross Domestic Product was analysed in the January 2010 edition of ELMR. This work investigated the behaviour of a long history of revisions to GDP showing, that although early estimates are often revised, it is rare that the data are changed to such an extent as to fundamentally alter the basic economic story. Overall revisions are not sufficiently regular or predictable to support the incorporation of bias adjustments into early estimates.

Gaps in the measurement of the economy were explored in a special edition of ELMR in July 2009 – ‘Financial statistics for policy’. A particular focus of the project was the identification of gaps in financial balance sheets and how to plug them. The financial crisis had made apparent the need for better financial statistics for understanding the role played by the financial sector in driving the behaviour of firms and households, but also for the purposes of conducting macro–prudential policy. The project also considered the wider measurement of public sector debt to ensure that fiscal policy is as soundly based as possible, as well as in the interests of transparency.

The final part of the speech covered analytical work carried out by the ONS on the subject of ‘recession and recovery’, largely drawn from articles published in the August 2010 edition of ELMR. This included analyses of output and expenditure in the last three recessions; the impact of the recession on households and the impact of the recession on the labour market.

Further information
www.rss.org.uk/sufconference

Contact
elmr@ons.gov.uk

Consumer Prices Advisory Committee annual report

On 3 November 2010, the Consumer Prices Advisory Committee (CPAC) released their second annual report to the UK Statistics Authority. The report includes a summary of the work of CPAC over the last year; sets out the forward work programme for the Consumer Prices Index (CPI) and Retail Prices Index (RPI) as agreed by CPAC; and makes some recommendations that have been endorsed by the Authority.

The Committee recommended that:

- ONS develops owner occupiers' housing costs (OOH) indices using the net acquisitions and rental equivalence approaches for potential inclusion in an expanded CPI (CPIH)
- ONS carries forward a programme of developmental work to improve the net acquisitions and rental equivalence OOH indices and report on progress to CPAC on a regular basis
- developing CPIH indices should be a high priority for ONS and sufficient resources should be made available to complete the work programme in the next two years
- ONS changes the method used to measure seasonal items in the CPI and RPI and that the new method should be introduced for the January 2011 CPI and RPI to be published on 15 February 2011
- ONS carries forward a programme of work for the further development and maintenance of the CPI and RPI. ONS should consult widely over the work programme

CPAC was set up by the UK Statistics Authority in 2009 to advise the Authority on proposed changes to the CPI and RPI. CPAC is chaired by the National Statistician and membership includes experts from academia, the media, consumer organisations and the trade unions.

Further information
www.statistics.gov.uk/CCI/nugget.asp?ID=19

Contact
cpi@ons.gov.uk

'Average' Briton highlighted on UN World Statistics Day

To mark United Nations World Statistics Day (20 October 2010) the ONS painted a portrait of the 'average' Briton.

The 'average' British woman is 40 years and seven months old and has 42 years left to live. If she works full–time, she works 34 hours a week, earns £22,151 a year, and is educated up to GCSE A*–C level. If she lives in England or Wales, she will have 1.96 children during her lifetime. If she lives in England, she is 161.6 centimetres tall and weighs 70.2 kilograms.

The 'average' British man is 38 years and 4 months old and has 41 years left to live. If he works full–time, he works 39 hours per week and earns 28,270 a year. He is educated up to A–level standard. If he lives in England he is 175.3 centimetres tall and weighs 83.6 kilograms.

When a British family goes shopping the five items most likely to be in the typical weekly grocery shopping basket are a two–pint carton of semi–skimmed milk, pre–packed sliced ham, unsweetened breakfast cereal, bacon and a bar of milk chocolate.

The average household size in Great Britain in Q2 2009 was 2.4 people per household compared to 2.9 people per household in 1971.

Further information
http://unstats.un.org/unsd/wsd/

Contact
heath.jeffries@ons.gov.uk

Fewer employees in private sector defined benefit (DB) pension schemes

In the private sector, active (employee) membership of defined benefit occupational pension schemes fell from 2.6 million in 2008 to 2.4 million in 2009. The analysis from the 2009 Occupational Pension Schemes Survey (OPSS) also shows that, although DB schemes are traditionally referred to as final salary schemes, 23 per cent of active members of such schemes were in 'career average' schemes in 2009.

Active membership of defined contribution (DC) occupational pension schemes in the private sector – also known as money purchase schemes – remained stable at 1.0 million in 2009. Most active members of DC schemes (92 per cent) were in open schemes, while only 44 per cent of active members of private sector DB schemes were open schemes.

Total membership of occupational pension schemes – including public sector membership – was 27.7 million in 2009, unchanged from 2008. Active membership fell in 2009, while pensions paid to retirees and the pensions of former employees who are not yet retired (preserved pension entitlements) rose. In 2009, there were:

- 8.7 million active members, down from 9.0 million in 2008
- 9.0 million pensions in payment, up from 8.8 million in 2008
- 10.1 million preserved pension entitlements, up from 9.9 million in 2008

Further information
www.statistics.gov.uk/StatBase/Product.asp?vlnk=1721

Contact
hazel.mitchell@ons.gov.uk

Workless households across the United Kingdom

In January to December 2009, there were three areas across the UK where more than three out of every ten households had no one in work. These were:

- Liverpool (32.1 per cent)
- Nottingham (31.3 per cent)
- Glasgow City (31.0 per cent)

Over the same period for the UK as a whole, 18.7 per cent of households had no one in work. There were large variations across the country with the lowest percentages in:

- Bedfordshire (9.2 per cent)
- Surrey (10.9 per cent)
- Inverness, Nairn and Moray, Badenoch and Strathspey (11.0 per cent)

This was the second consecutive year that Liverpool came out on top with the highest percentage of workless households, and was an increase of 1.2 percentage points on a year earlier. Glasgow City was also in the top three in 2008 and increased by 1.3 percentage points. For the UK as a whole, the percentage of workless households increased by 0.9 percentage points.

Further information
www.statistics.gov.uk/StatBase/Product.asp?vlnk=15150

Contact
jamie.jenkins@ons.gov.uk

Estimates of the number of enterprises in the UK

The National Statistics publication ‘Small and Medium–sized Enterprise Statistics for the UK and Regions 2009’ was released on Wednesday 13 October 2010 by the Department for Business, Innovation and Skills (BIS). The publication provides the latest official government estimates of the total number of enterprises in the UK private sector. Also provided are details of the employment and turnover within these enterprises by industry, legal status and region.

This publication shows that at the start of 2009, there were an estimated 4.83 million private sector enterprises, an increase of 51,000 (1.1 per cent) since the start of 2008. Employment in the private sector fell by 309,000 (-1.3 per cent) to 22.8 million, whilst turnover increased by almost £250 billion (8.2 per cent) to £3,200 billion over the same period.

Small and medium–sized enterprises (fewer than 250 employees) accounted for 99.9 per cent of all enterprises in the UK private sector, whilst representing 59.8 per cent of employment and 49.0 per cent of turnover.

The increase in the number of enterprises was due to growth in numbers of unregistered businesses (76,000). The number of businesses registered for VAT and/or PAYE fell by 25,000.

The number of enterprises with employees fell by -1.4 per cent to 1.2 million, whilst those with no employees increased by 1.9 per cent to 3.6 million.

The next update of the publication will show estimates at the start of 2010, providing an indication of the full impact of the economic recession and early stage of the economic recovery. This will be released in 2011. Feedback on these statistics is invited at www.surveymonkey.com/s/DMFYDPB

Further information
http://stats.bis.gov.uk/ed/sme

Contact
steve.white@bis.gsi.gov.uk

Social Trends release chapters in November

On 11 November 2010 the first four articles of the 41st edition of Social Trends were published. These were the first to be published online only and are the start of a rolling quarterly release of articles. The articles released in November were:

- **Expenditure**, which reports that in 2009, the volume of consumption of goods and services by UK households was more than two–and–a–half times the consumption in 1971 and that between 1987 and 2009 total household debt as a percentage of household disposable income rose from 103 per cent to 161 per cent
- **Income and wealth**, which details how during the recent recession (2008 to 2009) GDP per head decreased by 5.5 per cent while real household disposable income per head increased by 1.2 per cent
- **International comparisons**, which covers topics including the economy, health, population change and crime
- **e–Society**, which details that in 2010, 19.2 million households in the UK had Internet access, 73 per cent of households. In 2008, households in the highest decile group of the income distribution in the UK were over three–and–a–half times as likely as those in the lowest decile to have an Internet connection, 96 per cent of households compared with 26 per cent.

The next group of articles are planned for release in January/February 2011 and will cover Transport, Housing and lifestyles and Social participation.

Further information
www.statistics.gov.uk/socialtrends

Contact
social.trends@ons.gov.uk

Life expectancy at birth and at age 65

A Statistical Bulletin, published by ONS on 19 October 2010, presents the latest figures on male and female life expectancy at birth and at age 65 for the UK, its constituent countries, Government Office Regions in England, and local area for 2007–09.

In 2007–09, life expectancy at birth for males was highest in the South East of England (79.4 years) and lowest in Scotland (75.4 years). For females, life expectancy was highest in the South East and South West of England (83.3 years) and lowest in Scotland (80.1 years). For local areas, life expectancy at birth for both males and females in 2007–09 was highest in Kensington and Chelsea (84.4 years and 89.0 years respectively) and lowest in Glasgow City (71.1 years and 77.5 years respectively).

Life expectancy at age 65 in 2007–09 was highest in the South East of England for males (a further 18.7 years) and in the South East and South West of England for females (a further 21.3 years). Scotland had the lowest life expectancy at age 65 for both men and women; a further 16.5 years and 19.1 years respectively. For local areas, at age 65, life expectancy for males and females was highest in Kensington and Chelsea (a further 23.7 years for males and 26.5 years for females) and lowest in Glasgow City (a further 13.9 years for males and 17.6 years for females).

Further information
www.statistics.gov.uk/StatBase/Product.asp?vlnk=8841

Contact
healthgeog@ons.gov.uk

Updates

Updates to statistics on www.statistics.gov.uk

12-Oct

International comparisons of productivity

New estimates for 2009

www.statistics.gov.uk/cci/nugget.asp?id=160

Inflation

CPI inflation 3.1%, RPI inflation 4.6%

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

13-Oct

Average weekly earnings

Regular pay growth increases

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

Employment

Rate rises to 70.7%

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

20-Oct

Public sector

September: £16.2 billion net borrowing

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

21-Oct

Retail sales

Growth continues to slow in September

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

26-Oct

GDP growth

UK output increases by 0.8%

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

Index of services

2.7% annual rise into August

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

28-Oct

Occupational pension schemes

Total membership remains at 27.7 million

www.statistics.gov.uk/cci/nugget.asp?id=1837

04-Nov

Workless households

Nov-10

www.statistics.gov.uk/cci/nugget.asp?id=409

05-Nov

Producer prices

Factory gate inflation rises 4.0%

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

09-Nov

Index of production

Production: 3.8% annual rise

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

UK Trade

Deficit narrowed to £4.6 billion

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

11-Nov

Travel and tourism

Short–term rise in visits

www.statistics.gov.uk/cci/nugget.asp?id=352

Forthcoming releases

Future statistical releases on www.statistics.gov.uk	
12-Nov	29-Nov
Output and employment in the construction industry – September 2010	Business demography –2010
16-Nov	30-Nov
Consumer price indices – October 2010	Family spending – A report on the 2009 Living Costs and Food Survey
Annual Business Inquiry – National Provisionals 2009	
	01-Dec
17-Nov	Business Enterprise Research and Development – 2009 edition
Average weekly earnings – September 2010	
Labour market statistics – November 2010	03-Dec
	New orders in the construction industry – Q3 2010
18-Nov	
Retail sales – October 2010	07-Dec
Public sector finance – October 2010	Mergers and acquisitions involving UK companies – Q3 2010
	Index of production –
19-Nov	Assets, liabilities and transactions in finance leasing, factoring and credit granting – Q3 2010
Turnover and orders in production and services industries – September 2010	
	08-Dec
24-Nov	Business register employment survey – 2009
Index of services – September 2010	UK Trade – October 2010
UK output, income and expenditure – Q3 2010	Overseas travel and tourism – October 2010
Business investment – Q3 2010 provisional results	
Services producer price indices – Q3 2010	09-Dec
Average earnings index – November 2010	Foreign direct investment – 2009
25-Nov	10-Dec
Public service output, input and productivity: education	Producer price index – November 2010
	Output and employment in the construction industry – October 2010
26-Nov	
ICT activity of UK business – 2009	14-Dec
	Consumer price indices – November 2010

Economic Indicators

PRICES AND INFLATION	Value	Period	Monthly change	Annual change	Release date
Consumer Prices Index (CPI) (2005=100)	114.9	Sep-10	0.0	3.1	12-Oct-10
Retail Prices Index (all items) (Jan 1987=100)	225.3	Sep-10	0.4	4.6	12-Oct-10
RPI excluding mortgage interest (RPIX) (Jan 1987=100)	224.4	Sep-10	0.4	4.6	12-Oct-10
Producer Prices Index - Output (2005=100)	118.9	Oct-10	0.6	4.0	5-Nov-10
Producer Prices Index - Input prices (materials and fuel) (2005=100)	148.0	Oct-10	2.1	8.0	5-Nov-10

LABOUR MARKET	Value	Period	Change on 3 months	Change on 1 year	Release date
Employment rate (%)	70.7	Jun-Aug 10	0.2	0.0	13-Oct-10
Unemployment rate (%)	7.7	Jun-Aug 10	-0.1	-0.1	13-Oct-10
Average Weekly Earnings - total pay (%)	1.7	Jun-Aug 10	-1.0	1.0	13-Oct-10
Average Weekly Earnings - regular pay (%)	2.0	Jun-Aug 10	0.4	0.4	13-Oct-10
Claimant count (Jobseeker's Allowance) (Thousands) (2005=100)	1,473.1	Sep-10	8.1	-144.1	13-Oct-10
Vacancies (Thousands)	459	Jul-Sep 10	-30	26	13-Oct-10

NATIONAL ACCOUNTS ECONOMIC ACTIVITY	Value	Period	Quarterly change	Change on 1 year[3]	Release date
UK Gross Domestic Product (chained volume measure £ billion)	331.4	Q3 10	0.8	2.8	26-Oct-10
Private Non-Financial Corporations Net Lending (£ billion)	17.5	Q2 10			28-Sep-10
Household Saving Ratio (%)	3.2	Q2 10			28-Sep-10
Public Sector current budget (£ billion)	-13.2	Sep-10			20-Oct-10
Public Sector net debt as a % of GDP	56.3	Aug-10			21-Sep-10
Public Sector net borrowing (£ billion)	3.8	Jul-10			19-Aug-10
Public Sector net cash requirement (£ billion)	20.7	Sep-10			20-Oct-10
Public sector net borrowing (excluding financial interventions) (£ billion)	16.2	Sep-10			20-Oct-10

Public sector net debt as a % of GDP (excluding financial interventions)	57.2	Sep-10			20-Oct-10

BALANCE OF PAYMENTS AND TRADE	**Value**	**Period**	**Change on 3 months**	**Change on 1 year**	**Release date**
UK's trade balance (£ billion)	-4.6	Sep- 10			9-Nov-10
Balance of Payments current account - (£ billion)	-£7.4	Q2 10			28-Sep-10
of which: EU	-£9.3				
non-EU	£2.0				
Goods export volumes - excluding oil and erratics (2006=100)	88.7	Sep-10			9-Nov-10
Goods import volumes - excluding oil and erratics (2006=100)	91.3	Sep-10			9-Nov-10

SHORT TERM INDICATORS	**Value**	**Period**	**Change on 3 months[1]**	**Change on 1 year[2]**	**Release date**
Retail Sales (2006=100) (chained volume, seasonally adjusted)	107.9	Sep-10	1.0	0.9	21-Oct-10
Index of Manufacturing (2006=100)	91.3	Sep-10	1.0	5.3	9-Nov-10
Index of Production (2006=100)	89.8	Sep-10	0.6	3.3	9-Nov-10
Productivity - Whole economy (2005=100)	99.3	Q2 10	0.5	1.4	29-Sep-10
Productivity - Manufacturing (2005=100)	106.2	Q2 10	2.2	7.9	29-Sep-10
Index of Services (2006=100)	102.3	Aug-10	0.3	1.8	26-Oct-10

Notes:

1. Three months on previous three months
2. Three months on corresponding period one year ago
3. Quarter on corresponding period one year ago

Economic Review

November 2010

Graeme Chamberlin
Office for National Statistics

Summary

This month's Economic Review article looks at three aspects of the UK economy as described by the latest official statistics. First, preliminary estimates of Gross Domestic Product show that the economy expanded by 0.8 per cent in the third quarter of the year. Growth was broad–based across the main sectors of the economy, with construction output recording a particularly strong increase for the second quarter in a row. Second, total employment increased by 178,000 in the three months June–August 2010. Most of the increase was accounted for by male employment and by part–time employment. Employment rates for the under 25 age group though remain low, having fallen significantly during the recession. Total hours worked increased in this same three–month period, but most of the increase was attributed to an increase in average hours worked rather than employment. Ahead of the Spending Review there was a decline in vacancies, with the largest falls in the predominantly public services industries. However, redundancies remained at normal rates. Third and finally, some financial statistics relating to UK households and corporations are analysed. The housing market weakened in the third quarter as average prices fell and numbers of mortgage approvals remained at low levels. Households and firms have continued to pay–down debts. Households have continued to show little appetite for relatively expensive consumer credit, and private non–financial corporations have continued to build cash surpluses as a result of low investment intentions and the uncertain economic outlook.

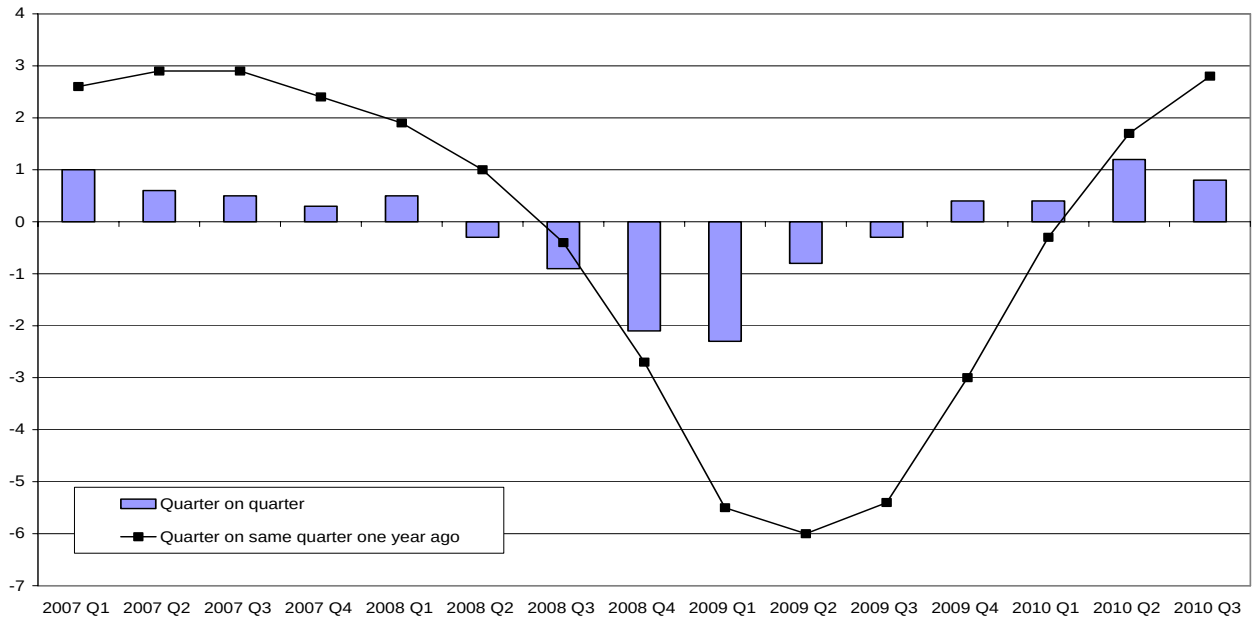
UK economy grows by 0.8 per cent in the third quarter of 2010

Preliminary estimates show that Gross Domestic Product (GDP) increased by 0.8 per cent in the third quarter of the year. Output has now expanded for four successive quarters and is 2.8 per cent higher than in the same quarter in 2009 (**Figure 1a**). Growth though did slow from the second quarter when output had rebounded strongly from the weaker first quarter – which was affected by adverse weather conditions and the rise in Value Added Tax (VAT) in January.

Figure 1b shows the contributions to growth in the latest two quarters. There was a marked increase in construction output in the second quarter (up 9.5 per cent), and although growth slowed in the latest quarter, the 4 per cent increase in output contributed 0.25 percentage points to

Figure 1a GDP growth

Percentages

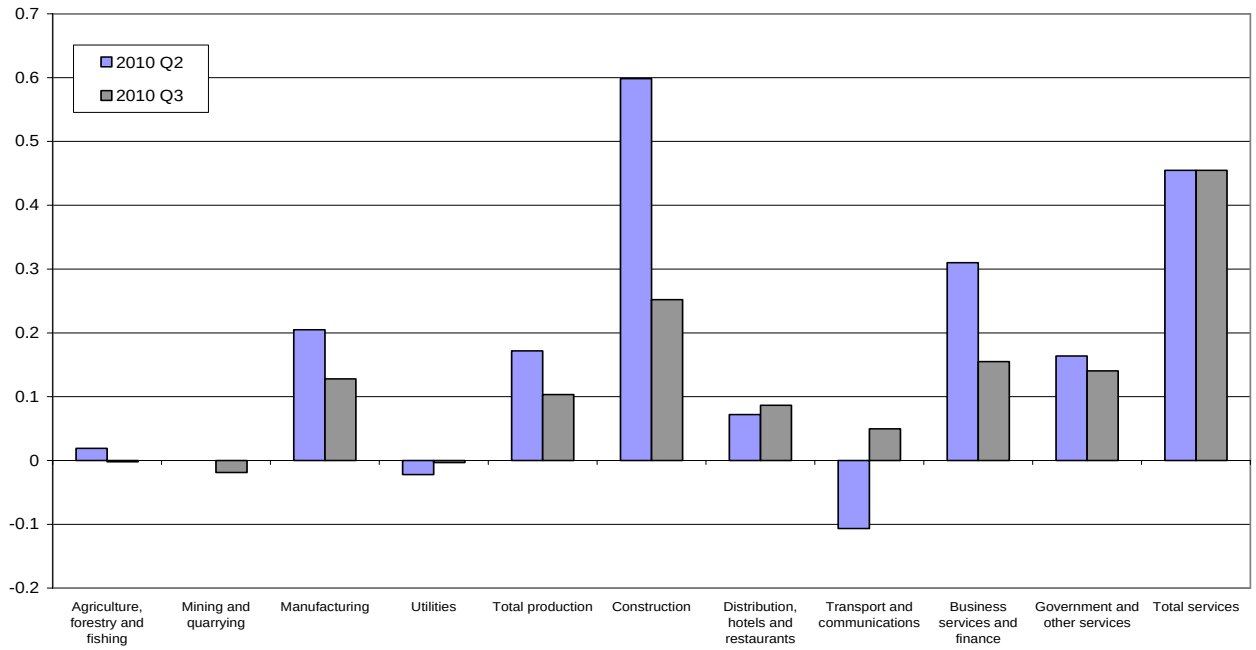


Source: GDP Preliminary estimate

Figure 1b Contributions to GDP growth by industry

Percentages

Quarter on quarter



Source: GDP Preliminary estimate

total growth. Construction output has now increased by 13.8 per cent in the last six months and is almost back to pre–recession levels.

Business survey data also pointed to a rise in construction output since the start of the year but are less optimistic about the future. The latest Purchasing Managers Index (PMI) provided further evidence that the recovery in UK construction output peaked in the summer. The survey showed that output has expanded for eight successive months, but growth had slowed to its lowest rate in October. The Royal Institute of Chartered Surveyors' (RICS) *Construction Market Survey* reported that surveyors are more pessimistic about workloads over the next 12 months as the Building Schools for the Future (BSF) program is scaled back and due to uncertainty over the impact of public spending cuts. The Bank of England's Regional Agents noted that public sector construction work had started to edge downwards and that continuing credit restrictions are limiting growth.

Output of the services industries, which accounts for around three–quarters of total value–added in the UK, has grown by 0.6 per cent in each of the last two quarters contributing 0.45 percentage points to overall growth. Between the second and third quarters, there was a slight change in the pattern of services growth, as business services and finance growth slowed whilst transport storage and communications grew faster. Growth in the distribution, hotels and restaurants and the government and other services sectors was broadly unchanged.

The services PMI for October registered an eighteenth successive monthly increase in activity, however the rate of growth has slowed from the start of the year and is now below the fourteen–year survey average. Those sectors most dependent on discretionary demand like hotels and catering and personal services are the least confident about the future due to the possible impact of public spending cuts on disposable incomes.

Despite the slowdown in the most recent published quarter, business services and finance has been the main driver of service sector growth since the recovery started in 2009 Q3. Over the last four quarters this sector has grown by around 3 per cent and has accounted for over half (1.2 percentage points) of the 2.1 per cent increase in total services output over this period.

The *Financial Services Survey* administered by the Confederation of British Industry (CBI) and PricewaterhouseCoopers (PwC) reported the strongest increase in business volumes since 2007 in the third quarter of the year. Furthermore, as this was broad–based across most sectors and across both retail and commercial customers it is an encouraging indicator of the overall strength of the recovery. However, all sectors are more cautious about future growth prospects. Uncertainty over the impact of fiscal tightening has increased concerns for future demand levels. The financial services industry is also preparing itself for an exceptional range of new regulatory initiatives with all survey respondents expecting compliance expenditure to increase over the next 12 months.

Manufacturing output expanded by 1.0 per cent in the third quarter, and has now expanded by 5.2 per cent since the trough in 2009 Q3. Given that a relatively large proportion of manufacturing output is traded, it is little surprise that this has coincided with recovery in the global economy and world trade over the last year. The latest *World Economic Outlook* published by the International Monetary Fund noted that the fastest growing countries so far in 2010 were those with a relatively high proportion of manufacturing in GDP, particularly emerging market economies.

Recent growth in manufacturing output around the world has been driven by a move to restocking as businesses, now more optimistic about future demand, seek to replenish stocks of raw materials, intermediate and finished goods that were run down quickly during the recession. As production processes are increasingly organised around global supply chains, reflecting the growing importance of multinational corporations, the move to restocking has gone hand–in–hand with an increase in the international trade of manufactures, especially for intermediate goods.

Other data sources show a similar story. The CBI *Industrial Trends Survey* in October reported a moderate increase in production in the third quarter following strong growth in the second when there had been exceptionally strong stockbuilding. The July 2010 survey had reported the fastest rate of stockbuilding since 1977. Export orders are expected to remain robust, but the October survey notes that a further fading of stockbuilding is considered inevitable. The Manufacturing PMI registered a seventeenth consecutive monthly rise in output in October, mainly attributed to the intermediate goods sector, although the index also showed a fall in the rate of growth relative to the record balances earlier in the year. Purchases of raw materials and other intermediate goods have picked up sharply. October marked the thirteenth successive monthly increase in purchases with stocks rising for the first time since November 2007 as manufacturers act to guard against raw material shortages, supplier delivery delays and expected future price increases. Stocks of finished goods have fallen for the thirtieth successive month, but the speed of de–stocking has continued to slow from the beginning of the year.

The Bank of England's Regional Agents also highlighted the important influence of 'export–led supply chain' demand. But on a more cautionary note, there were growing concerns about the potential impact of government spending cuts, especially in industries supplying the defence and construction sectors.

Employment up by 178,000 in the three months June–August 2010

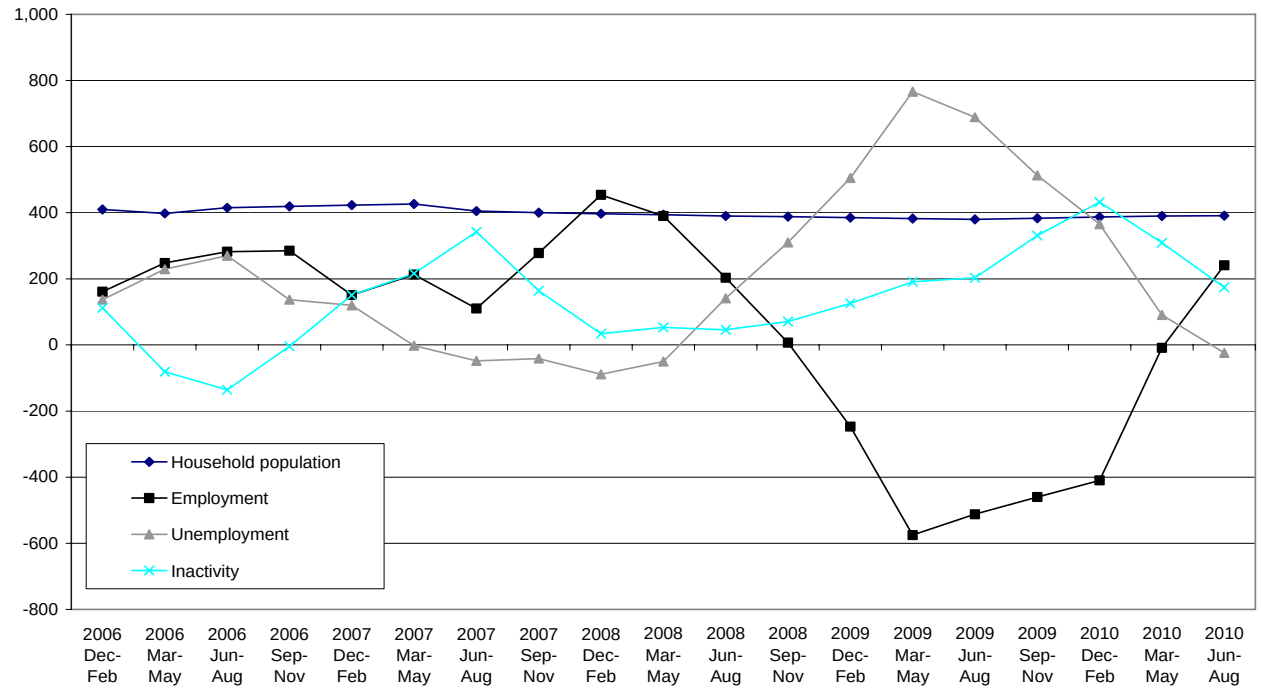
UK employment levels have grown strongly since the spring as the recovery in output feeds through to the labour market. In the three–months March–May 2010 total employment was 137,000 higher than in the previous three–month period. In June–August 2010 total employment increased by a further 178,000 and is now almost quarter of a million (241,000) higher than in the same period in 2009 (**Figure 2**). As a result, the headline employment rate has improved to 70.7 per cent, 0.4 percentage points higher than in December–February 2010. However, employment still remains below pre–recession rates, which peaked at 73.0 per cent in March–May 2008.

Given that the increase in the household population (over 16 years old) has been fairly stable at about 400,000 per year, the rise in employment has resulted in a lower increase in the numbers of inactive and a fall in the total unemployed. In June–August 2010 total unemployment was 23,000 lower than in the same three months of 2009. The headline unemployment rate of 7.7 per cent in June–August 2010 is now the lowest for over a year (since spring 2009).

Figure 2 Labour market summary

Thousands

Change, three months on same three months one year ago



Source: Labour Force Survey

Figures 3a and **3b** show recent changes in employment by sex and age respectively. In the latest three months, total UK employment has increased by 0.6 per cent, which was predominately driven by male employment which grew by 0.9 per cent compared to 0.3 per cent for women. This continues the pattern seen in the previous three–month period, when male employment growth also outstripped female employment growth. As a result, out of the total employment increase of 315,000 since December–February 2010, the majority (247,000) has been accounted for by men.

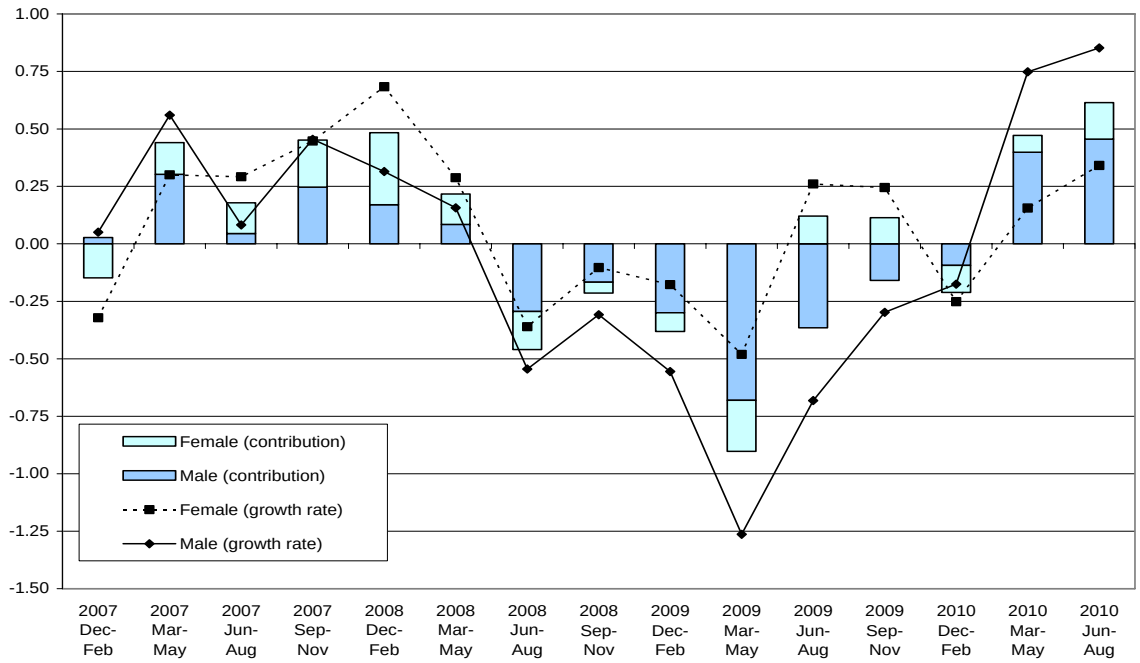
However, as Figure 3a shows, faster growth in male employment during 2010 followed significantly larger falls during the recession. Between March–May 2008 and December–February 2010, total employment fell by 721,000 (-2.4 per cent), of which 602,000 (-3.8 per cent) was attributed to male employment and 118,000 (-0.9 per cent) to female employment.

Therefore, despite recent stronger growth, male employment is still further below its pre–recession level (-2.2 per cent) than female employment (-0.4 per cent). This partly reflects the pattern of male and female employment across industries, and the differential impact of the recession and recovery on employment across those industries. The concentration of male employment is relatively high in the manufacturing and construction sectors where output fell significantly during the recession, but has since rebounded faster than the rest of the economy. Female employment,

Figure 3a **Employment growth: by sex**

Percentages

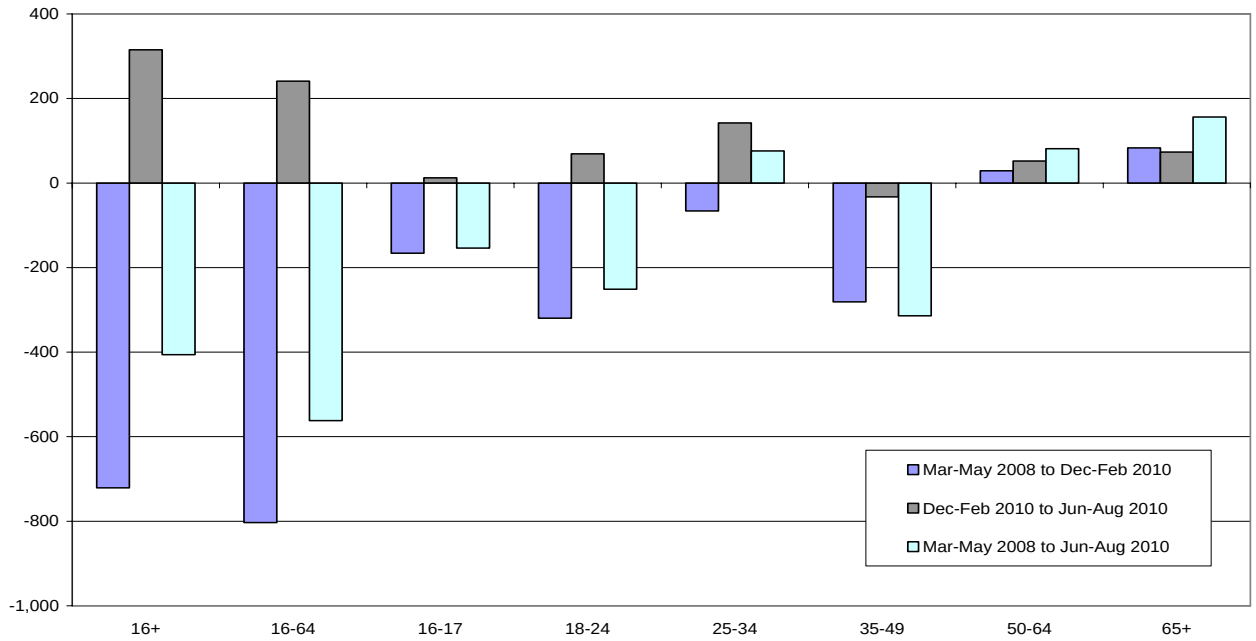
Three months on same three months one year ago



Source: Labour Force Survey

Figure 3b **Change in employment: by age**

Thousands



Source: Labour Force Survey

on the other hand, is more concentrated in the public services, particularly education and health, where output movements have been less cyclical and employment is relatively more stable.

Changes in employment during the up and down phases of the economic cycle have also been unevenly distributed over the age profile of the workforce (see Figure 3b). The fall in total employment of 721,000 between March–May 2008 and December to February 2010 was especially skewed towards the younger cohorts. Employment of the under–25s fell by 688,000 whilst that of the over–50s actually increased by 112,000.

Falling employment among the younger generations is particularly prominent in terms of employment rates. The employment rate of 16–64 years fell by 2.7 percentage points, compared to 9.5 percentage points for the 16–17 years and 6.5 percentage points for the 18–24 years. The subsequent improvement in the labour market and total employment since spring 2010 has not significantly reversed these falls with youth employment remaining considerably below pre–recession levels and rates.

Total employment of those aged 50–64 increased by 81,000 since March–May 2008. But given the larger rise in the household population of this age group, there was a fall in the employment rate of 0.6 percentage points. Over the same period, total employment of those aged above 65 has increased by 186,000, meaning that the current employment rate of 8.6 per cent is 1.3 percentage points higher than before the recession. This suggests that the impact of the recession on older workers has been relatively mild. Older workers, especially those beyond state retirement age, may be better placed to take advantage of the growth in part–time and temporary opportunities. Those who have been in employment the longest will typically cost more to make redundant. In addition, the Financial Reporting Standards (FRS) 17, concerning the treatment of company pension fund positions on balance sheets, may have reduced the incentive to use early retirement as an alternative to redundancy.

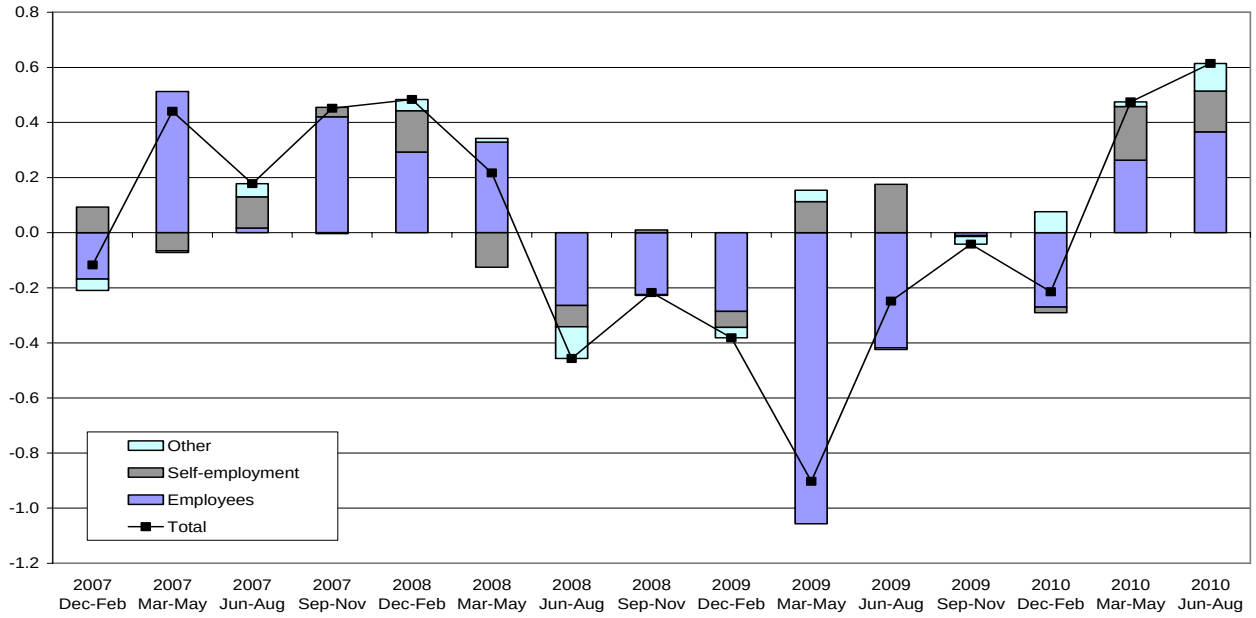
Employment of 25–34 year olds fell modestly in the downturn and has subsequently increased to stand 76,000 higher. Employment of 35–49 year olds fell significantly during the recession, and has shown a further slight fall since then and is now 314,000 lower. However, when looking at employment rates the pattern is reversed. The current employment rate of 25–34 year olds is 78.7 per cent, 3.1 percentage points lower than in March–May 2008. However, for the 35–49 year old age category, the current employment rate of 81.1 per cent is only 1.7 percentage points lower. This reflects changes in the underlying household populations with stronger growth in numbers of 25–34 years olds than in 35–49 year olds.

Increases in part–time and self–employment

An interesting feature of the labour market over the last year has been the rise in numbers of self–employed. Although changes in total employment are dominated by employees, which typically account for 9 out of 10 people in employment (see **Figure 4a**), self–employment has contributed around a third of the increase in the last six months (99,000 out of 315,000 in employment since December–February 2010). Furthermore, during the recession, whilst total employees fell sharply (-739,000), total self–employment actual increased (+40,000) over the same period. Increases in numbers of small and medium enterprises also suggests that many UK workers have reacted to

Figure 4a Changes in employment by full–time, part–time and others[1]

Percentages, three months on previous three months

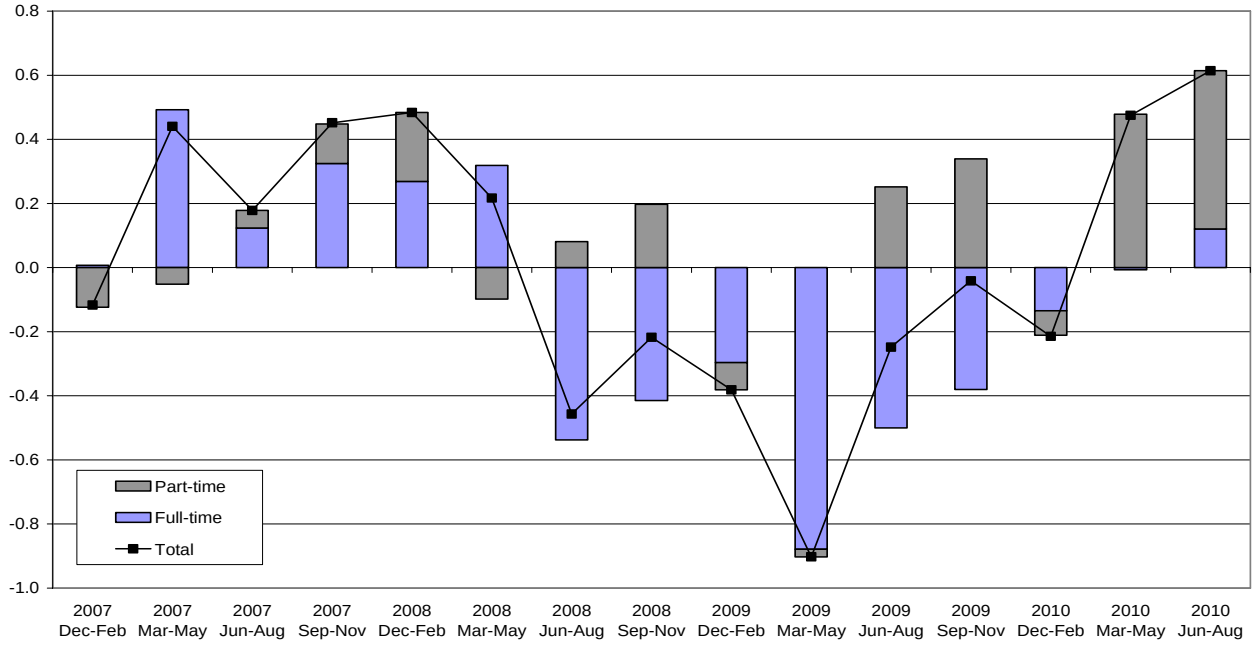


Source: Labour Force Survey

1. Other includes Unpaid family workers and Government supported training and employment programmes

Figure 4b Change in employment: full-time/part-time

Percentages, three months on previous three months



Source: Labour Force Survey

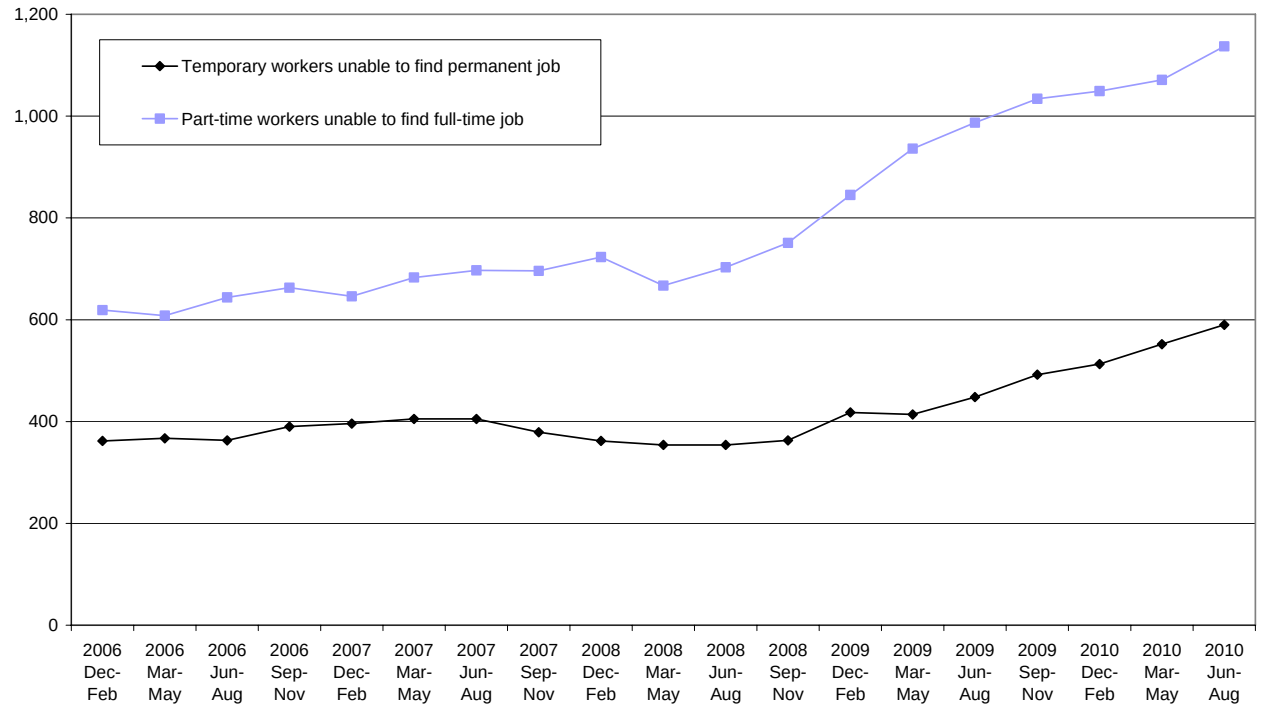
the slowdown in employee opportunities by establishing their own businesses. This has probably been aided by low mortgage interest rates which have supported household cash flows – providing resources for start–ups despite a tightening in credit availability from banks and other monetary and financial institutions.

Employment has also been boosted by growing numbers of part–time workers. In fact, **Figure 4b** shows that almost all the growth in employment over the last six months has been due to part–time employment. Even during the recession, when total employment fell markedly, part–time employment increased. As a result, the share of part–time employment in total employment has risen by 2 percentage points from 25.3 per cent in March–May 2008 to 27.3 per cent in June–August 2010.

The increasing incidence of part–time working has reduced the extent to which employment might have fallen during the downturn. However, the evidence suggests that this has manifested itself in underemployment, where people work fewer hours than they would otherwise like at prevailing wage rates. This is shown in **Figure 5** where the numbers of those who gave the reason for working part–time as being unable to find a full–time position has almost doubled between March–May 2008 (667,000) and June–August 2010 (1.14 million) (up from 9.1 per cent to 14.6 per cent of all part–time workers).

Figure 5 Labour market constraints[1]

Thousands



Source: Labour Force Survey

Note

1. Some people may be constrained to both part–time and temporary employment so are included in both time series.

There has also been an increase in the numbers constrained to temporary work – that is those who are working in temporary employment even though they would prefer a permanent position. Between June–August 2008 and June–August 2010 these increased by 236,000 (from 25.7 per cent to 37.8 per cent of the total in temporary employment). The latest services PMI reported that recruitment consultants noticed a decline (for the fourth time in five months) in permanent jobs while temporary/contract employment increased at the fastest rate for three months. The Bank's Regional Agents have reported that private sector employment intentions remained cautious about expanding the labour force – reflected by a rise in temporary rather than permanent recruitment – due to uncertainty over demand prospects and ongoing need to control labour costs.

As it is possible to work part–time in temporary positions it is likely that some of those who report to be constrained to temporary employment will also report being constrained to part–time employment. Therefore adding together the two time series in Figure 5 would most probably overstate the numbers reporting to be constrained in the labour market.

Average and total weekly hours increase

Changes in total hours worked each week can be broken down into the contributions from employment and average hours worked per person. The long–term trend has been for average working hours to gradually fall, reflecting changes in working practices, life–style choices and legislation. For example, average working hours on the eve of the recession in March–May 2008 were 32 hours per week, compared to 33.2 hours ten years earlier. Short–term movements in total hours though have tended to be driven by more pronounced changes in economic activity, as employers find it easier to vary hours than employment.

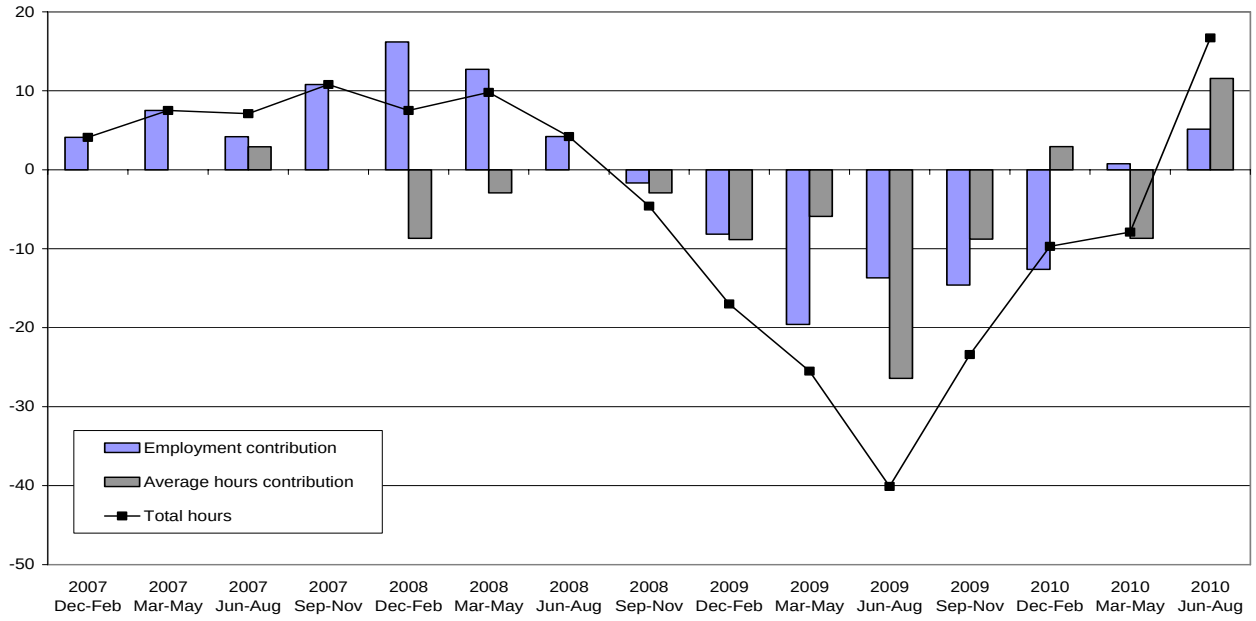
Figure 6a breaks down recent changes in total weekly hours into employment and average hours contributions. When total hours were increasing prior to the recession the employment contribution was greater with little change in the hours component. However, during the recession period, changes in average hours accounted for a sizeable reduction in total hours.

It is not surprising that adjustments will come through average hours as well as headcounts. In the first instance firms can cut back on overtime, and then if necessary use shorter working hours/weeks or extended shut downs to reduce hours further. It is not costless for firms to change the size of their workforce due to severance payments and the costs of searching for and training new workers. With good profitability coming into the recession and with low interest rates reducing debt servicing costs, firms may have sufficient cash to hoard labour through the recession – thereby reducing the pass through from falling output to employment.

One of the consequences of reducing labour intensity though is to sustain the underlying supply capacity of the economy by retaining workers. This opens up spare capacity, making it possible for firms to increase total hours by working the existing labour force more intensively. Therefore, as the economy recovers businesses might have scope for increasing output through productivity

Figure 6a **Changes in hours**

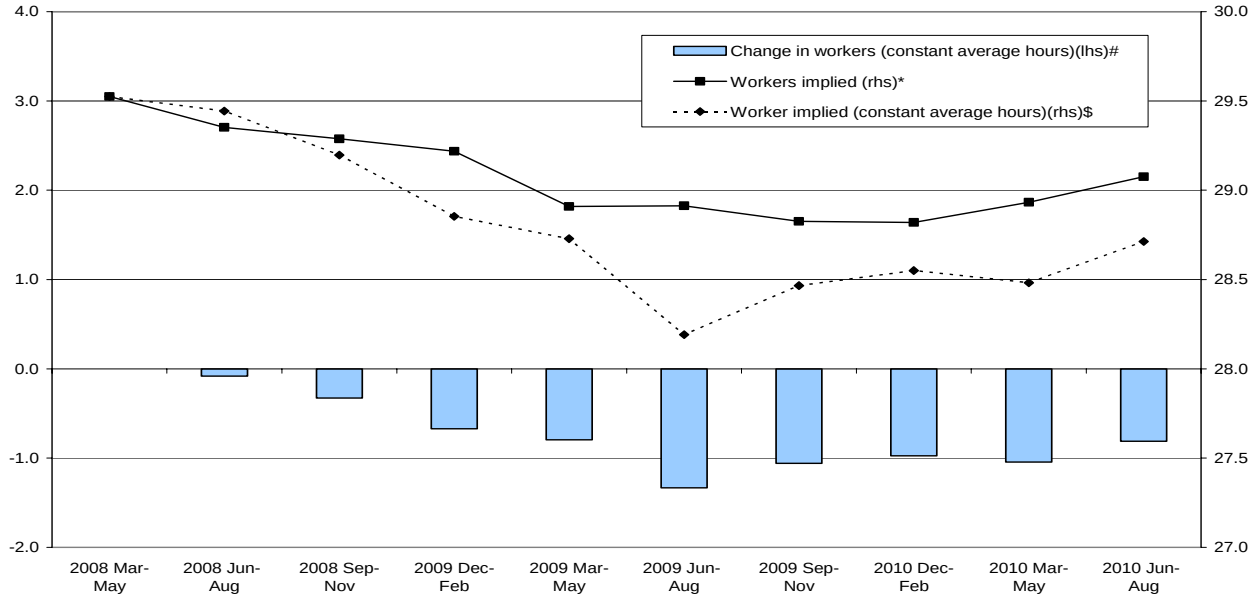
Million hours, three months on same three months one year ago



Source: Labour Force Survey

Figure 6b **Hours and employment**

Millions



Source: Labour Force Survey

* Derived from total weekly hours divided by average weekly hours

$ Derived by dividing total weekly hours by 32.0

The difference between the two implied time series

gains rather than through higher employment. As seen in Figure 6a, the majority of the increase in total hours in the latest three–month period arose through an increase in average hours.

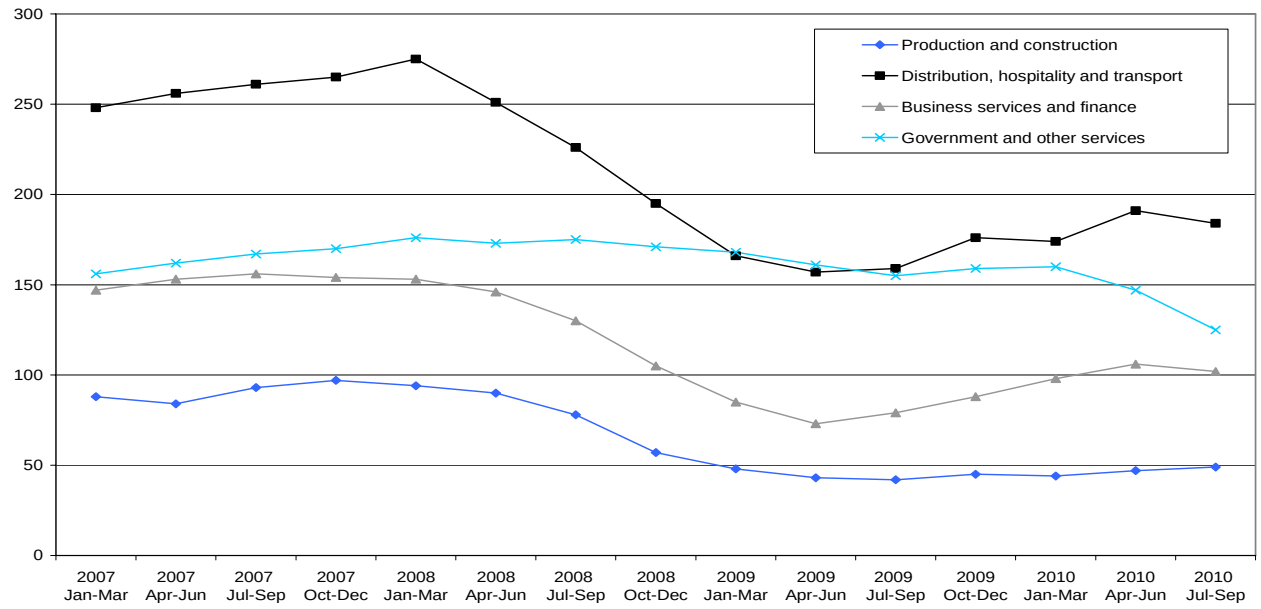
Reductions in average hours (to a low of 31.2 hours in June–August 2009) may have supported employment numbers through the recession period. **Figure 6b** shows the implied levels of employment if total hours fell by the same amount but average weekly hours were maintained at 32.0. Without the reduction in average hours the level of employment may have been up to 1.3 million lower (in June–August 2009). In the latest three–month period, June–August 2010, average hours were 31.6 hours. If the same number of total hours were worked at the average of 32 hours per week then employment would be 812,500 lower. Of course, these calculations assume that everything else is held even. For example, if average hours were fixed then more adjustment in labour costs may have come through average earnings instead.

Public sector leads the fall in vacancies

Figure 7 shows total vacancies by industry. Clearly vacancies declined rapidly as the economy entered recession, from 697,000 in January–March 2008 to 434,000 in April–June 2010. Over this period there were particularly sharp reductions in the manufacturing (-32,000), distribution (-57,000) and professional, technical and scientific activities (-37,000) industries. Public and other services vacancies though were fairly robust, particularly public services where total vacancies fell by a comparatively modest 4,000 (including small increases in education and health vacancies).

Figure 7 Vacancies by industry

Thousands



Source: Vacancy survey

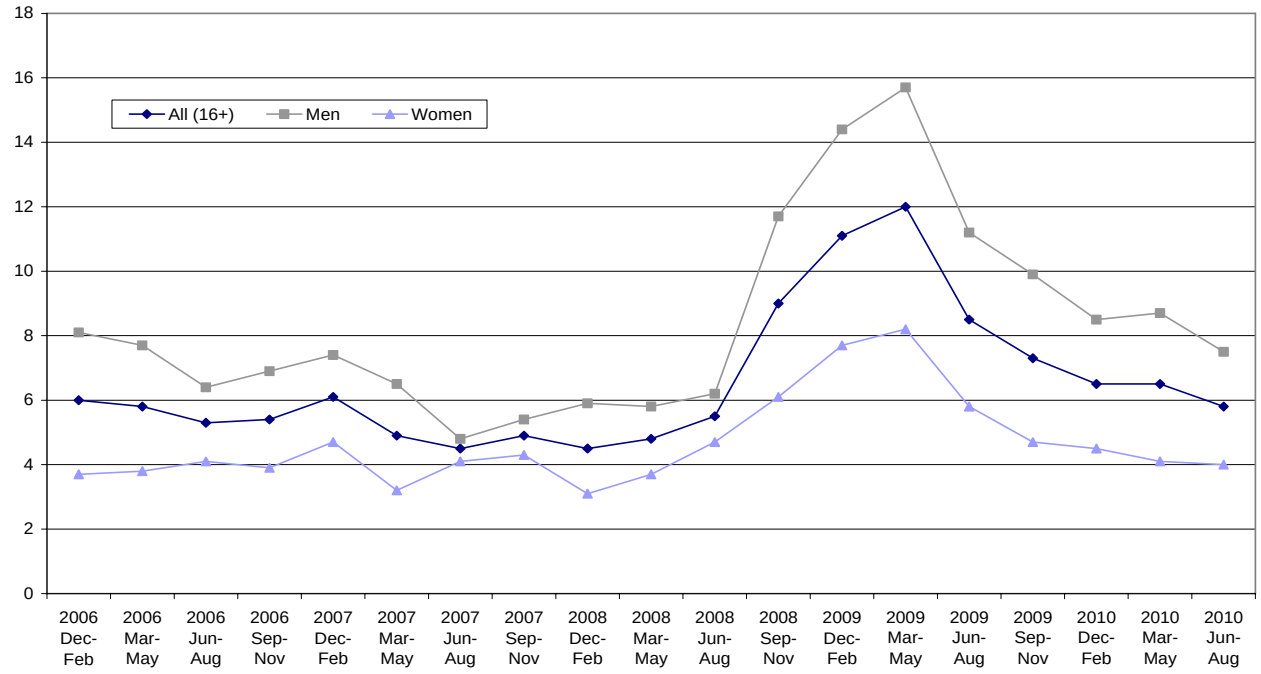
This stands in stark contrast to more recent patterns. In the three months July–September 2010 the total number of vacancies fell by 30,000 relative to the previous three–month period, of which 22,000 were accounted for by the predominantly public services industries (public administration, education, health and social work activities). In fact, this is the second successive three–month period in which vacancies have fallen and this is likely to reflect the build up to the Spending Review, with public sector organisations and government departments taking a cautious approach to new hires. Uncertainty generated by the impact of the Spending Review may also have weighed on private sector decisions to recruit. The services PMI reported that companies were choosing not to replace leavers – and as a result payroll numbers fell between September and October.

Redundancies back at pre–recession rates

The redundancy rate, which is the number of redundancies per 1000 employee jobs, has continued its downward path to 5.8 (143,000 redundancies) in the three months June–August 2010. This compares to 12.0 (304,000 redundancies) in March–May 2009 (**Figure 8**). Redundancies are now back close to their pre–recession rates. Figure 8 also shows the redundancy rates of men and women, clearly highlighting the stronger rise in the redundancy rate for men during the recession concurring with the evidence on employment in Figure 3a.

Figure 8 Redundancy rate

Redundancy rate



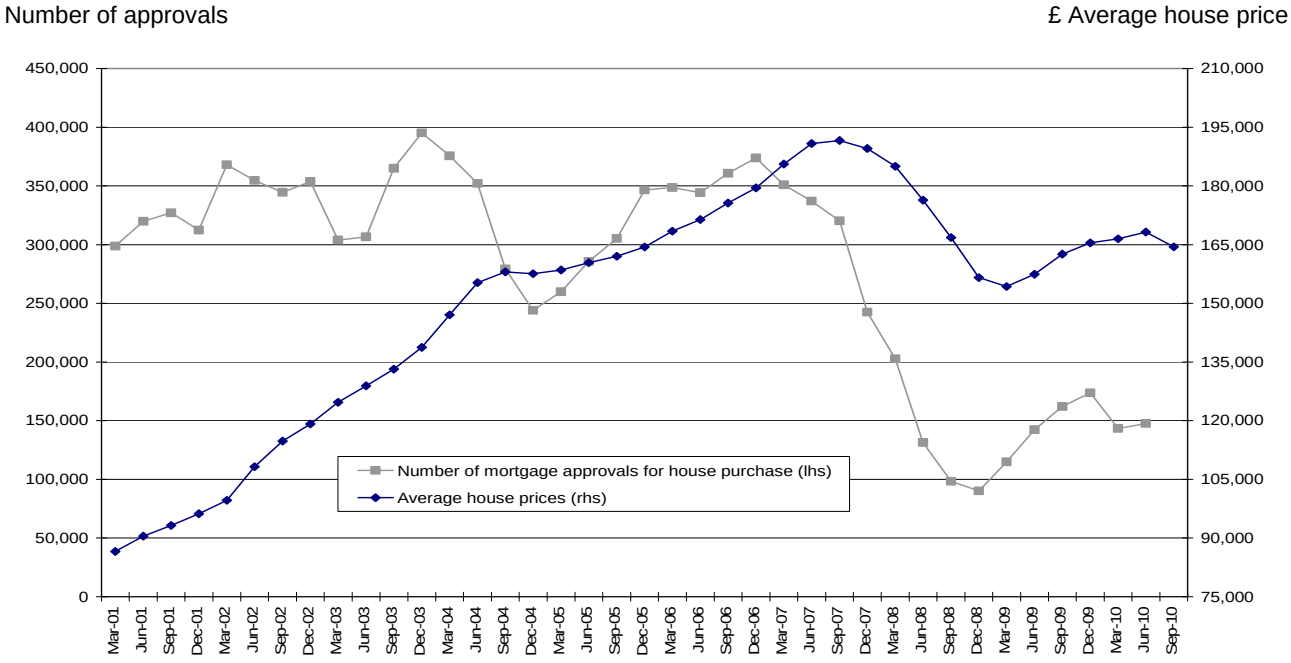
Source: Labour Market Statistics

Redundancies have fallen as businesses come to the end of reorganisations and efficiency programmes following the recession.

Average house prices fall during the third quarter of 2010

According to an average of the Halifax and Nationwide indices, UK average house prices fell by 2.6 per cent in 2010 Q3 (see **Figure 9**). However, after five successive quarters of increases through 2009 house prices remain marginally ahead of where they were in the third quarter of last year. To a certain extent the fall in house prices reflects a reversal of the factors that led to increases in the second half of last year. Specifically, the supply of new properties to the market has moved ahead of demand, as potential vendors look to test the market following last year's house price increases and the abolition of home information packs. This has been reflected in a number of surveys of the UK housing market.

Figure 9 **Number of mortgage approvals and average house prices**



Source: Halifax, Nationwide and Bank of England Bankstats

The Nationwide house price index reflects the fact that buyers now have 'a better hand' than sellers. But with interest rates remaining low there is little urgency to sell, so prices may remain high for a while and at the expense of volumes. Demand may remain weak due to low earnings growth and the uncertain impact of the fiscal tightening on disposable incomes. The Halifax house price index also reports that the recent fall reflects the changing balance of demand and supply in the market. Demand has been constrained by weak earnings growth but monetary policy is

expected to remain supportive in the immediate term. Low interest rates have reduced the costs of servicing mortgage debts. Typical mortgage payments that were 48 per cent of average disposable incomes in mid 2007 were around 30 per cent in mid 2010. The RICS *Housing Market Survey* also identifies the increased supply of properties coming on to the market as a drag on prices. New buyer inquiries have stabilised and there was a small increase in stocks of unsold houses per surveyor, so ratios of sales to stock have fallen.

The number of mortgage approvals for house purchases, which is a good indicator of both credit availability and the volume of transactions, remains at depressed levels. Despite a small pick up through 2009 the number of mortgage approvals has remained at less than half of its pre–recession levels. It is difficult to identify the extent to which the fall in mortgage approvals reflects demand versus supply side factors, although both are likely to be at play and adversely affected by the recent dampening in house price growth.

These conclusions were reached in the Bank of England's latest *Trends in Lending* publication. Low numbers of approvals were driven by weaker confidence among potential buyers as house prices started to fall and due to the uncertain impact of the well–publicised government spending cuts. Some potential purchasers were reported to be deferring decisions to proceed on transactions. The Bank's Regional Agents noted the importance of the macroeconomic outlook as well as the ongoing credit restrictions facing first time buyers. Margins on lower loan–to–value mortgages have fallen due to increased competition among lenders to attract more secure (higher collateral) borrowers, but not on the higher loan–to–value mortgages typically required by first time buyers. As first time buyers are an important source of liquidity to the whole market, their continued absence may continue to keep sales volumes at depressed levels. As a consequence of low transactions volumes rental demand has remained strong. Despite this, an increased supply of rental properties and lower mortgage interest costs faced by landlords have kept rents low.

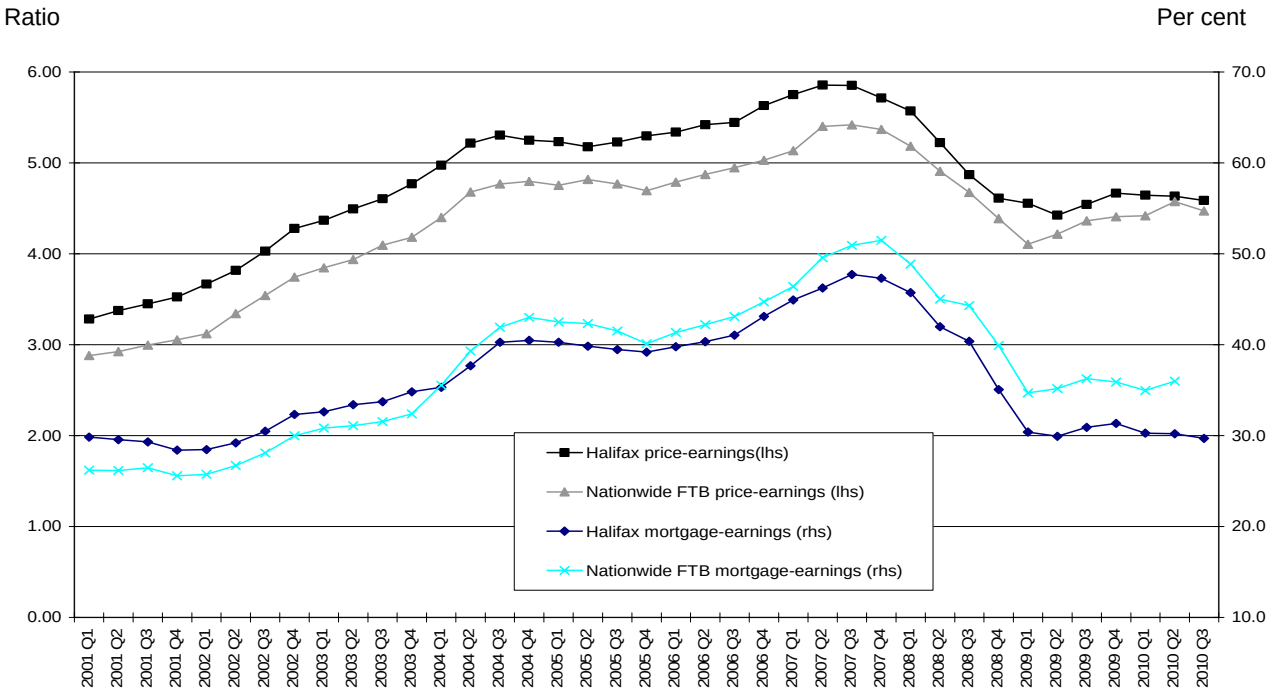
Falling house prices and low mortgage interest rates help affordability

Measures of housing affordability are presented in **Figure 10**. Clearly price–to–earnings ratios have fallen due to the sharp reduction in prices (according to the Halifax house price index average prices fell by 22.5 per cent between August 2007 and April 2009, while the Nationwide Index recorded a fall of 20.6 per cent between October 2007 and February 2009). The Halifax price–earnings ratio of 4.59 in 2010 Q3 though is still above the long–term average of 4.05. The Nationwide measure, which applies specifically to first time buyers (FTB), is also above its long–term average of 3.3 despite the recent fall to 4.5. However, there is no reason to believe that the long–term average is an equilibrium ratio to which prices will return. Other factors such as the cost and availability of credit and factors affecting the supply of housing are also likely to be important determinants of prices over time.

In terms of the ratio of mortgage payments to earnings, affordability remains relatively good. According to the Halifax ratio, mortgage interest payments in 2010 Q3 were 29.7 per cent of average earnings compared to a long–term average of 36.9 per cent. The ratio has kept low following sharp reductions in interest rates in December 2008. For first time buyers relatively good affordability has also been maintained since the end of 2008, with mortgage interest payments at

36 per cent of average earnings in 2010 Q2 according to Nationwide figures. Although this is a significantly lower than in 2007 Q4, when mortgage interest payments were 51.5 per cent of incomes, it is slightly above the long–term average of 33 per cent. Many first time buyers may have purchased property at elevated prices and as a result accumulated a high level of debt, which is why mortgage repayments as a proportion of income have been particularly sensitive to mortgage rates.

Figure 10 Housing affordability



Source: Nationwide (first time buyer FTB) and Halifax house price surveys

Low interest rates have been an important factor in supporting household balance sheets, offsetting some of the fall in primary incomes (wages and salaries, self–employment income, gross operating surpluses of the household sector). After accumulating a substantial amount of mortgage debt the UK household sector is a net–debtor in interest bearing assets, meaning that a reduction in interest rates will boost net property incomes. This may also be one factor supporting the labour market, enabling people to work part–time or to fund self–employment.

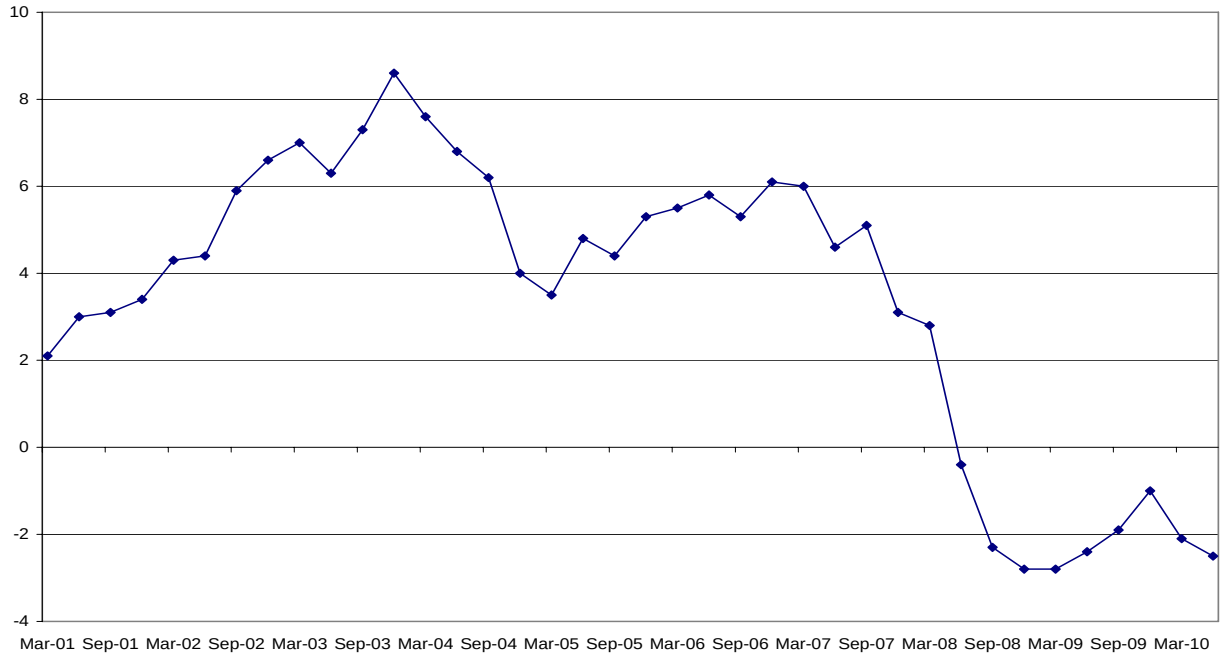
Mortgage equity injections

Mortgage equity withdrawal (MEW) reflects the change in debt secured on the same level of housing stock. As a proportion of disposable incomes, this peaked at 8.6 per cent in 2003 Q4, but remained significantly positive through the period of rapid UK house price inflation (**Figure 11**).

Equity can be withdrawn from housing by replacing an existing mortgage with a greater one or by taking a mortgage out on a property that previously did not have one. As this could be achieved by remortgaging or through other means of secured borrowing, it might have given the impression that households were extracting larger amounts of equity from the homes to possibly fund household consumption.

Figure 11 Mortgage equity withdrawal

Percentage of post–tax income



Source: Bank of England

However, very little MEW was actually done in this way. Most MEW occurs automatically when houses turnover and the vendor is a last time seller – meaning that they are moving into rented or retirement accommodation or that the house has been inherited. In this case, the seller often has little or no mortgage, but the purchaser is likely to have taken out a mortgage to fund the acquisition. In times of strong house price growth these flows will become larger producing more and more equity withdrawal from property. Rather than being used to fund household consumption the proceeds of equity withdrawal were primarily used to accumulate financial assets.

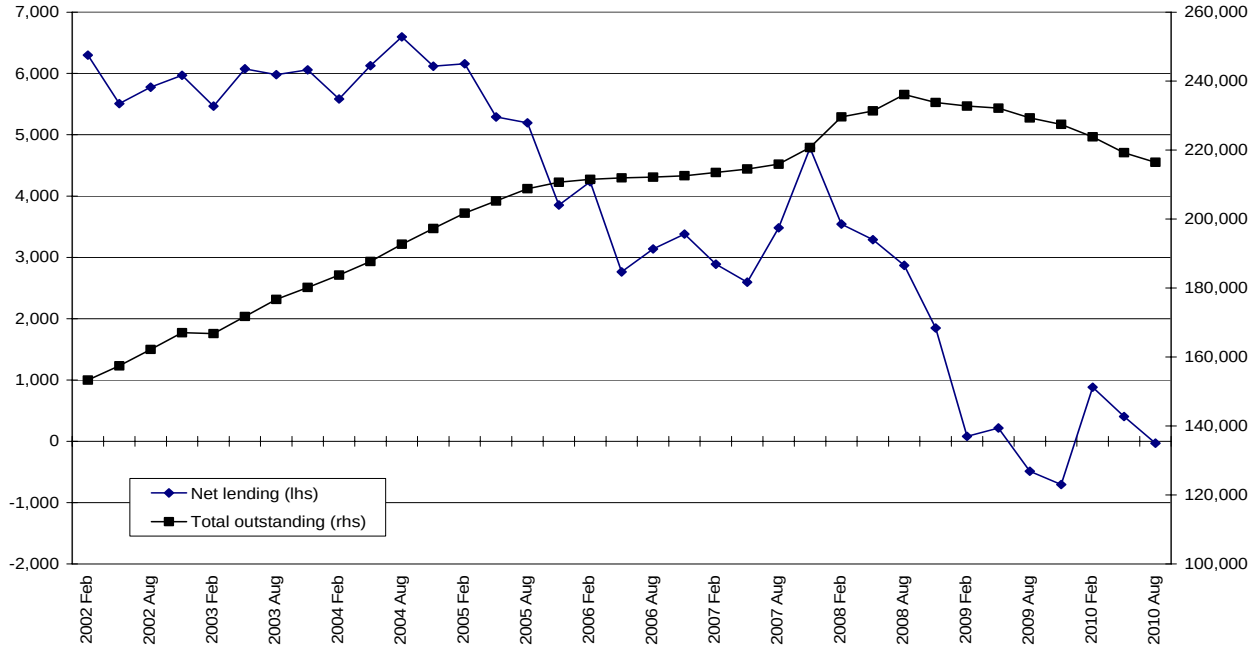
Therefore, the fall in MEW during 2008 to its current negative level (implying that households are injecting equity into their properties) will partly reflect the fact that in the last two years houses have been turning over at lower prices. In the second quarter of 2010 MEW was -£6.2 billion, implying that households were injecting equity into their properties equal to 2.5 per cent of post–tax income. Negative MEW can also arise from home owners over–paying their mortgages, perhaps looking to take advantage of low interest rates in order to pay down secured debts and to avoid negative equity.

Appetite for consumer credit remains weak

The recession has also seen a large fall in unsecured lending to consumers, a reflection of tighter credit conditions imposed by lenders and a reduced appetite for (relatively expensive) consumer credit from individuals. As a result, net lending has been close to zero since 2009, due to a sharp fall in gross lending and also individuals repaying existing debt. Gross consumer credit lending in August 2010 was 7.5 per cent lower than in the same month two years earlier. The total amount of outstanding consumer debt has therefore been falling in nominal terms, and even faster as a proportion of incomes (see **Figure 12**).

Figure 12 Consumer credit

£millions



Source: Bank of England Bankstats

Unlike secured lending, household exposure to consumer credit has been diminishing for several years before the economic downturn. In 2005 many credit providers, experiencing an increase in credit impairments, tightened eligibility and scoring, resulting in a fall in net lending. This continues to be the case. The Bank of England's *Credit Conditions Survey* noted that unsecured net lending to households remained weak for the same two reasons – high effective interest rate spreads and tight credit scoring.

Corporations continue to pay down debts

Net lending to the corporate sector (private non–financial corporations, PNFCs) has also fallen significantly since the onset of financial crisis and subsequent recession. In fact net lending to the PNFC sector turned negative in mid 2009 indicating that firms were paying down debts (see **Figure 13a**). Again it is difficult to identify the relative importance of demand and supply factors but both are likely to have had a negative impact on net lending to PNFCs.

Low business demand for credit partly reflects depressed investment intentions. Faced with an uncertain economic outlook and weak demand, firms have been reluctant to invest in future capacity, and as a result demand for longer–term finance has declined. Uncertainty generated by the impact of the Spending Review has undermined confidence further, as reported by several business surveys, which continue to indicate that weakness of future demand is the main determinant in driving investment intentions.

Firms' cash holdings may also have reduced their dependence on external financing (loans). Profitability going into and during the recession was fairly robust and the large subsequent reduction in interest rates has also reduced debt servicing costs, boosting corporate cash flows. The Bank of England's *Credit Conditions Survey* also finds that firms have supported cash flows through better management of working capital – by strongly running down stocks of inventories and purchases of intermediate goods. Furthermore, there is some evidence that businesses increased capital issuances in the early part of the recession so as to pay down debts and strengthen balance sheets (also shown in Figure 13a).

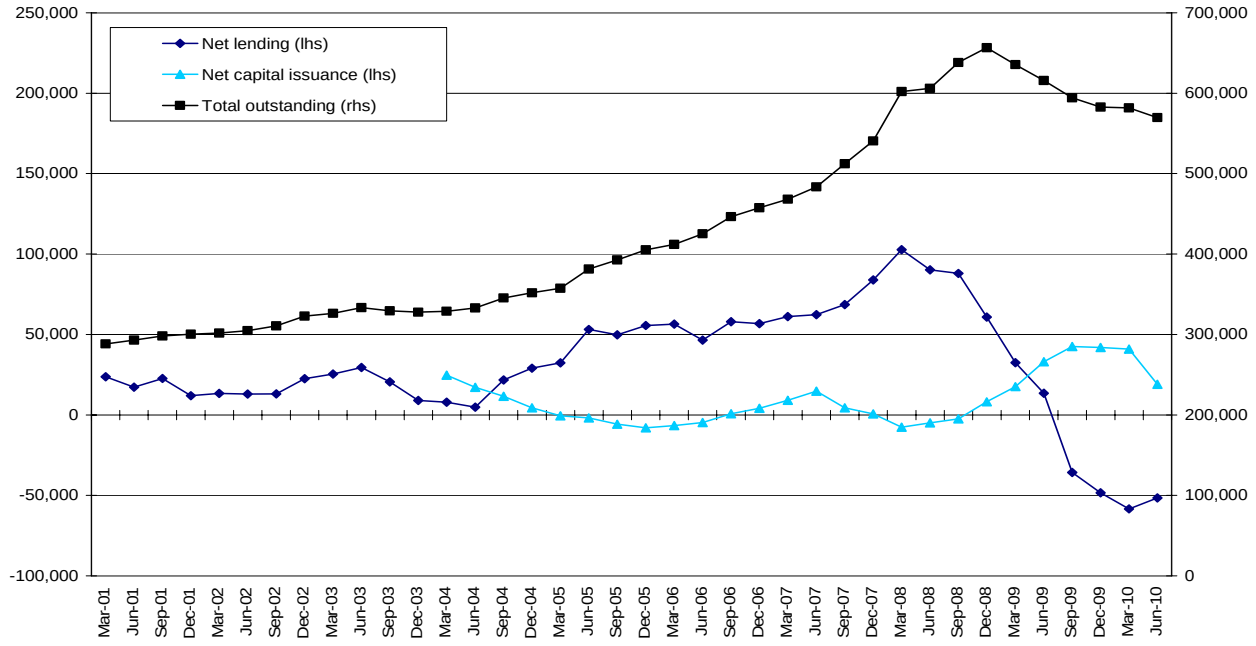
The Bank of England's Regional Agents have conducted a survey on company cash holdings. They found that the aggregate financial surplus of corporations was high going into the recession and rose further during it. A significant majority of firms had cash holdings above normal, especially the larger firms, and increased cash holdings in the last year. These results applied across all sectors. Cash balances resulted from higher profits and larger cash buffers to protect against uncertainty, for example about demand conditions and credit availability (as companies were less confident that short term financing would be available if they were to experience liquidity problems).

On the supply side, there is little evidence that firms are significantly constrained. Business surveys indicate that weakness of demand has depressed investment intentions. The Bank's Regional Agents report that total investment remains below pre–recession levels, and that it is focussed on the replacement of existing capital and on improving efficiency rather than on boosting capacity. Therefore the availability of credit to finance long–term investments/expansions has been a secondary factor. The CBI *Industrial Trends Survey* in October 2010 found that, although credit availability as a constraint on output has picked up, only 9 per cent of firms indicated that it would limit growth in output. This compares to 71 per cent of firms identifying sales or orders as likely to limit growth.

The Bank of England's October edition of *Trends in Lending* reported that gross lending to businesses had fallen and remains below the level of repayments as businesses look to pay down debt, reduce leverage and improve capital management. Credit availability though was particularly weak for smaller businesses.

Figure 13a Net lending to PNFCs and amounts outstanding

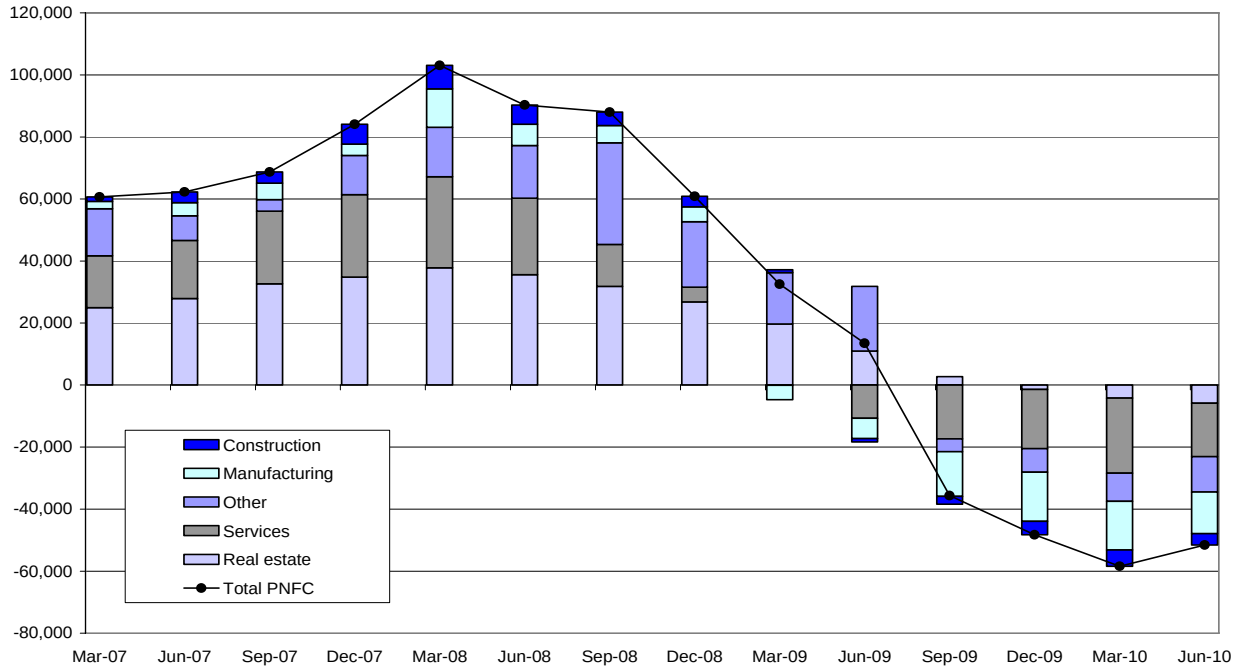
£millions



Source: Bank of England Bankstats

Figure 13b Net lending to PNFCs by sector

£ millions



Source: Bank of England Bankstats

Figure 13b shows the same time series for net lending to PNFCs as in Figure 13a but broken down by the main industrial sectors. This shows that the move to reduce borrowing and pay down debts has been a common activity across all sectors.

Of particular interest has been lending to the real estate sector, comprising loans to companies who develop, buy, sell and rent real estate. Following a period of strong growth, in which the share in the total stock of loans to the PNFC sector rose markedly, the slowdown since the start of the financial crisis has been significant. Lending to the real estate sector has contracted at the fastest rate since the late 1980s in line with the downturn in the residential and commercial property markets. For instance, the RICS *Commercial Market Survey* reports that tenant demand, rental expectations and enquiries for occupation have declined across all sectors, and retail, office and industrial available space has increased. However, the stock of real estate lending as a share of total corporate lending has continued to rise as lending to other sectors has fallen more rapidly. The real estate sector typically relies on loans of a longer maturity. Commercial real estate companies are also more likely to be highly leveraged and less able to reduce their working capital in order to pay down debt. This might also explain the relatively large fall in net borrowing by the manufacturing sector where, PMI, CBI and Regional Agents' surveys indicate that destocking has been important in maintaining working capital.

Contact

elmr@ons.gov.uk

Measuring the UK's human capital stock

Richard Jones and Blessing Chiripanhura
Office for National Statistics

Summary

Estimates of the UK's stock of human capital are derived by applying a lifetime labour income methodology to data from the UK Labour Force Survey. The results show that using an annual discount rate of 3.5 per cent and assuming annual labour productivity growth of 2 per cent, the market value of the UK's human capital stock in 2009 was £16,686 billion. This is more than two–and–a–half times the Blue Book estimate of the Net Worth of the UK for the same year and £2,703 billion higher than the estimate for the human capital stock in 2001. In 2009, the average human capital stock per head of working age population was £419,326. This is £46,797 higher than in 2001 but only £717 higher than in 2007. Less time in paid employment over their lifetime and lower average labour market earnings means that the total market value of women's human capital (£6,481 billion) was around 63 per cent of men's (£10,206 billion). In 2009, one–third of the human capital stock was embodied in the 21.7 per cent of the working age population whose highest educational attainment was a degree or equivalent.

Introduction

This paper contributes to a number of key agendas by presenting experimental measures of the UK's stock of human capital. These estimates are relevant to:

- the explanation of productivity performance, since human capital is a key factor of production;
- to the fiscal policy debate, since a crucial question is the extent to which productive capital was impaired by the financial crisis and recession, and thus the productive potential of the UK economy; and
- to the measurement of national well–being, since the evidence suggests a clear relationship between human capital formation and people's perceived well–being.

For over three centuries economists have been interested in valuing the productive capacity of the workers in an economy.[1] Despite advances in accounting systems, present day National Accounts are still considered by some to be limited in their analysis of human capital. Recognising this, the Atkinson Review (Atkinson, 2005) and the Commission on the Measurement of Economic Performance and Social Progress (CMEPSP, 2009) recommended the development of measures of the stock of human capital. There is international acceptance of the need to improve measures of human capital and ONS is a member of an international consortium developing such measures.[2]

This paper presents experimental estimates of the UK's human capital stock. The paper first discusses the concept of human capital and its importance. Next, it considers the alternative methods for measuring human capital before explaining in detail the lifetime labour income approach. The methodology is then applied to data from the Labour Force Survey to produce estimates of the UK human's capital stock between 2001 and 2009 inclusive. These results and the factors driving them are then discussed. The paper ends with conclusions and suggestions for further work.

What is human capital?

OECD (2001a: 18) define human capital as 'the knowledge, skills, competencies and attributes embodied in individuals that facilitate the creation of personal, social and economic well–being.' This is a broad definition, encompassing a range of attributes (such as knowledge, skills, competencies and health conditions) of individuals. For the purposes of this paper, the term human capital is restricted to people's knowledge, skills and competencies, which means excluding other attributes such as the heath of the population. Thus, any activity that adds to these can be thought of as investment in human capital. These activities can take place throughout an individual's life and in a range of environments. OECD (2001) identifies four main contexts for human capital development:

Learning within family and early childcare settings
Families contribute to the development of human capital in their children through direct expenditures on educational materials etc and through time spent fostering learning habits and attitudes.

Formal education and training
This includes activities ranging from early childhood education, school–based compulsory education, post–compulsory vocational or general education, tertiary education, public labour market education, adult education and so on.

Workplace training
Firms and organisations invest in human capital to develop those skills and competencies with economic value.

Informal learning
This is a wider concept taking place through 'on–the–job' learning, in daily living and through civic participation.

For consistency with other members of the international consortium, this paper focuses on human capital acquired through participation in the formal education system, thus excluding the human capital gained in the years before primary education and in adult life. The analysis is also restricted to individual human capital rather than collective human capital. Collective human capital encompasses work organisation, work processes, information networks and other forms of intangible, non–visible knowledge which is embedded in a group of people rather than in individuals.

Why is human capital important?

Macroeconomic effects

Human capital is recognised as having important economic impacts. At a macroeconomic level, the accumulation of human capital has been theorised as being an important driver of output growth (Solow, 1988; Romer, 1989, 1994a and 1994b). However, difficulties in controlling for other influences on growth, establishing the direction of causation[3] and data limitations meant that the link between human capital and growth was not always fully supported by empirical work, for example Barro and Lee (1993, 1996). More recent work, however, using better data and more sophisticated analytical techniques, is more supportive of the growth and human capital relationship (Barro and Sala–i–Martin, 2004; Durlauf et al, 2005). Thus, to the extent that relationship holds, those countries with higher levels of human capital have greater potential for future growth, other things being equal.

Microeconomic effects

At the microeconomic level, individuals' labour market outcomes are linked to their human capital. The economics literature contains hundreds of studies showing positive associations between human capital (in particular educational attainment) and labour market outcomes such as employment and earnings (see Card, 1999, Psacharopoulos and Patrinos, 2004 for reviews). There is, however, some disagreement over the reason(s) for these associations. The obvious explanation is that education directly increases the productivity of individuals. Early empirical studies by Denison (1962), Kendrick (1976), Jorgenson and Griliches (1967) and others found that human capital has a positive impact on productivity. An alternative explanation may be that those people who acquire more education are more able and/or more motivated than those who do not, and earn more because of this. Closely related to this is the idea that educational attainments perform a signalling function by identifying more productive workers rather than directly raising productivity. The idea is that more able individuals find it less costly, in terms of time and effort, to acquire higher levels of education. Thus, the acquisition of qualifications indicates ability and motivation rather than directly increasing productivity (Spence, 1973 and Weiss, 1996).

Inequality and human capital

During the 1980s, the demand for less–skilled workers in developed countries fell sharply. Bartel and Lichtenberg (1987) argued that technological innovation alters demand in favour of better educated workers because they have a comparative advantage in implementing new technologies. This has led to a relative fall in the real wages of low–skilled workers. This in turn contributed to the widening of the income distribution in many industrialized nations including the UK and the US (Berman et al, 1998). Part of the observed pay gap between men and women is related to the acquisition of human capital. Mincer and Polachek (1974) suggested that, on average, women have a weaker attachment to the labour market than men and therefore have less incentive to acquire human capital, other things being equal.

Inequality might also persist over time as educational attainments are highly correlated between generations in families (Gang and Zimmerman, 2000; Francesconi et al, 2005) and parental educational attainment has an impact on their children's future outcomes. Greenwood (1997) and Maynard and McGrath (1997) summarise the literature on these effects. They report that higher parental education is associated with lower incidence of teenage childbearing; lower levels of child abuse and neglect; better performance in school and in the labour market by the children; lower criminal propensities in children; and better health. These impacts are significant even after controlling for parental income.

Externalities

Investment in human capital may also generate externalities. These are outcomes that are due to the investment decision of some individuals but affect people who did not invest in education and for which no compensation is paid.[4] Several examples have been suggested in the literature. Lucas (1988) and Jovanovic and Rob (1989) consider technological externalities, where the free movement of workers between firms within the same industry sectors and similar production technologies facilitates the transfer of knowledge and ideas. Acemoglu (1996) presents a model in which imperfect information in the employer–employee matching process generates an externality.[5] Higher earnings may understate the value of acquiring human capital since jobs which require more schooling are likely to be more desirable on both monetary and non–monetary grounds (Rosen, 1985).

Social effects

Evidence on many of the social effects of human capital and in particular education is reviewed in more detail by Behrman and Stacey (1997) and Haveman and Wolfe (1984). Human capital has been related to improved health outcomes (for example Taubman and Rosen, 1982 and Grossman and Kaestner 1996); lower crime rates (Grogger, 1998 and Lochner and Moretti, 2004); measures of social capital, trust and social participation (Helliwell and Putman, 1999; Milligan et al, 2003 and Schuller et al, 2001).

Diminishing returns

The literature presented so far suggests that greater expenditure on human capital brings important benefits. It is important to note, however, that there may be diminishing returns to spending on education for higher levels of economic development (Hanushek and Kim, 1995). The rapid growth in educational attainment and levels of literacy in the past decade suggests that human capital is not in short supply in OECD countries. Moreover, a number of economists have suggested that there may be some 'over–education' taking place in Europe and the United States (see Sloane, 2003 for a review of the literature).

The accounting treatment of human capital

Capital theory is one of the most difficult and contentious topics in economic theory and accordingly the measurement of capital is one of the most complex dimensions in the official National Accounting system.[6] It has taken many years for statisticians to develop and establish the existing physical capital measurement system as it is within the System of National Accounts (SNA) 1993. Even so, there is still disagreement on several important issues.

One such debate concerns the accounting treatment of human capital, in particular whether expenditure on goods and services such as education and training should be treated as consumption or investment expenditure.[7] This question stems from the observation that, similar to investment in other assets, individuals devote resources to their education incurring direct costs such as tuition fees, books etc and the indirect cost of the earnings foregone whilst studying in the hope of gaining a return on this investment in the form of higher earnings (Shultz, 1960, 1969 and 1971; Becker, 1961 and 1975). Similarly, governments invest significant resources in the education system in the anticipation of securing benefits to society.

The European System of Accounts (ESA95) defined economic assets as, 'entities functioning as a store of value over which ownership rights are enforced by institutional units, individually or collectively and from which economic benefits may be derived by their owners by holding them or using them over a period of time.' (Eurostat, 1995: para: 7.10)

OECD (1996) sets out four conditions that must be met by a resource for it to be treated as an asset of an entity for accounting purposes:

- it must be an economic resource;
- the resource must be controlled by the entity;
- the cost at the time of acquisition must be objectively measurable; and
- in day–to–day transactions, capital and labour markets place value on the output potential of the asset.

SNA 1993 acknowledged that investment in human capital investment exhibits many of the characteristics of a fixed asset in that ‘it raises the productive potential of the individuals concerned and is a source of future economic benefit to them.’ SNA93 and ESA95, however, exclude human capital from the asset boundary arguing that human capital is:

- non–physical;
- non–appropriable – SNA93 purports that expenditure on human capital investments should not be treated as fixed assets because, 'they are embodied in the individuals as persons' and 'cannot be transferred to others and cannot be shown in the balance sheets of the enterprises in which the individuals work';
- immeasurable; and
- incompatible with the conventions and institutions that guide the day–to–day transactions recorded by financial accounting and reporting.

Appelbaum and Hood (1993) argued that non-appropriability need not necessarily be a problem since if equipment can be measured by its original cost, human capital should also be measured

by its original cost. In the event that an employee leaves the organization, the remaining unamortized cost can be written off. For examples, professional sports teams' players are traded and thus human capital can have the exchangeability characteristic.

Several authors have countered the SNA's argument that the human capital is immeasurable and have proposed several methods for doing so. These methods and the issues involved are discussed in the next section.

Measuring human capital

Three general approaches to measuring the human capital stock can be identified:

- measures based on educational attainment
- measures based on the value of the inputs that enter the production of human capital (input or cost-based approach)
- output (typically measured by labour market income) that stems from human capital (output or income based approach)

The educational attainment based approach

The educational attainment approach estimates human capital based on educational output indicators. This method is based on the assumption that these indicators are closely related to investment in education and this is a key element in human capital formation. Human capital encompasses more dimensions but education is arguably the most important component. A variation of this approach is to test individuals directly to determine whether they have certain attributes relevant to economic activity. Several measures have been used in the literature. For example, adult literacy rates (Romer, 1989 and Azariadis and Drazen, 1990); school enrolment rates (Barro 1991, Mankiw et al. 1992, Levine and Renelt, 1992 and Gemmell, 1996); and average years of schooling. The main limitation of these approaches is that they miss most of the elements that extend beyond that elementary level, such as numeracy, logical and analytical reasoning and scientific and technological knowledge. Thus, they are unlikely to be good proxies for human capital in developed countries (Judson, 2002). Establishing the direction of causality may be difficult since high enrolment may result from high productivity growth, rather than vice versa (Wolff, 2000).

Psacharopoulos and Arriagada (1986 and 1992) and Barro and Lee (1996) used a measure that has several advantages over literacy rates and school enrolment rates. First, it is a valid stock measure. Second, it quantifies the accumulated educational investment in the current labour force. Wachtel (1997) showed that under particular assumptions, the number of schooling years is equivalent to cost–based measures of human capital. The studies that have attempted to develop data series on years of schooling can be divided into three groups based on the method they employ: the census/survey-based estimation method (for example Psacharopoulos and Arriagada, 1986 and 1992), the projection method (for example Kyriacou, 1991); and the perpetual inventory method (Lau et al, 1991).

This proxy has a number of short–comings. First, the years of schooling measure fails to allow for the costs and returns of education varying at different levels. Thus, this measure incorrectly assumes that one year of schooling always raises human capital by an equal amount. For example, a worker with ten years of schooling is assumed to have ten times as much human capital as a worker with one year of schooling. This assumption is at odds with the empirical literature which has typically documented diminishing returns to education (Psacharopoulos, 1994). Second, no allowance is made for differences in quality of education across time and location. Behrman and Birdsall (1983) found that neglecting quality of schooling biased estimates of returns to schooling. Since the quality of schooling varies more considerably across countries than within one country, overlooking quality is likely to create more severe biases. Third, this measure unrealistically assumes that workers of different education categories are perfect substitutes for each other as long as their years of schooling are equal.

Thus, while informative for a number of purposes, these indicators are less suitable for other uses such as the assessment of the 'sustainability' of a development path, which require comparing changes in the aggregate stock of human capital with those in the stocks of other types of assets. Such comparisons typically require a common monetary metric.

Cost of production method

Using the cost of production method the value of the human capital stock is calculated as being the depreciated value of the monetary amount spent on investment in human capital. Kendrick (1976) and Eisner (1985 and1989) provide seminal examples of this approach. One advantage of this approach is that it provides an estimate of the resources invested in the education and other human capital related sectors, which can be useful for cost–benefit analyses.

This approach has several limitations. The first is that it is only supply–side based, yet the value of human capital is also determined by the demand for it. This makes cross–sectional and inter–temporal comparisons difficult. This method also fails to take account of the heterogeneity of individuals. As an illustration, consider two children, one of whom is innately less able than the other. To the extent that it more expensive to educate the less able child to a particular attainment level the cost–based approach will overestimate that child's human capital while underestimating the human capital of the more able child. Similarly, differences in the quality of education providers are ignored in this method. For example, schools vary in their quality as do the teachers within schools. Hanushek (2000) and Lavy (2002) found that after social background, the quality of teaching is the best predictor of how well students do in school.

Another difficulty of this approach is identifying which costs should be included and how they should be measured. Simply reclassifying all human capital expenditures as investment rather than consumption may not be correct. To the extent that individuals enjoy their courses or have their range of interests, tastes and activities extended, educational expenditures also provide some consumption benefits. Thus, the difficulty lies in determining which part of educational expenditure is investment spending and which part is consumption (see Schultz, 1961 and Shaffer, 1961 for a discussion). Part of the expenditure on schooling could also be regarded as a form of childcare in that it provides children with a safe environment allowing their parents to use their time in other ways. Similarly, Kendrick (1976) classified the costs of raising children to the age of fourteen as

human capital investments, reasoning that these expenses, typically on necessities such as food and clothing, compete with other types of investment. This contradicts Bowman (1962) and Machlup (1984) who argued with this view, maintaining that basic expenditures should be considered as consumption.

Calculating the depreciation rate is an important element of this method. Like physical capital, human capital depreciates over time, because of:

- the wear of skills due to aging, or illness;
- the atrophy of skills due to insufficient use;
- job–specific obsolescence due to technological and organizational change;
- sector–specific obsolescence due to shifts in employment; and
- firm–specific skills obsolescence due to displacement (Grip and Van Loo, 2002).

Grip and Van Loo also suggested ways in which the obsolescence of human capital could be measured as:

- objective methods such as testing;
- subjective method, for example asking workers or their employers;
- workers' wages; and
- the probability of losing employment.

All four measures have limitations. The last two indirect methods have the advantage that they measure the labour market effects of skills obsolescence that are the main concern on human capital obsolescence in a knowledge economy: a lower productivity and lower labour market participation.

The two main methods used to calculate depreciation in the literature are: the straight–line method (Eisner, 1988) in which a constant proportion of the original human capital is assumed to become obsolete in each period and the (modified) double declining balance method (Kendrick, 1976), in which depreciation is assumed to be higher in the early years of an assets life. The rationale behind this method is that physical capital depreciates faster in early years of life, so using the double declining balance method provides consistency across different types of capital. The appreciation of human capital is often ignored in the literature, despite some empirical evidence that showed that human capital can appreciate at younger ages (Mincer, 1958, 1974; Graham and Webb, 1979).

Some aspects of education aim to create 'skills for life', for example educational attainment that enables individuals to enjoy leisure activities during and after their working life and these skills may appreciate or depreciate depending on use and wider factors.

The output or income based approach

The output or income based approach measures human capital by summing the discounted values of all future income streams that all individuals in the population expect to earn throughout their lifetime (Farr, 1853; Jorgenson and Fraumeni, 1989, 1992a,b). This method is 'forward–looking'

because it focuses on expected returns to investment, as opposed to the 'backward–looking' method whose focus is on the historical costs of production.

One advantage of this approach is that there is no need to assume an arbitrary rate of depreciation since it is already implicitly captured. The main limitation of this approach is that it relies on the assumption that labour is paid according to its marginal productivity. In practice, factors such as market power, trade unions, discrimination and so on all affect wages. This measure is also sensitive to the choice of discount rate and the retirement age. This method relies upon accurate data on earnings, life tables and employment rates.

A variation of the income–based approach is presented by Mulligan and Sala–i–Martin (2000) who calculated an index measure of human capital. Specifically, they measure human capital as the total labour income per capita divided by the wage of the uneducated. The rationale for this method is that labour income incorporates not only the workers' human capital but also the physical capital available to them, such that for a given level of human capital workers in regions with higher physical capital will tend to earn higher wages. Therefore, to obtain a 'pure' measure of human capital, the effect of physical capital should be netted out. This method assumes that uneducated workers always have the same human capital, although they do not necessarily earn the same income.

A drawback which is common to all these approaches is that, as noted before, formal education and training are not the only determinants of human capital. Some of an individual's capital is innate to them and is in some sense, a non–produced asset. Thus, the asset created by education could be regarded as improvements in human capital by education and training. Another drawback of these measures is that they focus on individual's human capital and aggregate them to arrive at the population measure. This ignores spillovers between workers so that the whole may be more than the sum of the parts.

This paper applies the output or income based measure to value human capital in the UK. This method is preferred to a cost of input approach or a quality adjusted student count approach to measuring the output of education for several reasons. First, it allows output to be measured independently of inputs. Accordingly, the productivity of the education sector can be estimated. Students and the time they spent on education are inputs to the education process, not outputs. Second, it is difficult to quantify elements of the education process that produce higher output. Accordingly, it makes sense to use labour market evaluations as representing the worth of an educated individual. Quality–adjustments applied to student counts are typically very small and perhaps not fully representative of the difference between students (the inputs) and educated individuals (the output). Finally, the Atkinson Report (2005, para. 9.33-9.34) recommends exploring a lifetime income (human capital) approach such as that implemented by Jorgenson and Fraumeni.

Comparison with the measurement of the physical capital stock

The estimation method used for measuring human capital is quite different from that conventionally used for physical capital where in the latter the directly available information covers the quantity of new capital goods added to the existing capital stock. The magnitude of the stock is indirectly derived using the perpetual inventory method. As the owners and users of capital goods are often

one and the same, the quantity of capital services has to be imputed indirectly as well. For human capital, it is the value of labour services that is directly observable (from labour market transactions), and the stock of human capital can be directly estimated from the present value of discounted lifetime labour income streams. Because the changes in the human capital stock between the beginning and the end of an accounting period must equal the sum of human capital flows, the amount of investment in human capital is indirectly derived by decomposing the stock changes into various components.

Methodology

This section sets out how the output or income based approach is implemented. The methodology is described in two parts. The first part describes how the dataset is constructed and presents some of the descriptive statistics. The second shows how the dataset is used to derive estimates of the human capital stock. To illustrate the method the construction of estimates for quarter four of 2009 are presented in detail.

Stage one: Construction of the database

The first stage is the construction of a database containing the economic value of labour market activities for various categories of people. This database contains information on the number of people, their earnings (when employed), enrolment rates for different levels of education, employment rates, and survival rates. All these data should, ideally, be cross–classified by gender, age and levels of educational attainment but this was not possible in all cases. For example, in practice, most data on survival rates do not distinguish between different categories of educational attainment (that is, survival rates differ only according to the age and gender of each person).

The main source of data used in the analysis is the Labour Force Survey (LFS).[8] Conducted by the Office for National Statistics, this is a quarterly sample survey of households living at private addresses in Great Britain. Its purpose is to provide information on the UK labour market that can then be used to develop, manage, evaluate and report on labour market policies. The survey seeks information on respondents' personal circumstances and their labour market status during a specific reference period, normally a period of one week or four weeks (depending on the topic) immediately prior to the interview. The survey collects household and individual data from a nationally representative sample.[9] The LFS was chosen ahead of other data sources because it contains relevant demographic and labour market information. The survey is also on–going and has a collection of previous waves allowing the construction of a time-series of estimates.

This paper focuses on the LFS data covering the years 2001 to 2009 inclusive. The human capital series cannot be calculated consistently for years prior to 2001 because of changes in the questions asked about pay in the Labour Force Survey. This survey covers over 120,000 individuals in over 50,000 households distributed across the UK. In common with other studies, this paper focuses on effective human capital (that is, human capital of people of working age) as this is more relevant for growth and for comparative purposes than estimates that cover the whole population. Thus, the paper focuses on individuals aged between 16 and 64 years, as these limits

mark the end of compulsory education and the current retirement age.[10] This is the convention that has been adopted by members of the international consortium developing measures of human capital and is a somewhat arbitrary choice that, while not crucial, could easily be relaxed and extended to other age groups.

The human capital of those people not in employment is valued at zero. This is consistent with the OECD's guidance on the measurement of physical capital which states that, 'be counted as part of the capital stock all that is required is that assets are present at production sites and capable of being used in production or that they are available for renting by their owners to producers.' (OECD, 2001b: 31).

Reponses to the Labour Force Survey question on highest educational attainment are classified into 49 categories.[11] To make the analysis practicable, these results are compressed into 7 wider categories:[12]

- degree or equivalent
- higher education
- GCE A level or equivalent
- GCSE grades A-C or equivalent
- other qualifications
- no qualification
- don't know

The survival rate is the conditional probability that a person who is alive in year *t* will also be living in year *t+1.* Information on survival rates, by gender and individual year of age, was derived from country life-tables published in ONS' interim life tables.

Stage two: Using the dataset

In the second stage the dataset is used to produce estimates of the human capital stock. Under competitive market conditions, the market price of an asset is related to the rental income that the asset is expected to earn through the following equation (the scrap value is ignored).

Equation 1

$$V_t = \sum_{\tau=1}^{T} \frac{f_{t+\tau-1}}{(1+r)^{\tau}}$$

where
V_t is the real market value of an asset at the beginning of year t
f is the real rental income earned in each period
T is the service life of the asset in years
τ takes values of 1,2,3…. T, and
r is the discount rate

The corresponding equation for a labour asset involves using total labour market earnings as the rental income and working life as the service. Thus the real market value of an asset at the beginning of year t, is the present value of lifetime labour income.

Lifetime labour income is calculated for a representative individual in each classified category (by gender, age and educational attainment) in the database. A key assumption used here is that an individual of a given age, gender and educational level will, in year *t+1*, have the same labour income and other characteristics (for example school enrolment rate, employment rate, survival rate, and so on) as those of a person who, in year t, is one year older but has otherwise the same characteristics (for example gender and educational level).

Based on this assumption, the lifetime labour income of an individual was computed as follows:

- for individuals aged 65 and over (the 'retirement' stage), their lifetime labour income is zero since, by assumption, these persons will not receive earnings after withdrawing from the labour market
- for persons aged 16 to 64 (the 'study–and–work' stage), their lifetime labour income (LLI) is estimated as

Equation 2

$$\mathrm{LLI}_{\mathrm{age}}^{\mathrm{edu}} = \mathrm{EMR}_{\mathrm{age}}^{\mathrm{edu}}\mathrm{ALI}_{\mathrm{age}}^{\mathrm{edu}} + \left\{1 - \sum_{\mathrm{edu}} \mathrm{ENR}_{\mathrm{age}}^{\mathrm{edu}-\overline{\mathrm{edu}}}\right\}\mathrm{SUR}_{\mathrm{age+1}}\mathrm{LLI}_{\mathrm{age+1}}^{\mathrm{edu}}\{(1+\mathrm{r})/(1+\delta)\}$$
$$+ \sum_{\mathrm{edu}} \mathrm{ENR}_{\mathrm{age}}^{\mathrm{edu}-\overline{\mathrm{edu}}}\left\{\left(\sum_{\mathrm{t=1}}^{\mathrm{t}_{\mathrm{edu}-\overline{\mathrm{edu}}}} \mathrm{SUR}_{\mathrm{age+1}}\mathrm{LLI}_{\mathrm{age+1}}^{\overline{\mathrm{edu}}}\{(1+\mathrm{r})/(1+\delta)\}^{\mathrm{t}}\right)/\mathrm{t}_{\mathrm{edu}-\overline{\mathrm{edu}}}\right\}$$

where

$\mathrm{LLI}_{\mathrm{age}}^{\mathrm{edu}}$ is the present value of lifetime labour income for a representative individual with educational level of *edu* at age of *age*;

$ENR_{age}^{edu-\overline{edu}}$ is the educational enrolment rate for a representative individual with educational level of *edu* pursuing his/her studies into a higher educational level of $\overline{edu}$;

$EMR_{\mathrm{age}}^{\mathrm{edu}-\overline{\mathrm{edu}}}$ is the employment rate for a representative individual with educational level of *edu* at age of *age*;

$\mathrm{ALI}_{\mathrm{age}}^{\mathrm{edu}}$ is the current total annual labour income for a representative individual with educational level of *edu* at age of *age;*

$\mathrm{SUR}_{\mathrm{age+1}}$ is the survival rate (i.e. the probability of surviving one more year) at age of "*age*".

$t_{edu-\overline{edu}}$ is the school duration for this individual with educational level of *edu* to complete a higher educational level of $\overline{edu}$;

r is the rate of growth in real wages. Lindsay (2004) estimates that the long run UK labour productivity growth is around two per cent per annum; and

δ is the discount rate. HM Treasury's Green Book (2003), which provides guidelines for appraisal and evaluation in central government recommends using a discount rate of 3.5 per cent per annum.

At the start of each period, the representative individual in the next year can either continue his/her work (holding the same educational level as before) and earn income of $\mathrm{SUR}_{age+1}\mathrm{LLI}^{edu}_{age+1}\{(1+r)/(1+\delta)\}$ with the probability of $\left\{1-\sum_{edu} ENR^{edu-\overline{edu}}_{age}\right\}$ or undertake some education and (after completing study having gained a higher educational level) receive income of $\left\{\left(\sum_{t=1}^{t_{edu-\overline{edu}}} \mathrm{SUR}_{age+1}\mathrm{LLI}^{\overline{edu}}_{age+1}\{(1+r)/(1+\delta)\}^t\right)/t_{edu-\overline{edu}}\right\}$ with the probability of $\sum_{edu} ENR^{edu-\overline{edu}}_{age}$.

Therefore, his/her lifetime income in the next year is the expected value of the outcomes of these two courses of action.

The empirical implementation of Equation 2 is based on backwards recursion. In this approach, the lifetime labour income of a person aged 64 (that is one year before retirement) is simply his/her current labour income because his/her lifetime labour income at 65 is zero by construction. Similarly, the lifetime labour income of a person aged 63 is equal to his current labour income plus the present value of the lifetime labour income of a person aged 64, and so forth.

In estimating lifetime labour income by using Equation 2 several practical assumptions are made, some of which are used as well by other studies in the field (for example Gu and Wong, 2008; Le et al, 2006; Liu and Greaker, 2009; Wei, 2004, 2007). The most important assumptions are as follows:

- individuals can only enrol in a higher educational level than the one they have already completed;
- no further enrolment is allowed for people having already achieved the highest educational level;
- students enrolled in educational institutions requiring more than one year to complete are assumed to be evenly distributed across the total study–period. This is equivalent to saying that, during each school–year, there is the same (equal) proportion of the total students that will complete the study; and
- no delaying and quitting are allowed during the whole study period.

The lifetime labour income measures estimated through Equation 2 are applied to all individuals in each age/educational categories to compute the human capital stock for each category. Summing up the stocks of human capital across all classified categories yields the estimate of the aggregate value of the human capital stock (*HC*).

Equation 3

$$HC = \sum_{age} \sum_{edu} LLI_{age}^{edu} N_{age}^{edu}$$

where N_{age}^{edu} is the number of individuals in the corresponding age/educational category. Equation 3 can be applied separately to both males and females to estimate the stock of human capital by gender.

Results

Applying the methodology described in the previous section and using an annual discount rate of 3.5 per cent and a labour productivity growth rate of 2 per cent per annum, the UK's human capital stock is estimated to have been worth £16,686 billion in 2009. Dividing this amongst the working age population gives an average of around £419,326 per individual.

The reasonableness of the estimates can be illustrated using the following calculation that for simplicity ignores discounting, real wage growth and so on. The number of employed individuals in the economy was around 28 million, multiplying this by average annual earnings of around £25,000 and an average working life remaining of 24.5 years[13] gives 17,150 billion.[14]

Sensitivity analysis

Table 1 shows how these estimates change when the discount rate and labour productivity growth rate change. Increasing the assumed labour productivity growth rate by one percentage point whilst holding everything else constant increases the estimate of the human capital stock by around £2,506 billion. Conversely, lowering the assumed labour productivity growth rate by one percentage point decreases the estimate of the human capital stock by £2,044 billion. A similar exercise, this time changing the discount rate by one percentage point, leads to changes of a similar magnitude but in the opposite direction in the estimates of the human capital stock.

As noted in the previous section, restricting the sample to individuals aged between 16 and 64 years is a somewhat arbitrary assumption particularly at the higher end of the age range. **Table 2** illustrates the effects of changes in the upper age bound on estimates of the human capital with a discount rate of 3.5 per cent and a labour productivity growth rate of 2 per cent. As would be expected, increasing the upper age bound increases the estimates of the human capital stock since the human capital of additional workers is included in the estimate and the expected working

lives of individuals already in the sample is extended, raising the value of their human capital. The increases become smaller as the upper age bound is increased because the employment rate and total income is lower in each age–year cohort added to the sample.

Table 1 Estimates of the UK's human capital stock, 2009

Discount rate (per cent)	Labour productivity growth rate (per cent)	Totals (£ billion)	Per head of working age population (£'000s)
3.50	2.00	16,686	419
3.50	3.00	19,192	483
3.50	1.00	14,642	368
2.50	2.00	19,178	482
4.50	2.00	14,686	369

Source: Office for National Statistics

Table 2 Estimates of the UK's human capital stock in 2009 for different upper age limits

Upper Age Limit	Totals (£ billion)
64	16,686
65	16,993
66	17,272
67	17,530
68	17,758
69	17,943
70	18,083

Source: Office for National Statistics

The distribution of human capital

Table 3 shows the distribution of human capital across gender, age groups and educational attainments in 2009. The figures show that the estimated total market value of women's human capital was around 63 per cent of men's human capital. On average, a working-age man had around £516,000 worth of human capital compared to the average of around £324,000 for a working-age woman. This distribution was mainly the result of men earning more and having higher employment rates than women on average. Table 3 also shows that the stock of human capital was disproportionately concentrated in younger workers. For example, just over one–in–five of the working age population were aged between 20 and 29 inclusive but this group embodied

one–third of the human capital stock, showing that being relatively young and having more years of paid employment remaining more than offset the effect of having higher earnings whilst being relatively old. As might be expected, the value of the human capital stock was disproportionately embodied in those workers with the highest educational attainments: 33 per cent of the UK's human was embodied in the 22 per cent of the working age population with the highest qualification level. In contrast, only six per cent was embodied in the 11 per cent of the working age population with no qualifications.

Table 3 Distribution of the UK's human capital stock in 2009

	Share of working age population (per cent)	Share of total human capital stock (per cent)	Human capital (£ billion)
Gender			
Male	49.8	61.2	10,205.6
Female	50.2	38.8	6,480.9
Age band			
16-19	7.9	10.2	1,696.7
20-24	10.6	16.1	2,680.9
25-29	10.5	16.3	2,714.6
30-34	9.6	13.8	2,307.6
35-39	10.7	13.3	2,224.4
40-44	11.6	11.8	1,965.1
45-49	11.2	9.0	1,493.4
50-54	9.8	5.5	924.6
55-59	8.9	3.0	501.9
60-64	9.3	1.1	176.2
Highest educational attainment			
Degree or equivalent	21.7	33.7	5,615.4
Higher education	8.8	8.6	1,431.3
GCE A level or equivalent	22.7	22.3	3,720.4
GCSE grades A-C or equivalent	22.4	19.6	3,263.8
Other qualifications	13.4	9.8	1,634.7
No qualification	11.0	6.1	1,019.9

Source: Office for National Statistics

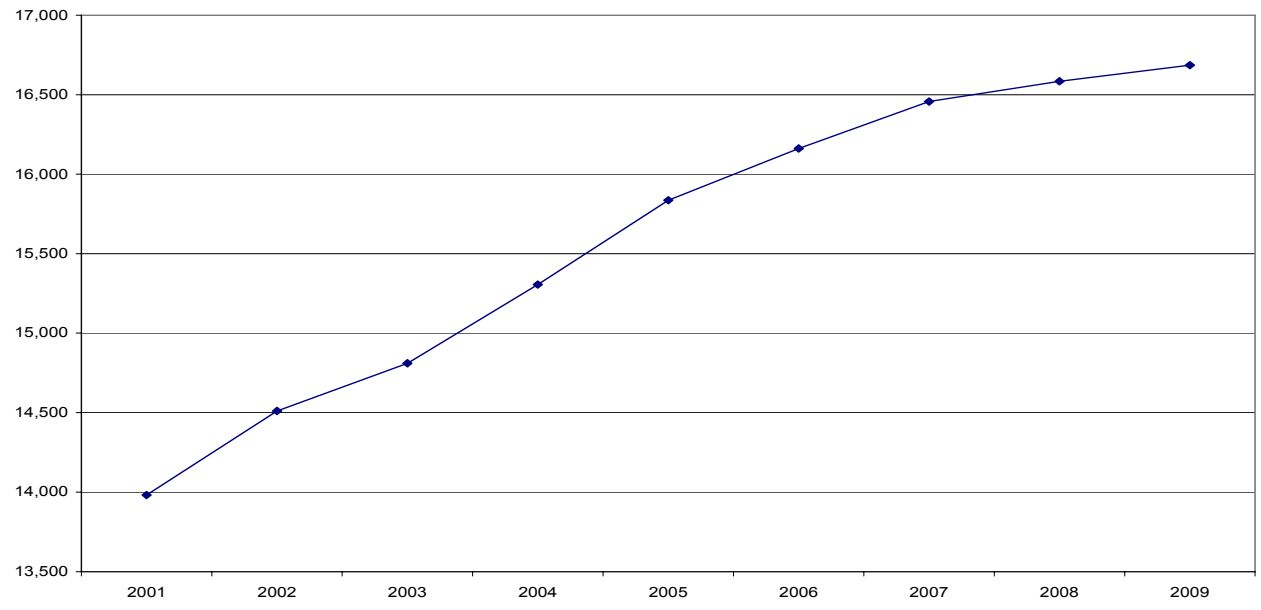
Human capital stock overtime

Figure 1 shows the annual estimates of the human capital stock for each of the years from 2001 to 2009. The estimates are inflated to 2009 prices using the consumer price index. The figures are calculated as annual averages to remove seasonal effects in the estimates and because there are three quarters of micro–data where no pay variable is available.[15] The figure illustrates that the annual average human capital stock in the UK, measured in 2009 prices, increased by £2,703 billion from £13,982 billion in 2001 to £16,686 billion in 2009. Figure 1 also illustrates the impact of the recession on the human capital stock. Between 2001 and 2007, the human capital stock grew by £2,474 billion in real terms, an average of £412 billion per year. In contrast, between 2007 and 2009, the human capital stock grew by £228 billion. As illustrated in **Figure 2**, the human capital stock per head of working age population, measured in 2009 prices, increased from £372,529 in 2001 to 419,326 in 2009 with £46,080 of the £46,797 increase occurring between 2001 and 2007.

Figure 1 **Human capital stock, 2001–2009**

United Kingdom

£ Thousands



Source: Labour Force Survey

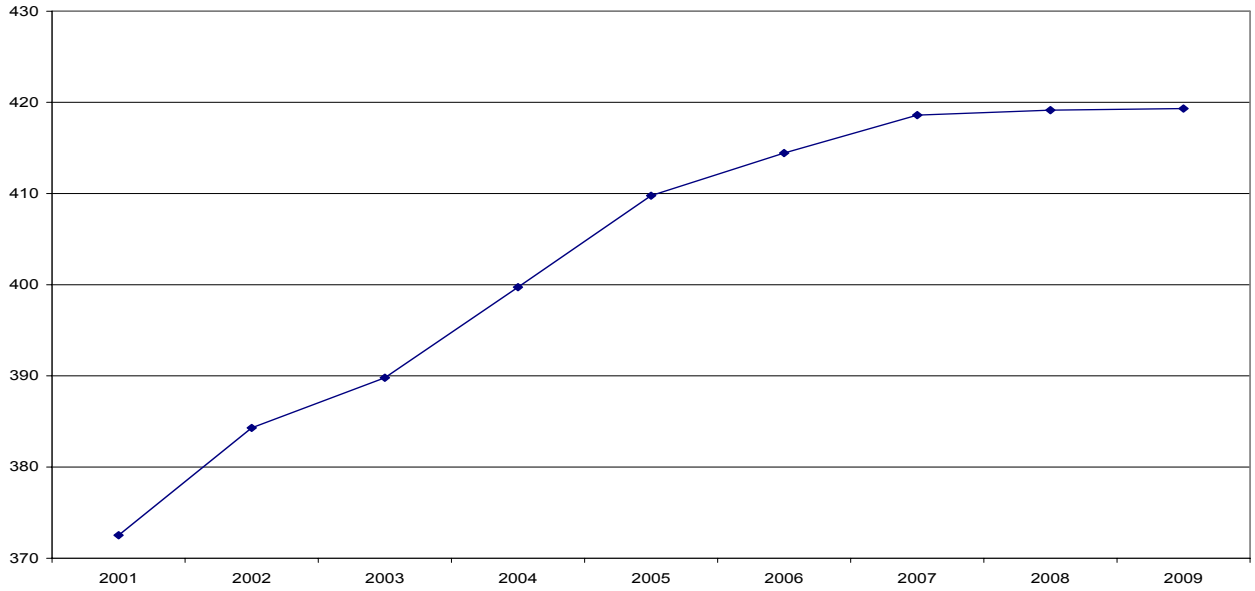
The increase in the human capital stock between 2001 and 2009 has been driven by several factors. First, the size of the working–age population increased from 37.5 million in 2001 to 39.9 million in 2009. Similarly, the number of people in employment increased from 27.3 million in 2001 to 28.2 million in 2009. To give an indication of the effect this had on the human capital stock, the estimate of the human capital in 2001 (£13,982 billion) can be multiplied by the ratio of the number of people in employment in 2009 and 2001 to give £14,506 billion. Thus, holding other things

equal, around £524 billion of the £2,703 billion increase in human capital between 2001 and 2009 can be attributed to the increase in the number of people employed over the same period.[16] Between 2001 and 2009, mortality rates for working age individuals also fell. Again holding other things constant, using the mortality rates for 2009 instead of the 2001 rates, increases the estimate of the human capital stock in 2001 by £49 billion to £14,031 billion.

Figure 2 Human capital per head of working age population, 2001–2009

United Kingdom

£ Thousands



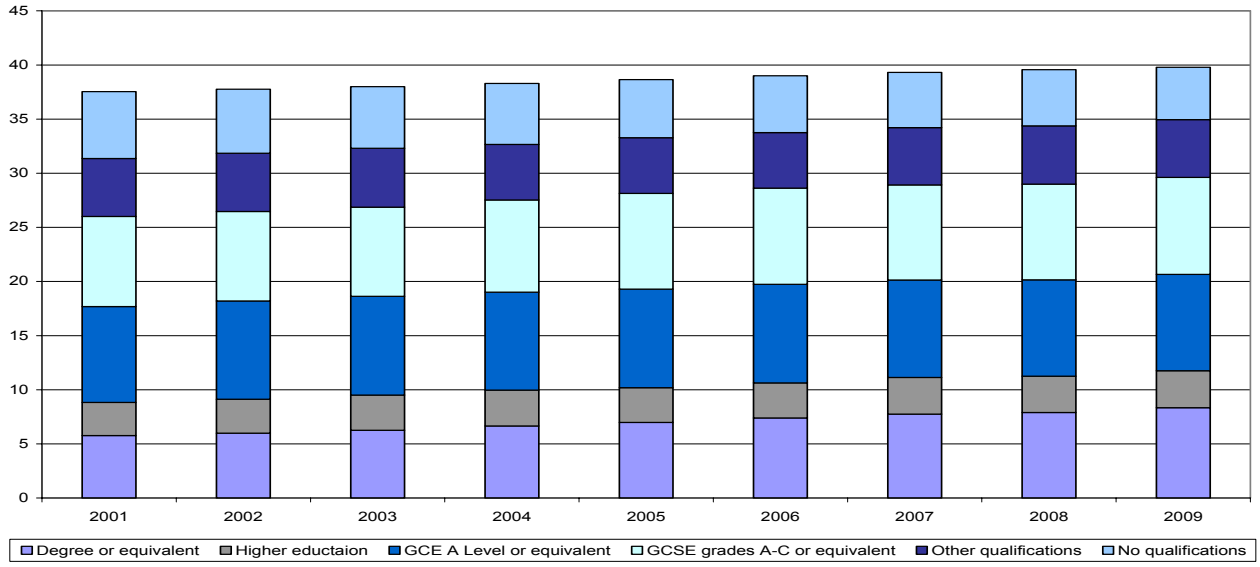
Source: Labour Force Survey

Figure 3 illustrates that between 2001 and 2009, the proportion of the working age population whose highest educational attainment is a degree or equivalent increased from 15.4 per cent (5.8 million people) in 2001 to 21 per cent (8.3 million people) in 2009. Moreover, the proportion of the population with no qualifications fell from 16.4 per cent (6.1 million people) in 2001 to 12.2 per cent (4.8 million people) in 2009. Other things being equal, this would have been expected to increase the human capital stock since, as illustrated in **Figure 4**, individuals with degrees tend to earn more than the rest of the population. Applying the distribution of qualifications in 2009 to the 2001 working age population and holding everything else constant, the estimate of the human capital stock for 2001 increases to £14,851 billion so around £869 billion of the £2,703 billion increase in human capital between 2001 and 2009 can be attributed to changes in the qualifications mix of the working age population over the same period.

Figure 3 Distribution of highest educational qualification in the working age population, 2001–2009

United Kingdom

Millions of people

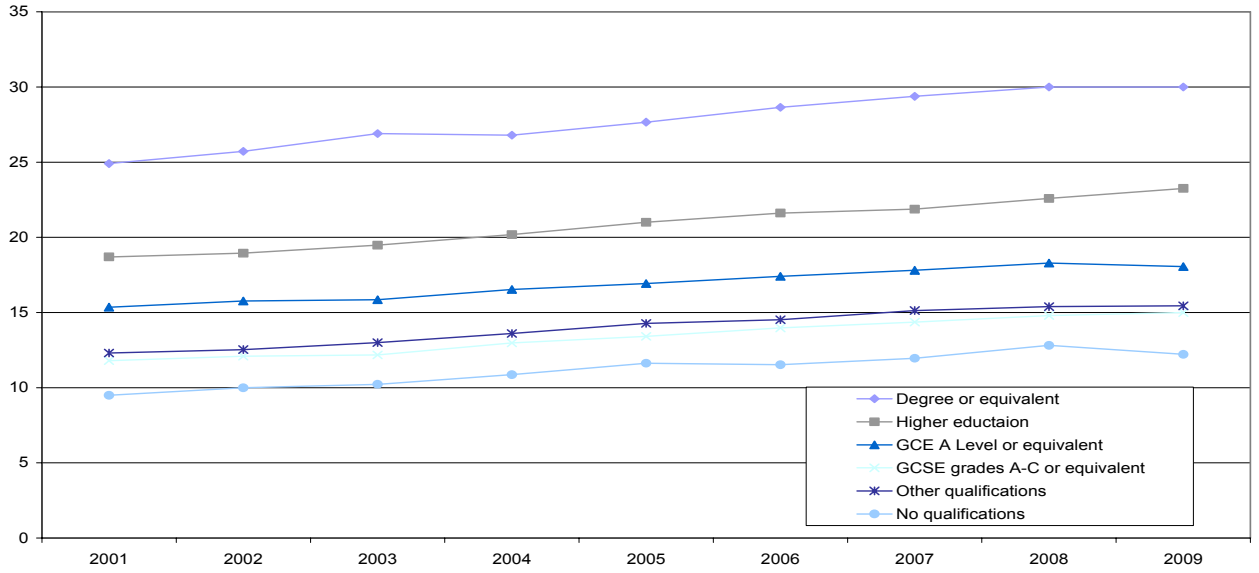


Source: Labour Force Survey

Figure 4 Median total annual income by highest educational attainment, 2001–2009

United Kingdom

£ Thousands



Source: Labour Force Survey

Another important driver of this series is the changes in the earnings. Figure 4 illustrates that median total earnings grew in real terms for educational attainment groups and the absolute size of the increase was generally higher the higher the educational attainment, the exception being the earnings of those whose highest educational attainment was 'A' level or equivalent. For example, the median total earnings of those whose highest educational attainment is a degree or equivalent increased the most, by £5,046, between 2001 and 2009, whilst the median total income of those with no qualifications grew by £2,721. However, in proportionate terms, the ordering of the size of increase is reversed so that those with no qualifications had the highest proportional growth in their real total incomes.

Applying the earnings distribution in place in 2009 to the 2001 workforce, increases the estimate of the human capital stock in 2001 by £998 billion to £14,980 billion. This is decomposed by qualification in **Table 4** and shows that almost two-thirds of the £998 billion increase came from the higher earnings of those whose educational attainment is a degree or equivalent and those whose highest educational attainment is GCSE grades A–C or equivalent.

Table 4 **Contributions to human capital growth, 2001–2009**

Increases in the total earnings of those whose highest educational attainment is:	£ billion
Degree or equivalent	291
Higher education	61
GCE A Level or equivalent	99
GCSE grades A–C or equivalent	355
Other qualifications	102
No qualifications	89
Total	**998**

Source: Office for National Statistics

Conclusions

Main findings

This paper has discussed the importance of human capital and how an economy's human capital stock can be measured. Using a discounted a lifetime labour income approach and assuming a discount rate of 3.5 per cent and labour productivity growth rate of 2 per cent, the UK's human capital stock was worth £16,686 billion in 2009. This is more than two-and–a–half times the Blue Book estimate of the Net Worth of the UK in the same year.[17] The average human capital stock per head of working age population was £419,326 in the final quarter of 2009. Less time in paid employment over their lifetime and lower average labour market earnings means that the market value of women's human capital (£6,481 billion) is around sixty per cent of men's (£10,206 billion). The paper also shows that the annual average human capital stock in the UK, measured in 2009

prices, increased by £2,663 billion from £13,982 billion in 2001. Human capital per head of working age population, again in 2009 prices and calculated as an annual average, increased from £372,529 to £419,326 over the same period.

Applications

This measure of human capital has several potential policy applications. First, it can be used as a measure of an economy's future well-being as the empirical work on economic growth suggests that countries with higher levels of human capital, other things being equal, have greater potential output and income in the future. The measures can also be used in the assessment of the impact of an ageing population, changes in retirement ages and in the evaluation of the economic benefits of different levels of education.

Limitations

As acknowledged in the section on methodology, this approach has some weaknesses. First, it relies on the assumption that labour is paid according to its marginal productivity. In practice, a range of institutional factors affect earnings. These measures are also sensitive to the choice of the discount rate and the retirement age. This method relies upon the use of current age-earnings profiles to project future earnings flows. The approach assumes that the attainment of educational qualifications is the main driver of higher earnings. Non–educational factors such as ability and family background are not taken into account. Thus, the estimated effect on lifetime labour incomes of educational attainments is likely to be over–estimated.

Further work

Non–wage benefits could be incorporated into the returns to qualifications. This is an important consideration when interpreting the relative valuation of human capital for women and men reported in Table 3. These experimental estimates of human capital are calculated using market factors only. Human capital is also important for non–market activity. Thus, one cannot conclude that male human capital is more 'valuable' to society than female human capital. Future work could incorporate imputations of the value of non–market labour activity, including household production and leisure into the measures of human capital.

The discounted lifetime income framework only considers formal education in its estimates of investment in human capital that enhances individuals' skills and knowledge, with the component of on-the-job training being mixed with its estimation of human capital. The standard human capital theory also emphasises the role of on–the–job training in human capital formation. This could be combined with the stock estimates to produce a capital accumulation account.

Acknowledgements

The authors would like to Paul Allin, Joe Grice, Stephen Hicks, Donna Livesey, Craig Mclaren, participants at the 2010 Government Economic Service Conference, the 2010 International Association for Research in Income and Wealth (IARIW) Conference and a BIS/ONS workshop for their comments and suggestions.

Notes

1. The first attempt at valuing human capital was made by William Petty in 1690 (Petty, 1690), who estimated the total human capital of England to be £520 million or £80 per capita.
2. Other members of the consortium are 14 other OECD countries (Australia, Canada, Denmark, France, Italy, Japan, Korea, Mexico, Netherlands, New Zealand, Norway, Poland, Spain, and the United States), two accession countries (Israel and Russia) and one non–member country (Romania). Eurostat and the ILO are also members of the consortium. The consortium is assisted and coordinated by the OECD Secretariat.
3. It may be that as countries become richer they are able to devote more resources to education and training and so on.
4. The presence of positive externalities is one of the justifications for government subsidies to education and training. From society's point of view, individuals might under–invest in certain kinds of education since they do not take into account the wider benefits to society of their decision.
5. In his model, workers and firms are complementary in the production process. This means that additions to human capital that raise productivity also increase the rate of return on investments in physical capital. Thus, increases in the average level of human capital can lead firms to make greater investments in physical capital. Since the matching process is inefficient, the firms that have invested more in physical capital are not necessarily matched with the workers who have invested more in human capital. As a result, some of the other workers will gain from the increase in average human capital, since they are matched with firms using more physical capital than before.
6. Hulten (1990) and others have called this, 'one of the most difficult tasks in economics'.
7. There is a similar debate amongst financial accountants over the accounting treatment of human resources in company accounts for example Gall (1988) and Flamholtz et al (2002).
8. Further information on the Labour Force Survey can be found at www.statistics.gov.uk/statbase/Source.asp?vlnk=358
9. The data has population weights that allow results for population to be derived from the sample.
10. The retirement age for women is 60 years. However, we take 64 years as the general retirement age given recent changes to the regulations.
11. Including 'Don't know'. The variable name in Q4 of 2009 is hiqual8.
12. Including 'Don't know'. The variable name in Q4 of 2009 is hiqual8d.
13. Assuming a uniform distribution of workers, the average working life remaining is ((65-16)/2) =24.5.
14. A discount rate greater than a labour productivity growth rate and a shorter expected working life for women brings this closer to the £16,686 calculated.
15. In these years, the annual figure is calculated as the average of the three remaining quarters.

16. Although the implicit assumption made in this calculation is that, on average, the human capital of additional individuals is identical to that of existing workers and that the additional individuals have no impact on the human capital of existing individuals.
17. United Kingdom National Accounts: The Blue Book 2010, Table 10.1.

Contact

elmr@ons.gov.uk

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Regional economic indicators:

with a focus on sub–regional Gross Value Added using shift–share analysis

Sebnem Oguz and Jonathan Knight
Office for National Statistics

Summary

This quarter, the Regional Economic Indicators article focuses on explaining the differences in sub–regional economic growth rates (Gross Value Added (GVA)) between 1995 and 2007 by using the shift–share method. The technique is based on the assumption that local economic growth is explained by the combined effect of three components: national growth, industry mix or structural effect, and local competitiveness. Thus, one can apply shift–share to determine how much each component contributes to local economic growth. The regular part of the article then gives an overview of the economic activity of UK regions in terms of their GVA, GVA per head and labour productivity. This is followed by a presentation of headline indicators of regional welfare, other drivers of regional productivity and regional labour market statistics. The indicators cover the nine Government Office Regions of England and the devolved administrations of Northern Ireland, Scotland and Wales. These 12 areas comprise level 1 of the European Nomenclature of Units for Territorial Statistics (NUTS level 1) for the UK. The term 'region' is used to describe this level of geography for convenience in the rest of this article.

Focus on differences in sub–regional economic growth (NUTS2 and NUTS3 regions)

The August edition of the Regional Economic Indicators (REI) article focussed on differences in economic growth in NUTS1 regions by using the shift–share method. This article takes this analysis to a lower geographical level by examining economic growth across UK sub–regions over the 1995 to 2007 period. It evaluates the performance of the 37 NUTS 2 sub–regions and the 133 NUTS3 areas by using the shift–share method. Looking at these lower geographical levels enables identification of those smaller areas which have been slowing down or accelerating the economic performance of NUTS 1 regions.

The shift–share is a popular technique in regional analysis that examines economic change in a region by splitting the growth of its GVA into three additive components: the reference area such as the national economy effect, the structural effect and regional competitiveness (see **Box 1**). By applying shift–share analysis to GVA growth in a region one can determine how much of the regional GVA growth may be attributed to the unique local factors and how much of it is due to the national business cycle and the national performance of specific industries.

Box 1 Shift–share

Shift–share analysis is a sectoral decomposition procedure widely used in regional analysis. Shift–share analysis is a method which examines growth (or decline) rates of a variable such as GVA or employment in a region by splitting it into three additive components:

1. A **growth effect** with respect to a reference area, which in regional applications is commonly the national economy (National Share (NS)). It indicates the regional growth that would occur if GVA in all industries within a region grew at the same rate as the growth rate of the national economy overall during the period of analysis. This component describes the change that would be expected due to the fact that a region is part of a dynamic national economy.

2. A **structural effect** (Industry Mix (IM)) which is measured on the basis of the deviation of each industry's national growth rate from the aggregate growth rate of the economy overall. It is the component of growth that is due to regional specialisation in industries. Thus, a local area, with an above–average share of output from the nation's high growth industries would have grown faster (indicated by a positive IM factor) than a local area with a high share of output from low–growth industries (indicated by a negative IM factor).

3. A **competitive effect** (Regional Shift (RS)) which compares a local area's growth rate in an industry sector with the growth rate for that same sector at the national level. The RS is perhaps the most important component. It highlights a local area's economic strengths by identifying its competitive industries. A competitive industry is defined as one that outperforms its counterpart at the national level (indicated by a positive factor). Regions that have positive (negative) regional shift effects have local advantages (disadvantages) for particular activities that affect the performance of particular industries. The advantages could be due to local firms having superior technology, management or market access, higher local labour productivity compared to other regions and/or lower wages. The RS factor does not tell what these advantages or disadvantages are. However, by looking at this factor it can be determined which industries are performing particularly well in the region.

The three components sum to the total shift, which is the actual growth or decline in a region's GVA. It should be born in mind that the shift–share technique is only a descriptive tool and it does not seek to explain the factors that influence the overall changes in local economies. Additionally, shift–share analysis is a 'snapshot' between two particular time periods and is on occasions sensitive to the time period chosen. However, the time period in this article covers a period of economic growth and sensitivity checks did not show significantly different results when the beginning and the end of time periods were changed.

Overall, shift–share analysis offers a simple, straightforward approach to separating out national and industrial contributions to GVA from local growth effects. The ability to separate local growth factors from national growth factors is an important aspect of understanding local economies. In particular, when used in combination with other analysis the technique offers a valuable tool to better understand a region's economic potential.

The August REI article showed that the largest contribution to regional GVA was made by national economic growth between 1995 and 2007. If the GVA in all the regions had grown at the same rate as the national GVA during this period, their GVA would have increased by 90 per cent. However, growth rates actually varied considerably among regions. This was explained by differences in the Industry Mix (IM) and Regional Shift (RS) components of the growth for NUTS1 regions.

Table1 presents shift–share decomposition of the change in GVA in the ten NUTS3 areas with the largest GVA growth between 1995 and 2007. With the exceptions of Inner London–West and Surrey, local advantage captured by the RS component was the main factor explaining higher than average GVA growth rates with the effect of the industry mix on GVA growth relatively small. Indeed, the IM factor was even negative in Cambridgeshire CC and North and Northeast Somerset, South Gloucestershire despite the high levels of overall GVA growth in these sub–regions. Similarly, **Table 2** shows that lower than average GVA growth rates amongst the bottom ten performing NUTS3 regions over the same period were also mainly influenced by the region–specific factors. It was only in West Cumbria that the industry mix slowed down the GVA growth more than the region specific factors.

Table 1 Shift–share decomposition of the change in workplace–based GVA at current prices in the top ten performing NUTS3 regions between 1995 and 2007

Percentages

Region	National Share (NS)	Industry Mix (IM)	Regional Shift (RS)	Total change (per cent)
Inner London - East	89.8	15.2	34.8	139.9
Inner London - West	89.8	32.7	14.2	136.7
Peterborough	89.8	2.9	40.9	133.6
Berkshire	89.8	7.3	32.5	129.6
Milton Keynes	89.8	5.1	32.8	127.7
North and North East Somerset, South Gloucestershire	89.8	-2.7	36.9	124.1
Hampshire CC	89.8	1.8	29.4	121.0
Northamptonshire	89.8	-3.3	34.0	120.5
Cambridgeshire CC	89.8	-0.1	29.4	119.1
Surrey	89.8	16.4	9.8	116.0

Source: Office for National Statistics

Table A1 in the **Appendix** presents a shift–share decomposition of the change in GVA for all the NUTS2 and NUTS3 regions between 1995 and 2007. Like the top and bottom ten regions, a strong and positive relationship between the RS component and the GVA growth could be seen in most of the regions. For the 133 NUTS3 regions the correlation coefficient between these two variables is 0.9. The relationship between the GVA growth and the IM factor, however, is weaker as indicated by a correlation coefficient of 0.5. This implies that factors specific to a region play a more prominent

role in explaining GVA growth differences between regions than the industry composition of the regions.

Table A1 also shows that rates of GVA growth and IM and RS factors displayed much larger variations within regions compared to variations between NUTS1 regions. For example, the RS component ranged from 37.0 percentage points in Derby to -22.4 percentage points in Nottingham resulting in an overall positive contribution of 7.0 percentage points to GVA growth in East Midlands. In London, the high RS factor of Inner London offset Outer London's negative RS factor resulting in a positive overall local advantage for the whole region. Similarly, IM components at higher geographical levels masked significant variations within regions. For example, in the South East, Surrey and Brighton and Hove had the largest influence in this region's positive IM factor.

Overall, in NUTS3 areas the RS component ranged from -55.6 percentage points in Blackpool to +40.0 percentage points in Peterborough and the IM factor ranged from -31.9 percentage points in Flintshire and Wrexham to 32.7 in Inner London–West. In NUTS2 areas, the ranges for both factors were narrower compared to NUTS3 areas. The ranges for RS and IM components in NUTS2 regions were -22.7 to 23.4 and -20.4 to 27.2 respectively. It is interesting to note that most of the positive IM factors are observed in urban areas.

Table 2 Shift–share decomposition of the change in workplace–based GVA at current basic prices in the bottom ten performing NUTS3 regions between 1995 and 2007

Percentages

Region	National Share (NS)	Industry Mix (IM)	Regional Shift (RS)	Total change (per cent)
Inverclyde, East Renfrewshire and Renfrewshire	89.8	-11.6	-49.1	29.1
East Ayrshire and North Ayrshire Mainland	89.8	-23.2	-35.9	30.7
Stoke-on-Trent	89.8	-15.4	-39.5	34.9
Blackpool	89.8	1.4	-55.6	35.6
Gwynedd	89.8	-8.3	-42.7	38.8
Dudley and Sandwell	89.8	-14.8	-32.9	42.1
Hartlepool and Stockton-on-Tees	89.8	-19.9	-27.4	42.6
West Cumbria	89.8	-31.8	-15.2	42.9
Blackburn with Darwen	89.8	-21.5	-25.3	43.0
Northumberland	89.8	-16.7	-28.4	44.8

Source: Office for National Statistics

To shed further light on differences in the local competitiveness captured by the RS component, **Table 3** presents the GVA growth for each industry by NUTS2 region between 1995 and 2007. Where a region's growth rate for an industry is higher than the UK growth rate for the same industry then this means that the region has a positive RS component for that industry. A positive RS component can be considered as an indication of a region's competitive advantage for that industry.

Table 3 **Change in workplace–based GVA at current basic prices between 1995 and 2007: by NUTS2 region and by industry**

Northern England

Percentages

	Tees Valley and Durham	Northumberland and Tyne and Wear	Cumbria	Cheshire	Greater Manchester	Lancashire	Merseyside	East Riding and Northern Lincolnshire	North Yorkshire	South Yorkshire	West Yorkshire	UK
Agriculture, hunting and forestry and fishing	0.0	4.4	-7.7	-26.6	-31.4	-34.5	-14.2	-22.2	-12.8	-4.9	-10.6	**-22.9**
Mining and quarrying	12.0	19.5	68.9	65.7	31.1	25.3	-38.8	9.2	-11.3	-30.9	-24.0	**12.6**
Manufacturing	-16.3	24.8	18.8	18.2	-7.0	11.6	-7.2	31.4	35.3	17.5	-3.9	**11.9**
Electricity, Gas and Water Supply	114.0	52.1	135.7	5.6	-38.0	46.9	26.3	117.5	46.5	15.6	24.9	**36.9**
Construction	133.9	122.9	110.5	155.2	131.5	132.9	132.3	101.3	91.1	159.2	143.8	**144.7**
Wholesale and Retail Trade; Repair of Motor Vehicles, Motorcycles and Personal and Household Goods	80.1	79.3	61.7	74.1	80.4	64.0	64.6	64.0	93.2	83.3	79.6	**89.3**
Hotels and Restaurants	142.4	87.2	74.6	88.5	127.5	81.5	155.4	119.3	84.6	98.1	90.9	**122.6**
Transport, Storage and Communication	43.4	49.6	56.7	73.0	75.1	48.0	54.1	37.5	113.7	50.8	68.9	**70.2**
Financial Intermediation	105.7	176.2	1.1	269.4	185.4	45.2	115.7	21.6	188.2	164.6	186.7	**158.8**
Real Estate, Renting and Business Activities	98.1	150.1	88.2	139.5	143.2	147.3	124.4	80.8	181.5	177.9	131.5	**155.8**
Public Administration and Defence; Compulsory Social Security	65.6	68.8	57.3	57.3	61.5	48.5	113.3	51.2	28.2	81.5	90.9	**63.1**
Education	98.7	75.7	109.9	105.3	72.7	106.0	85.8	78.9	108.8	102.3	121.3	**103.2**
Health and Social Work	116.0	87.6	86.9	109.1	106.1	91.3	82.0	108.9	73.7	167.4	96.5	**115.6**
Other Community, Social and Personal Service Activities and Private Household with Employed Persons	44.7	95.3	135.6	75.5	125.2	63.7	87.6	94.3	102.6	96.7	95.0	**130.9**

Midlands and Eastern England

Percentages

	Derbyshire and Nottinghamshire	Leicestershire, Rutland and Northamptonshire	Lincolnshire	Herefordshire, Worcestershire and Warwickshire	Shropshire and Staffordshire	West Midlands	East Anglia	Bedfordshire and Hertfordshire	Essex	UK
Agriculture, hunting and forestry and fishing	-35.3	-19.3	-38.8	-6.4	-22.3	40.1	-30.7	-27.3	-29.7	**-22.9**
Mining and quarrying	13.1	68.6	-2.9	90.6	-20.4	-74.8	-26.3	3.8	1.7	**12.6**
Manufacturing	7.0	17.0	40.0	10.8	8.7	-19.9	34.4	5.8	25.3	**11.9**
Electricity, Gas and Water Supply	58.0	117.1	9.7	270.7	9.0	29.6	77.9	48.5	0.6	**36.9**
Construction	158.4	182.5	137.5	130.5	122.4	141.5	138.2	152.2	203.5	**144.7**
Wholesale and Retail Trade; Repair of Motor Vehicles, Motorcycles and Personal and Household Goods	84.1	95.2	89.7	87.1	85.4	70.8	91.2	125.3	134.4	**89.3**
Hotels and Restaurants	131.4	130.3	91.0	90.0	108.3	196.2	118.1	165.7	109.9	**122.6**
Transport, Storage and Communication	81.6	139.5	40.6	127.4	113.6	47.9	42.3	105.9	76.0	**70.2**
Financial Intermediation	154.5	145.0	53.7	101.2	126.2	103.3	187.0	123.9	103.2	**158.8**
Real Estate, Renting and Business Activities	157.0	168.4	142.5	168.5	152.9	116.2	170.5	160.0	134.3	**155.8**
Public Administration and Defence; Compulsory Social Security	77.0	107.1	89.1	21.2	62.5	112.5	83.7	56.5	69.1	**63.1**
Education	107.4	106.5	141.9	118.2	72.5	108.2	138.7	115.4	100.1	**103.2**
Health and Social Work	145.2	78.3	96.8	84.0	140.4	109.4	148.3	112.2	130.5	**115.6**
Other Community, Social and Personal Service Activities and Private Household with Employed Persons	118.7	162.2	85.9	147.4	113.1	175.4	112.3	155.0	138.9	**130.9**

London and Southern England

Percentages

	Inner London	Outer London	Berkshire, Buckinghamshire and Oxfordshire	Surrey, East and West Sussex	Hampshire and Isle of Wight	Kent	Gloucestershire, Wiltshire and North Somerset	Dorset and Somerset	Cornwall and Isles of Scilly	Devon	UK
Agriculture, hunting and forestry and fishing	-6.0	-26.2	-33.8	-24.1	-25.4	-32.2	-16.4	-16.3	-5.3	-14.9	**-22.9**
Mining and quarrying	-5.8	-67.2	289.8	-49.8	26.6	3.6	158.4	101.4	5.8	97.3	**12.6**
Manufacturing	28.3	-12.2	22.6	38.1	25.5	-0.9	41.6	27.5	80.6	-5.7	**11.9**
Electricity, Gas and Water Supply	42.7	-6.5	25.9	-21.3	36.6	44.6	106.2	-10.4	-22.7	18.8	**36.9**
Construction	148.3	155.5	140.3	173.7	138.5	172.0	138.4	162.2	193.4	194.5	**144.7**
Wholesale and Retail Trade; Repair of Motor Vehicles, Motorcycles and Personal and Household Goods	66.2	96.1	106.0	92.9	135.8	94.1	109.2	95.5	112.2	84.0	**89.3**
Hotels and Restaurants	154.2	145.6	167.5	119.6	118.5	144.4	128.0	148.1	108.7	110.6	**122.6**
Transport, Storage and Communication	46.7	74.8	83.1	51.1	150.0	77.8	95.6	60.8	246.0	98.5	**70.2**
Financial Intermediation	211.5	74.1	139.4	129.7	111.5	57.7	149.6	117.1	49.9	8.3	**158.8**
Real Estate, Renting and Business Activities	191.6	123.1	176.2	123.1	214.8	179.1	159.5	185.6	176.8	130.0	**155.8**
Public Administration and Defence; Compulsory Social Security	69.8	69.4	48.2	53.4	9.5	51.7	43.1	31.7	84.4	65.2	**63.1**
Education	127.4	121.1	110.5	133.4	129.3	99.0	120.9	108.6	102.5	119.9	**103.2**
Health and Social Work	112.0	147.0	124.4	119.0	138.1	103.9	121.3	137.5	131.3	119.8	**115.6**
Other Community, Social and Personal Service Activities and Private Household with Employed Persons	160.0	121.9	212.3	161.4	157.5	135.2	120.6	106.0	160.8	124.3	**130.9**

Wales, Scotland and Northern Ireland

Percentages

	West Wales and The Valleys	East Wales	Eastern Scotland	South Western Scotland	North Eastern Scotland	Highlands and Islands	Northern Ireland	UK
Agriculture, hunting and forestry and fishing	-73.4	-75.9	4.3	-4.6	-0.4	5.6	-19.4	**-22.9**
Mining and quarrying	-14.4	-9.5	-61.3	-40.8	42.3	-36.8	135.6	**12.6**
Manufacturing	-2.2	16.1	20.9	-2.5	54.4	57.3	43.2	**11.9**
Electricity, Gas and Water Supply	-2.8	1.5	62.6	48.9	-15.8	60.7	44.2	**36.9**
Construction	117.3	140.6	120.6	133.6	44.3	119.4	196.9	**144.7**
Wholesale and Retail Trade; Repair of Motor Vehicles, Motorcycles and Personal and Household Goods	80.3	113.6	77.2	75.3	55.6	86.6	129.7	**89.3**
Hotels and Restaurants	89.7	98.9	92.2	71.3	38.1	127.9	138.6	**122.6**
Transport, Storage and Communication	46.7	68.3	56.5	63.7	31.7	94.6	88.8	**70.2**
Financial Intermediation	48.4	168.2	230.7	115.1	45.1	39.0	132.5	**158.8**
Real Estate, Renting and Business Activities	118.8	143.7	158.1	144.8	123.9	87.9	239.8	**155.8**
Public Administration and Defence; Compulsory Social Security	119.3	28.4	59.9	76.5	51.5	87.7	26.4	**63.1**
Education	79.3	105.2	68.3	63.1	3.2	111.9	89.7	**103.2**
Health and Social Work	108.6	113.4	110.1	118.0	197.0	150.9	91.0	**115.6**
Other Community, Social and Personal Service Activities and Private Household with Employed Persons	97.0	132.1	159.9	74.1	65.7	112.4	109.0	**130.9**

Source: Office for National Statistics

In general, the more industries in which a region has a competitive advantage the more likely the region is to have a positive RS component overall. However, some regions that have a relatively low RS component may still have one or more industries with a higher than average GVA growth for that industry over the period considered. For example, both IM and RS components were negative in Cheshire, however, the region recorded the highest GVA growth rate in the financial intermediation sector among the NUTS2 regions between 1995 and 2007. Similarly, the hotels and restaurants sector in West Midlands (NUTS2) and the construction sector in Devon grew faster than their counterparts in other regions over the same period. Manufacturing was one of the few industries that performed well in Lincolnshire and North Eastern Scotland despite their overall negative RS factors.

Among the regions with positive RS factors Leicestershire, Rutland and Northamptonshire had the highest number of industries with higher than average growth rates. This was followed by Inner London and Gloucestershire, Wiltshire and North Somerset. At the lower end of the economic performance scale, West Wales and the Valleys had only one industry with a higher than average growth rate between 1995 and 2007.

Regional overview

Key figures on a regional basis indicate that:

- in 2008 London was the region with the highest productivity, in terms of GVA per hour worked, at 33 percentage points above the UK average and diverged further from it while Northern Ireland had the lowest productivity, at 19 percentage points below the UK average
- South East and East of England were the only other regions with a productivity performance above the UK average (4.0 and 0.7 percentage points respectively) in 2008
- the total value of goods exports increased in all the regions except in East Midlands, Wales and Northern Ireland between June 2009 and June 2010. London and West Midlands had the largest percentage increase in the value of goods exports (up by 8.2 and 8.1 per cent respectively)
- the South East had the highest employment rate in the second quarter of 2010, at 74.6 per cent; Northern Ireland had the lowest rate, at 66.4 per cent, compared with the UK employment rate of 70.5 per cent

Headline indicators

In order to gain an overview of the economic performance of UK regions, this article discusses a selection of economic indicators. Currently, the most widely used indicator of regional economic performance is Gross Value Added (GVA) per head. Policymakers frequently use GVA per head as a headline indicator of regional productivity and of regional incomes when comparing and benchmarking regions that differ in geographical size, economic output and population. However, as Dunnell (2009) has explained, productivity and income are very different concepts.

GVA per head is calculated as the simple ratio of the economic activity in a region divided by the number of people living in a region, while productivity is defined as the ratio of GVA divided by the labour input (jobs or hours worked) used to create it. GVA per head does not take account of:

- people commuting in and out of regions to work
- regional differences in the percentages of residents who are not directly contributing to GVA, such as young people or pensioners, and
- different labour market structures across regions, such as full– and part–time working arrangements

Therefore, GVA per hour worked or GVA per filled job are more appropriate productivity indicators. It needs to be noted that these indicators also depend on pricing thus productivity can fall/rise with decreasing/increasing prices. As regional price deflators do not yet exist, GVA estimates used in productivity figures are in nominal, not real terms, therefore it is not possible to isolate volume changes from price changes.

Similarly, Gross Disposable Household Income (GDHI) per head is a better measure of regional incomes than GVA per head. For example, due to commuting, residents might derive their incomes from economic activity in another region, which is not captured by GVA per head of their region. They may also have sources of income which are unrelated to current work, such as pensions and investment incomes. GDHI, therefore, is one of the determinants of the welfare of the people in the region.

Regional performance

GVA is a good measure of the economic output of a region. In December 2009, ONS published GVA estimates for 2008 and revised estimates for previous years. **Table 4** shows the regional economic performance in terms of workplace–based GVA and GVA per head and their respective average annual growth over the period 1998 to 2008. Although GVA per head is not a good indicator of regional productivity or income, it does take account of variations in geographical size among UK regions and therefore allows better comparisons than using GVA in total.

The estimates show that London had the highest GVA (£266.8 billion) and GVA per head (£35,000) in 2008, followed by the South East (£182.1 billion and £21,700, respectively). London's GVA per head was 71 per cent above the average for the UK, while that of South East was 6 per cent above the average. The North West generated the third highest GVA (£119 billion), but was eighth in terms of its GVA per head (£17,300). Northern Ireland had the lowest GVA in 2008, while Wales had the lowest GVA per head (26 per cent below the UK average).

In terms of average annual percentage growth of nominal GVA between 1998 and 2008, London, East of England, South West, South East and Northern Ireland had the highest GVA growth. Average annual percentage growth of GVA in these regions was equal to or above the UK growth. The lowest growth occurred in West Midlands and North West. Average annual percentage growth of GVA per head between 1998 and 2008 was higher than the UK average in London, Scotland, South East, South West and Northern Ireland, while West Midlands and Yorkshire and The Humber grew slowest over the same period.

Table 4 Workplace–based GVA and GVA per head at current basic prices: by NUTS1 region

£

	UK[1]	North East	North West	Yorkshire and The Humber	East Midlands	West Midlands	East of England	London	South East	South West	Wales	Scotland	Northern Ireland
GVA (£ million)													
1998	769,500	26,600	78,500	58,000	49,900	63,200	66,700	146,800	109,200	58,900	29,700	64,600	17,400
2008[2]	1,259,600	40,700	119,000	88,500	80,100	94,700	111,700	266,800	182,100	98,500	45,400	103,400	28,700
Average annual percentage growth 1998–2008[2]	*5.1*	*4.3*	*4.2*	*4.3*	*4.8*	*4.1*	*5.3*	*6.2*	*5.2*	*5.3*	*4.3*	*4.8*	*5.1*
GVA per head (£)													
1998	13,200	10,400	11,600	11,700	12,100	12,000	12,600	20,800	13,800	12,100	10,200	12,700	10,400
2008[2]	20,500	15,800	17,300	17,000	18,100	17,500	19,500	35,000	21,700	18,900	15,200	20,000	16,200
Average annual percentage growth 1998–2008[2]	*4.5*	*4.3*	*4.1*	*3.8*	*4.1*	*3.8*	*4.5*	*5.3*	*4.6*	*4.6*	*4.1*	*4.6*	*4.5*

Notes

1 UK less Extra-regio and statistical discrepancy.

2 Provisional.

Source: Regional Accounts, Office for National Statistics

Labour productivity

To compare regions in terms of productivity, GVA per hour worked is the preferred indicator. At lower levels of geography, 'hours worked' estimates are not yet available and GVA per filled job should be used. These two measures of productivity divide GVA by the labour input, namely hours worked in all jobs or the number of jobs used to create it.

GVA per hour worked and GVA per filled job take account of commuting effects and different age profiles, and the former also accounts for variations in labour market structures, such as full– and part–time working arrangements and job share availability.

Productivity estimates for 2008 and revised estimates for previous years were published in February 2010. These estimates make use of the GVA figures presented in Table 4, and updated 'filled jobs' and 'hours worked' estimates.

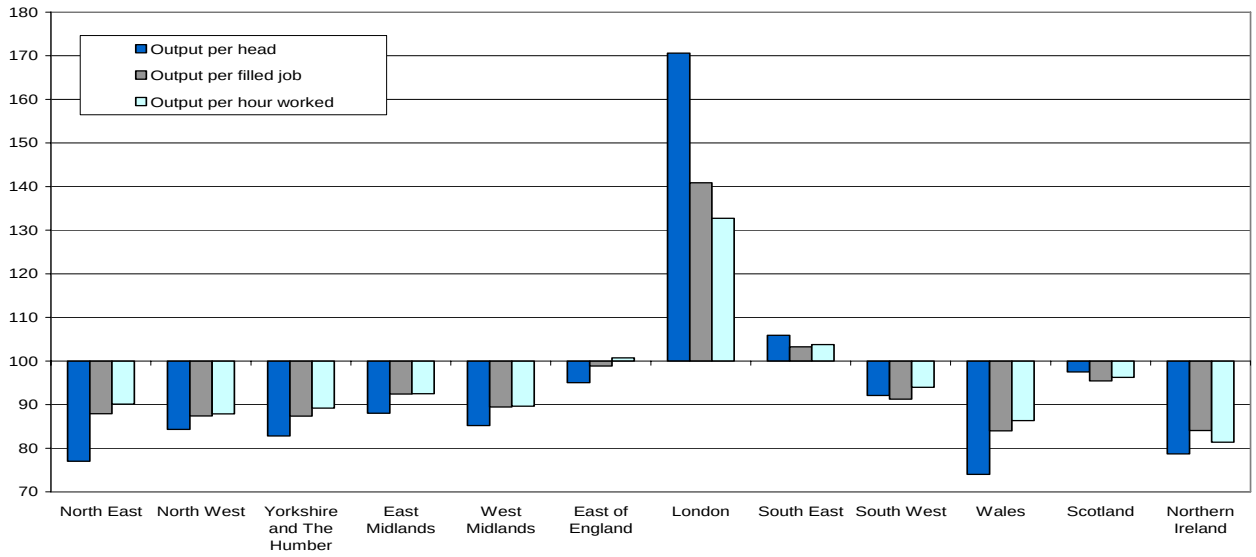
It should be noted that the productivity figures presented here use unsmoothed GVA as their output measure as opposed to headline GVA, which is calculated as a five–year moving average. The unsmoothed measure is used to ensure consistency with the labour input data (Dey–Chowdhury et al 2008), but raises some concerns about increased volatility of productivity estimates compared to those based on headline GVA. The question of whether to smooth productivity figures after dividing unsmoothed GVA by labour data, and presenting these as headline estimates, is one which will be addressed by ONS in the coming months.

Figure 1 shows that in 2008 GVA per filled job and GVA per hour worked exhibited smaller differences from the UK average than the catch–all indicator GVA per head. This is mainly due to commuting patterns. London, for example, has a very high GVA per head, mainly due to incoming workers generating a high GVA, which is then divided by a much lower resident population. Productivity indicators, on the other hand, divide regional GVA by the jobs or hours worked used to create it.

Figure 2 shows the regional GVA per hour worked productivity index on a time series basis from 2000 to 2008. In 2008, London, the South East and the East of England were the only three regions with a productivity performance above the UK average. The East of England saw the strongest improvement in its relative performance from below the UK average in 2000 to above average in 2008. London continued to improve its relative performance, therefore diverging further from the UK average. Relative productivity in the South East weakened slightly in 2008, but it remained above the UK average over the period. Northern Ireland and Wales had the lowest relative productivity compared to the UK average in 2008. Relative productivity in most regions diverged from the UK average between 2000 and 2008. The strongest divergence below the UK average productivity over this period was experienced in the North West, Wales and Northern Ireland. This indicates that these regions' productivity grew by less than the UK average, therefore widening the productivity gap between regions.

Figure 1 Regional economic indicators: by NUTS1 region, 2008[1]

Indices (UK[2] = 100)



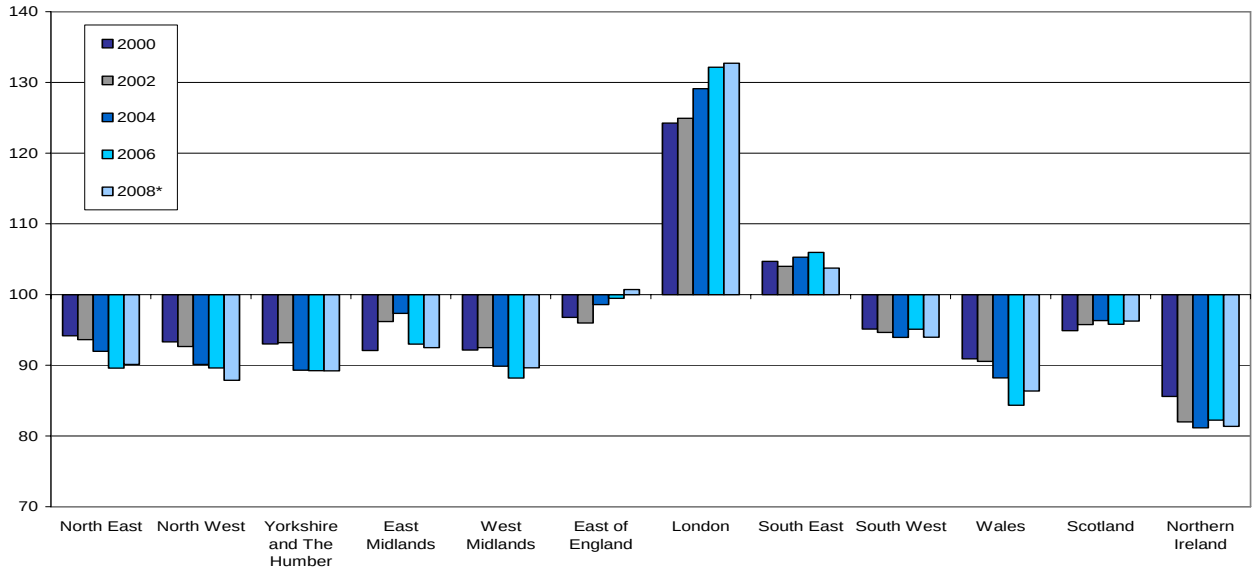
Notes

1. Provisional
2. UK less Extra–regio statistical discrepancy

Source: Office for National Statistics

Figure 2 GVA per hour worked: by NUTS1 region

Indices (UK[1] = 100)



Notes

1. UK less Extra–region statistical discrepancy

* Provisional

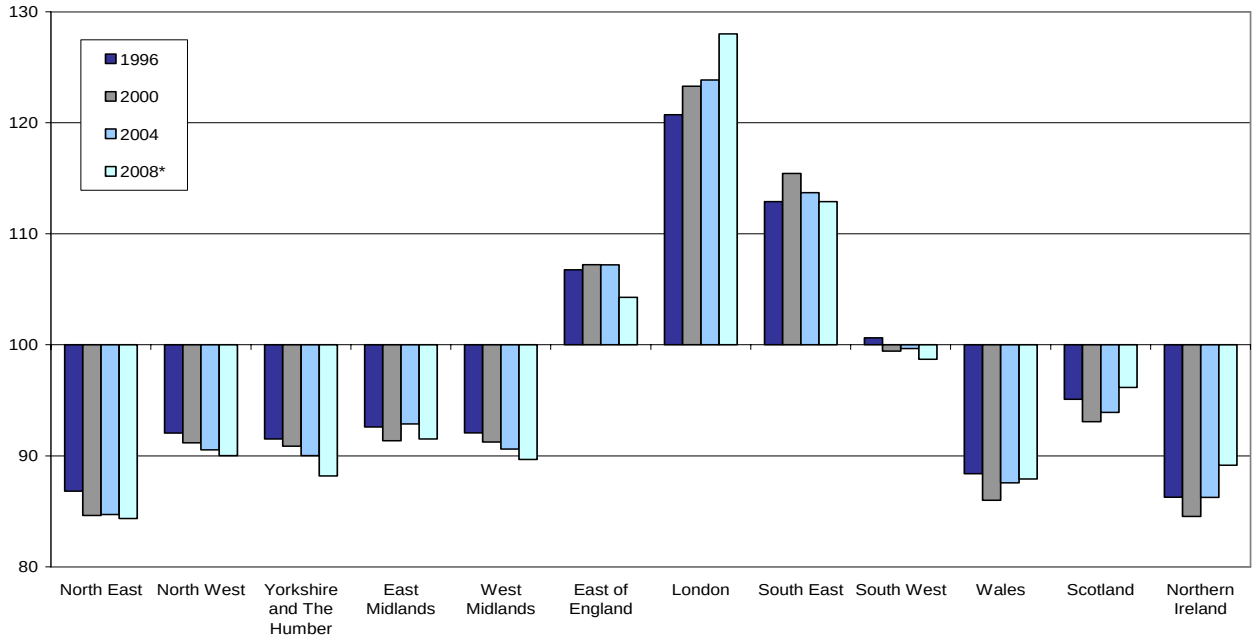
Source: Office for National Statistics

Income of residents

Figure 3 presents indices of GDHI per head for 1996, 2000, 2004 and 2008, showing movements in regional household income relative to the UK average over time. It is evident that the GDHI per head is above the UK average only in the regions of the 'Greater South East'. Of these regions, London has consistently had the highest GDHI per head since 1996 and is diverging from the national average. The South East and East of England, on the other hand, are getting closer to the national average as they experienced relatively lower growth in household income compared to the national average between 2000 and 2008. Most of the regions with relatively lower household income diverged further from the national average while improvements against national average are evident in the devolved administrations between 2000 and 2008.

Figure 3 Headline gross disposable household income per head: by NUTS1 region

Indices (UK[1] = 100)



Notes

1. UK less Extra–region statistical discrepancy

* Provisional

Source: Office for National Statistics

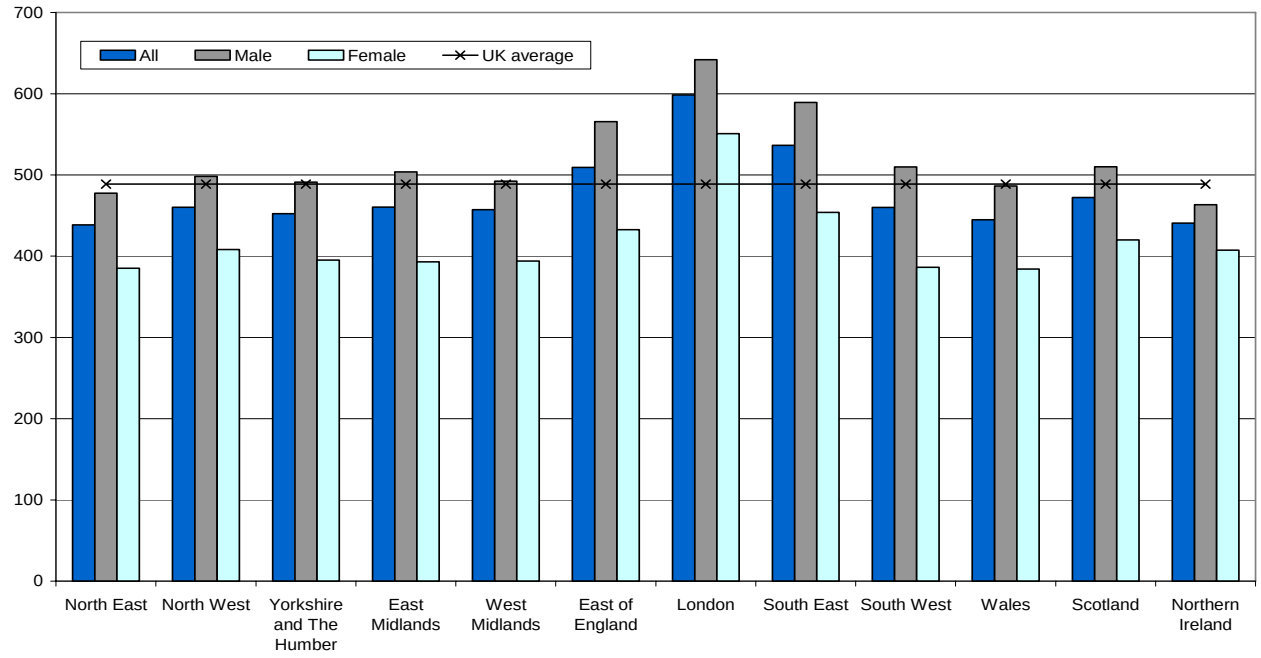
Gross median weekly earnings represent another indicator of regional welfare. **Figure 4** shows the gross median weekly pay for all full–time employees, split into female and male full–time employees, living in each region in April 2009.

As in previous years, London was the region with the highest gross median weekly pay, at £598.60, followed by the South East, at £536.60 and the East of England, at £509.40. These were the only regions above the UK average of £488.70. North East (£438.80), Northern Ireland (£440.80), and Wales (£449.90) recorded the lowest earnings in April 2009.

Females across the UK regions received lower pay than males. In Northern Ireland, the discrepancy was smallest, while it was largest in the South East and East of England. In terms of annual average percentage growth over the four years to 2009, pay for females outperformed that for males except in the South West. The highest annual average growth rate for male pay was observed in the North East while Scotland had the highest annual average growth rate for male pay between 2005 and 2009.

Figure 4 Gross median weekly pay of all full–time employees[1]: by NUTS1 region, April 2009

£



Note

1. Residents of the respective region

Source: Annual Survey of Hours and Earnings, Office for National Statistics

Drivers of productivity

HM Treasury and the Department for Business, Innovation and Skills (BIS) have identified five key drivers of productivity – investment, innovation, enterprise, competition and skills – that can help explain differences in productivity across regions.

Alongside these five key drivers, other factors, such as connectivity, industrial structure and region–specific assets can have a strong influence on regional productivity performance.

This article uses expenditure on Research and Development (R&D) by businesses as a measure of innovation; the numbers of business births and deaths and survival rates as an indicator for enterprise; UK regional trade in goods serves as a measure of competition; and the qualifications of the current working–age population and those of young people, who represent the future workforce, to provide an indicator for the skills driver.

Innovation

Innovation is a necessary, although not sufficient, condition for economic success and is therefore recognised as an important driver of productivity. Innovation comprises, among others, the development of new technologies that increase efficiency and the introduction of new, more valuable goods and services. It also includes intangibles such as new methods of working and improvements to services.

R&D represents one of the determinants to the innovation process and is defined by the Organisation for Economic Co-operation and Development (OECD) in its Frascati Manual, which proposes a standard practice for surveys on R&D, 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 create new applications'. The OECD definition of R&D covers the following:

- basic research: experimental and theoretical work to obtain new knowledge of the underlying foundation of phenomena and observable facts, without any particular application or use in view
- applied research: work undertaken to acquire new knowledge, which is directed primarily towards a specific practical aim, and
- experimental development: systematic work, drawing on existing knowledge, which is directed at producing new materials, products or devices, installing new processes, systems and services, or at improving substantially those already produced or installed

The OECD definition excludes education, training and any other related scientific, technological, industrial, administrative or supporting activities. However, innovation depends on a wider set of inputs than R&D, including skills training, design, software and organisational investment by firms. HM Treasury Economics Working Paper No. 1 (see Giorgio Marrano et al 2007) quantifies these broader knowledge economy inputs at UK level; more work is needed before these factors can be measured effectively at regional level.

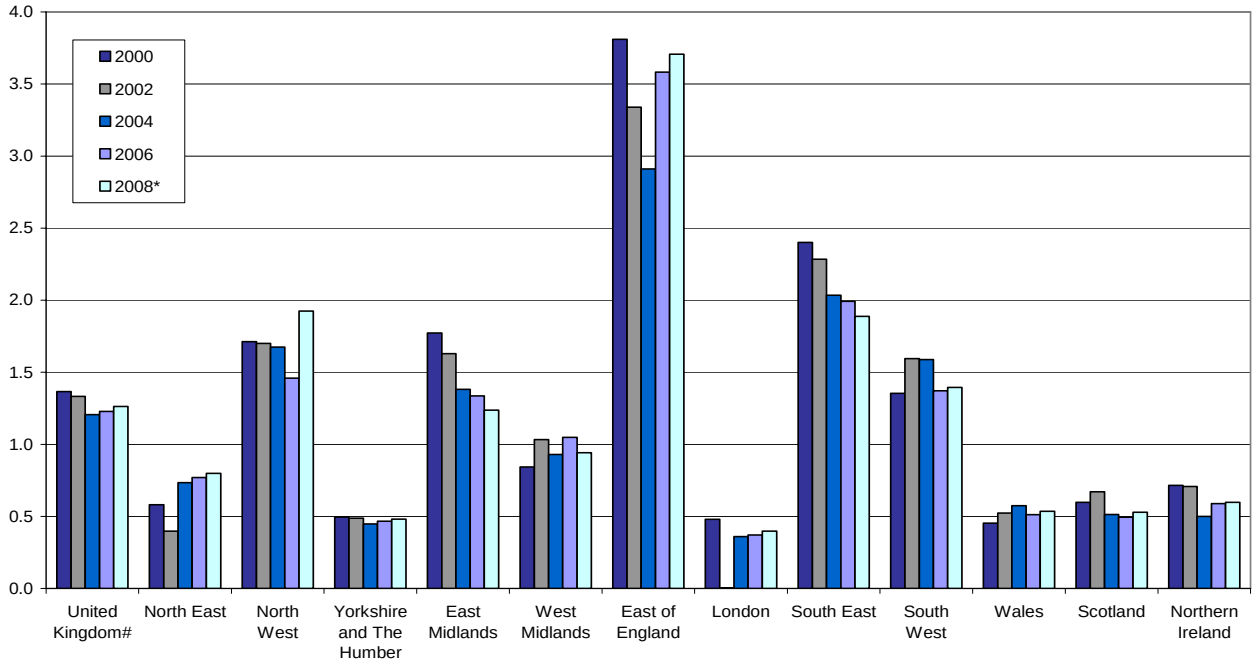
Figure 5 presents statistics on Business Enterprise Research and Development (BERD), which are consistent with internationally agreed standards. Figures for 2008 published on 11 December 2009 show business expenditure on R&D as a percentage of workplace–based GVA in 2000, 2002, 2004, 2006 and 2008. This is a measure commonly used in regional comparisons as it takes account of the size of regional economies. The figure shows that, since 2000, the East of England has been the region with by far the highest percentage of R&D expenditure in terms of GVA, with 3.7 per cent in 2008. The North West and the South East regions had the second highest

percentage (1.9 per cent) which has, however, been declining in the South East since 2000. These three regions together also accounted for 62 per cent of the total expenditure on R&D in 2008.

London had the lowest R&D expenditure as a share of its regional GVA in 2008 (0.4 per cent). Yorkshire and the Humber, Wales and Scotland had the second lowest shares in the UK in 2008, at 0.5 per cent each. London's very low share of expenditure on R&D does not necessarily suggest low levels of innovation but may be due to it having a large concentration of service industries, which may be less R&D intensive (within the OECD definition) if, for example, they rely heavily on human capital. It may also reflect the choice businesses make over locating their R&D activities.

Figure 5 Business expenditure on R&D as a percentage of workplace–based GVA: by NUTS1 region

Percentages



Notes

* Provisional

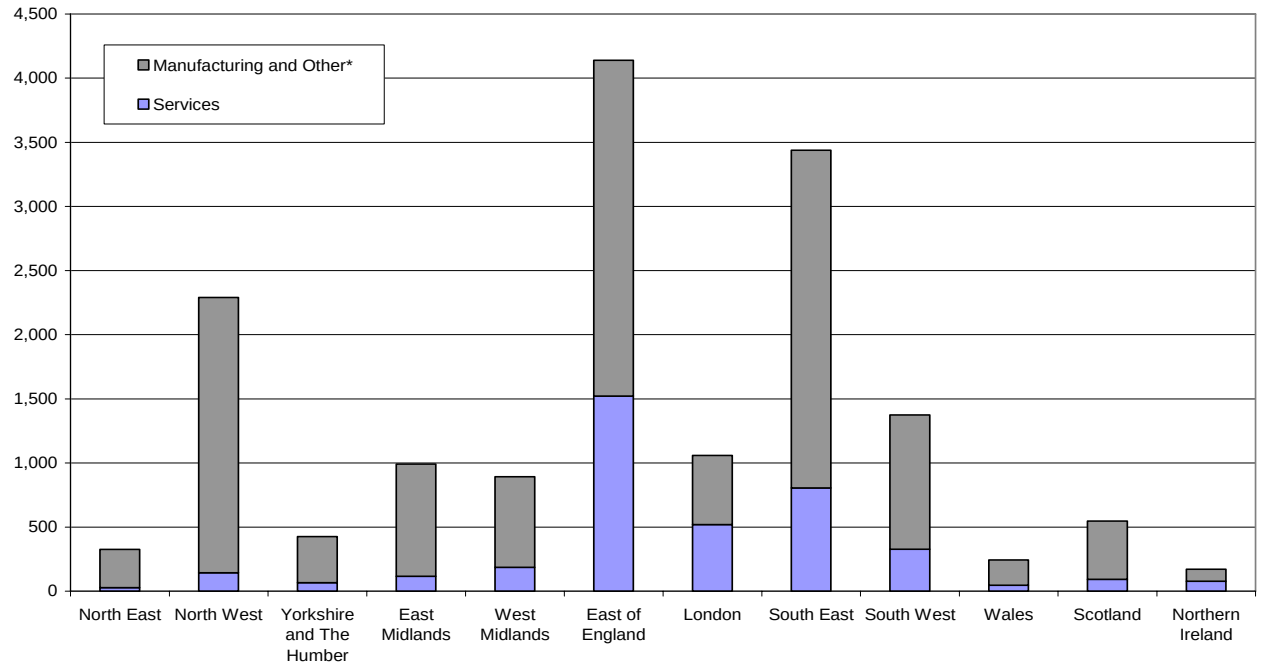
UK less Extra–region statistical discrepancy

Source: Regional Accounts and Business Enterprise Research & Development, Office for National Statistics

Approximately three–quarters of the R&D expenditure in the UK was made in the manufacturing sector in 2008. **Figure 6** shows that in most regions except in the Greater South East the share of the R&D expenditure on manufacturing was over 80 per cent of their respective expenditure. The figure also shows that East of England accounted for 26 per cent of the total R&D expenditure in the UK in 2008 and had the highest level of R&D expenditure on both manufacturing and services. This may suggest that some London R&D occurs in the surrounding regions such as Cambridge technology start–ups.

Figure 6 Business expenditure on R&D by NUTS1 region: broad industry groups, 2008

£ millions



Note

* Other includes agriculture, hunting and forestry, fishing, extractive industries, electricity, gas and water supply and construction. The expenditure on other industries across the UK was less than 2 per cent of the total expenditure.

Source: Business Enterprise Research & Development, Office for National Statistics

Enterprise

Enterprise is another driver of productivity. It is defined as the seizing of new business opportunities by both start–ups and existing firms. New enterprises can bring innovative processes and technologies to the market, forcing existing ones to improve their productivity in order to remain competitive. A relatively large proportion of enterprises joining and leaving the stock can be seen as desirable, as new enterprises entering the market are considered to bring innovative processes and technologies that drive up productivity and force unproductive enterprises to leave the market.

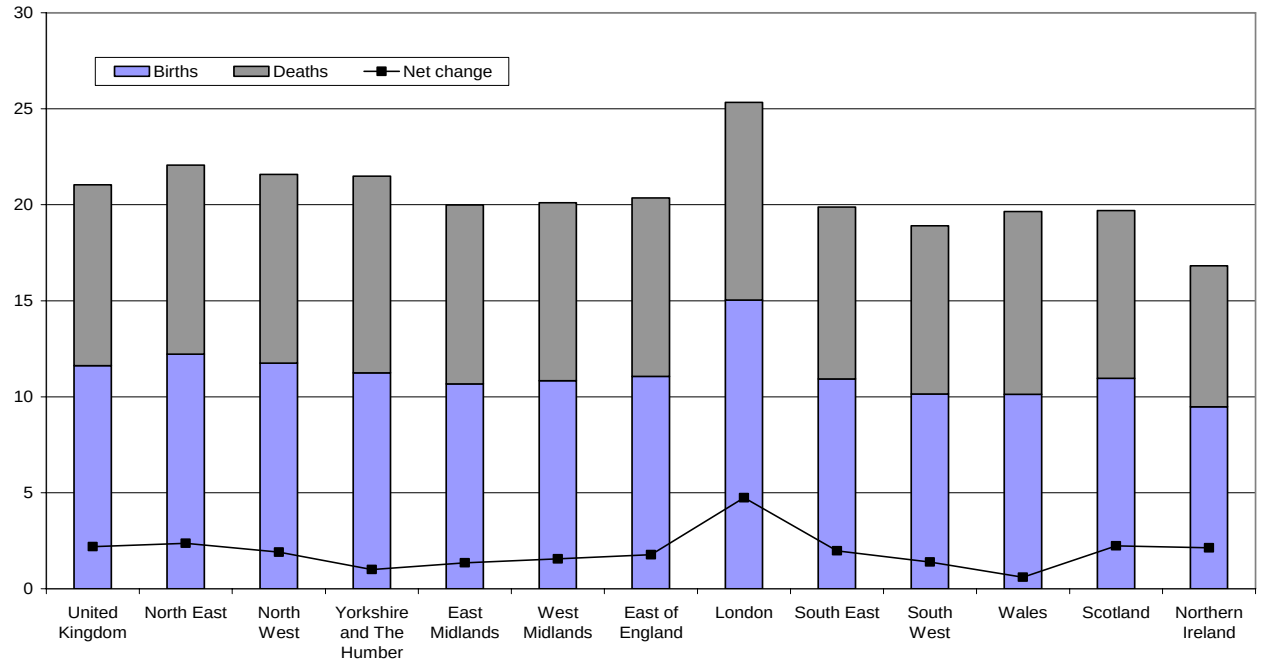
The February 2009 edition of this article focused on business demography in UK regions, using the newly published ONS series of enterprise births and deaths, which includes enterprises registered for VAT *and* also those registered for pay–as–you–earn (PAYE). It needs to be noted that enterprise statistics relate to the place of registration of the enterprise, even though the enterprise may consist of more than one local unit, possibly in different regions.

Figure 7 shows the number of births and deaths of enterprises as a proportion of the active enterprise stock in 2008. The difference between the two represents the net change, which is calculated as a proportion of total stock. In 2008, across all regions, the net changes were positive due to higher proportions of enterprises joining the stock than leaving it. These proportions were largest in London (4.7 per cent), followed by the North East (2.4 per cent). The lowest rate of net change was in Wales (0.6 per cent).

These rates were mainly driven by small enterprises with fewer than 5 employees which is approximately 80 percent of the total enterprise stock

Figure 7 Enterprise births, deaths and net change as a percentage of enterprise stock: by NUTS1 region, 2008[1]

Percentages



Note

1. Provisional

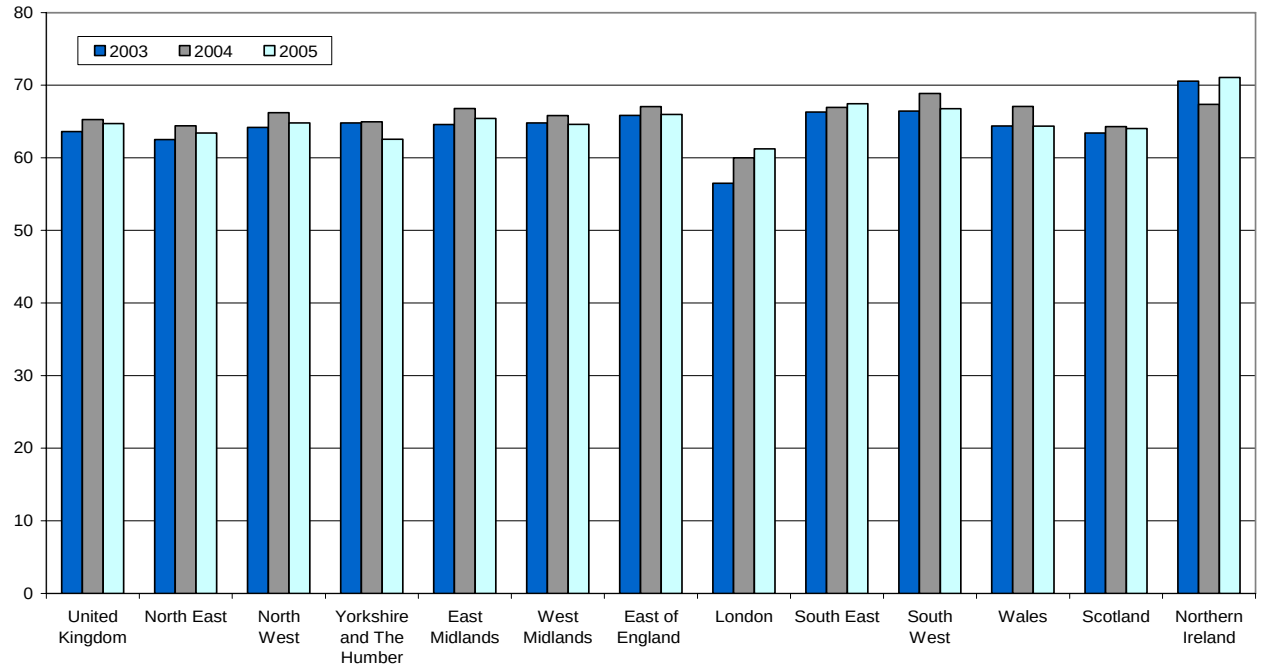
Source: Business Demography, Office for National Statistics

As well as analysing births and deaths of enterprises, it is useful to look at how long these enterprises survive. The Business Demography series contains data showing the number of years survived by enterprises born in the years 2003 to 2005.

Figure 8 shows the proportion of enterprises born in 2003, 2004 and 2005 that survived for at least three years each. It shows that, overall in the UK, survival rates increased from 63.6 per cent of enterprises born in 2003 to 65.3 per cent of those born in 2004 and went back down slightly to 64.7 per cent of those born in 2005.

Figure 8 Percentage of units surviving three years: by year of birth and NUTS1 region

Percentages



Source: Business Demography, Office for National Statistics

Patterns were similar across regions. In most regions enterprises born in 2004 had the highest three–year survival rates compared to 2003 and 2005. Northern Ireland had the highest three–year survival rates which were above the UK average for the enterprises born in all three years while London stands out as the region with the lowest rates. Figure 7 has shown that London had the highest percentage of births and deaths of enterprises and that survival rates were relatively low. They could be an indication of London's ability to exploit short–term business opportunities. At the same time, it may suggest that many of the new enterprises born will not provide long–term growth and employment.

Competition

Vigorous competition enhances productivity by creating incentives to innovate and ensure that resources are allocated to the most efficient firms. It also forces existing firms to organise work more effectively through imitations of organisational structures and technology. One indicator of competition is the volume of exports. Even though exports do not represent competition within a region, they still provide an indication of how international regions are in their outlook, and how able they are to face global competition.

HM Revenue & Customs (HMRC) publishes statistics on regional trade in goods to the EU and non–EU destinations by statistical value. Trade in goods by definition excludes trade in intangibles and services. The statistical value of export trade is calculated as the value of the goods plus the cost of movement to the country's border.

Table 5 presents the latest quarterly estimates up to the end of June 2010. The total value of UK goods exports to all destinations increased by 4.0 per cent between June 2009 and June 2010. The total value of goods exports increased in all the regions except in East Midlands (down by 9.1 per cent) and Wales and Northern Ireland (down by 15.6 and 14.3 per cent respectively). London had the largest percentage increase in the value of goods exports (up by 8.2 per cent), followed by West Midlands (up by 8.1 per cent) and East of England (up by 6.5 per cent) during the same period.

As the European Union (EU) is the main export destination for UK goods, the table separates exports to EU and non–EU destinations. In the UK as a whole, the value of exports to the EU was up by 2.6 per cent between June 2009 and June 2010. However, with the exception of London (up by 11.6 per cent), East of England (up by 9.4 per cent) and North East (up by 4.9 per cent), all the regions recorded decreases in the value of goods exports to the EU. Wales reported the largest drop, down by 9.0 per cent.

The total value of the UK exports to the rest of the world increased by 5.7 per cent from June 2009 to June 2010, with the highest increase occurring in the West Midlands (up by 20.8 per cent). The East Midlands, Wales and Northern Ireland were the only regions that had a decrease in the value of their goods exports to the rest of the world during the same period.

The number of exporters in the UK for the June 2010 quarter compared with the same quarter last year, decreased by 1.9 per cent to 49,719. Northern Ireland had the largest decrease of 7.3 per cent[1]. There were no regions where the number of exporters increased.

Figure 9 shows the value of exports of goods as a percentage of workplace–based regional GVA in 2000, 2004 and 2008, which takes account of the differing sizes of regional economies. In 2008, the value of goods exports relative to the size of the regional economy was greatest in the North East and lowest in London. It needs to be noted that these figures show exports of goods as a percentage of headline GVA which also includes services and therefore is likely to underestimate the export performance of some regions with a large share of services industries such as London.

In terms of this indicator's change over time, exports relative to GVA were lower in all the regions in 2004 than in 2000, with some recovery in 2008 except in East Midlands, London and Scotland. In Scotland, exports as a percentage of regional GVA dropped significantly between 2000 and 2004, but remained fairly stable over the four years to 2008. The North East had the largest increase in relative export performance, followed by Northern Ireland between 2004 and 2008.

Table 5 UK regional trade in goods – statistical value of exports: by NUTS1 region[1]

£ millions

Exports	United Kingdom	North East	North West	Yorkshire and The Humber	East Midlands	West Midlands	East of England	London	South East	South West	Wales	Scotland	Northern Ireland
EU Exports													
2008 Q3	35,737	1,620	3,282	1,913	2,012	2,138	3,222	2,853	5,102	1,700	1,647	1,534	871
2008 Q4	32,677	1,447	2,861	1,828	1,908	1,996	2,898	2,389	5,171	1,557	1,329	1,512	856
2009 Q1	31,225	1,334	3,094	1,611	1,907	1,797	2,824	2,445	4,911	1,671	1,188	1,331	791
2009 Q2	29,408	1,311	2,959	1,464	1,801	1,697	2,902	2,398	4,361	1,575	1,179	1,229	764
Total to June 2009	129,046	5,712	12,196	6,816	7,629	7,628	11,846	10,084	19,545	6,504	5,343	5,607	3,283
2009 Q3	30,365	1,352	2,901	1,473	1,703	1,642	2,951	2,818	4,557	1,453	1,163	1,342	720
2009 Q4	32,807	1,488	2,933	1,747	1,823	1,895	3,536	2,537	4,901	1,504	1,264	1,440	771
2010 Q12	34,561	1,530	2,829	1,798	1,789	1,889	3,274	3,023	4,844	1,644	1,149	1,229	735
2010 Q2[2]	34,675	1,623	2,996	1,750	1,698	1,956	3,203	2,878	4,672	1,642	1,287	1,478	769
Total to June 2010	132,408	5,993	11,658	6,768	7,013	7,382	12,964	11,256	18,975	6,243	4,863	5,489	2,996
Non-EU exports													
2008 Q3	28,265	1,357	2,936	1,707	1,914	2,142	2,267	3,577	5,173	1,373	1,312	2,103	623
2008 Q4	28,181	1,112	2,807	1,522	2,089	1,900	2,252	3,749	5,430	1,306	1,298	2,224	806
2009 Q1	22,909	977	2,766	1,260	1,958	1,209	1,893	2,711	4,090	1,149	1,074	1,978	510
2009 Q2	24,813	881	2,540	1,263	1,995	1,504	2,002	2,934	4,722	1,164	1,241	2,337	606
Total to June 2009	104,167	4,327	11,048	5,752	7,955	6,755	8,414	12,970	19,415	4,993	4,925	8,641	2,545

2009 Q3	25,050	1,014	3,383	1,365	1,751	1,588	1,954	2,883	4,654	1,078	933	2,502	454
2009 Q4	28,687	1,273	3,272	1,510	1,786	2,268	2,328	3,172	5,910	1,122	968	2,809	525
2010 Q12	26,292	1,014	2,722	1,364	1,701	1,914	1,985	3,934	5,134	1,697	894	1,874	442
2010 Q2[2]	30,051	1,345	3,209	1,795	1,913	2,391	2,337	3,710	5,734	1,842	1,009	2,318	564
Total to June 2010	110,079	4,646	12,586	6,034	7,151	8,161	8,605	13,698	21,431	5,739	3,803	9,504	1,985
	5.7%	7.4%	13.9%	4.9%	-10.1%	20.8%	2.3%	5.6%	10.4%	15.0%	-22.8%	10.0%	-22.0%
Total Exports													
2008 Q3	64,002	2,977	6,218	3,620	3,926	4,280	5,489	6,429	10,275	3,074	2,959	3,637	1,495
2008 Q4	60,857	2,560	5,667	3,351	3,997	3,897	5,150	6,138	10,601	2,863	2,627	3,736	1,661
2009 Q1	54,134	2,311	5,860	2,870	3,865	3,006	4,717	5,155	9,001	2,820	2,262	3,309	1,302
2009 Q2	54,221	2,191	5,499	2,727	3,796	3,200	4,904	5,331	9,084	2,740	2,420	3,566	1,370
Total to June 2009	233,214	10,039	23,244	12,568	15,584	14,384	20,260	23,054	38,960	11,497	10,268	14,248	5,828
2009 Q3	55,415	2,366	6,283	2,838	3,454	3,230	4,906	5,700	9,211	2,531	2,096	3,844	1,175
2009 Q4	61,494	2,761	6,205	3,258	3,610	4,162	5,864	5,709	10,812	2,626	2,232	4,249	1,296
2010 Q12	60,853	2,544	5,550	3,162	3,489	3,803	5,258	6,957	9,978	3,341	2,043	3,103	1,177
2010 Q2[2]	64,726	2,969	6,205	3,544	3,611	4,347	5,540	6,588	10,405	3,484	2,296	3,796	1,333
Total to June 2010	242,488	10,639	24,244	12,802	14,164	15,542	21,568	24,955	40,407	11,983	8,666	14,992	4,981

Notes

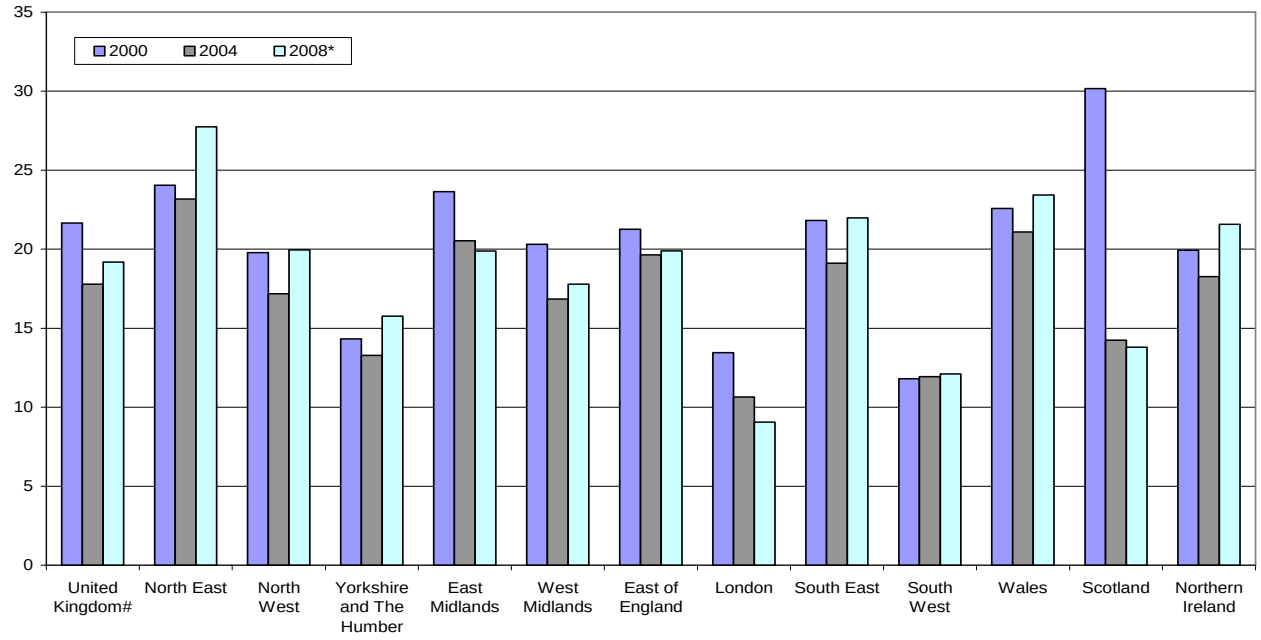
1 Components may not sum to totals as Regional Trade Statistics includes estimates made for EU trade below the Intrastat threshold which are included in the 'unknown' region and not displayed in this table.

2 Provisional

Source: Office for National Statistics

Figure 9 Value of total export goods as a percentage of workplace–based GVA: by NUTS1 region

Percentages



* Provisional

UK less Extra–region statistical discrepancy

Source: HM Revenue and Customs, Regional Trade Statistics, Office for National Statistics

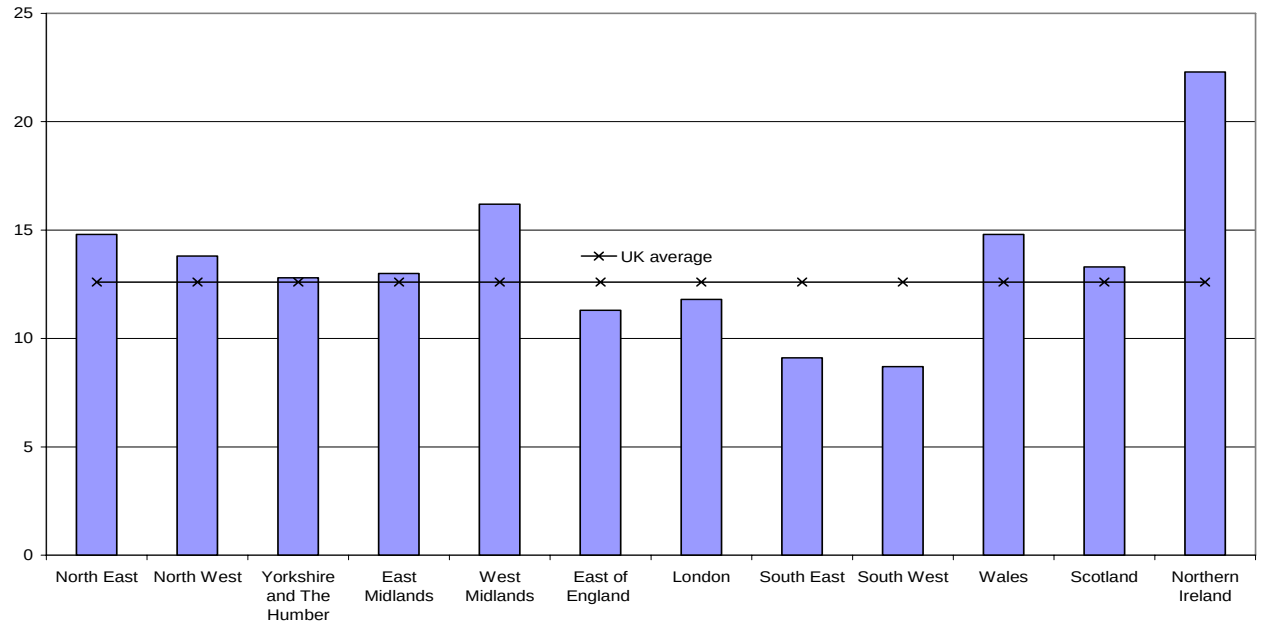
Skills

The skills of workers influence productivity as they define the capabilities that the labour force can contribute to the production process. The concept of skills includes attributes of the workforce, such as 'softer' or interpersonal skills, which are difficult to measure or to compare in different situations or over time. Therefore, qualifications are often used as proxy indicators. By examining the qualifications, such as degree or equivalent, of the current workforce as well as those of young people, who represent the future capabilities of the labour market, a view of how skills are changing over time and their potential impact on productivity can be analysed. However, as characteristics of local economies dictate which labour skills are required, comparability between regions might be difficult. An alternative approach is to compare the percentage of the working–age population that has no recognised qualifications.

Figure 10 shows the proportion of the working–age population in 2009 that had no qualifications in each region. Compared to the UK average of 12.6 per cent, Northern Ireland had the highest proportion of the population with no qualifications (9.7 percentage points above the UK average); whereas the South West and the South East had the lowest proportions, 3.9 and 3.5 percentage points below the UK average, respectively.

Figure 10 Working–age population with no qualifications: by NUTS1 region, 2009[1]

Percentages



Note

1 For summary of qualifications and equivalents see www.statistics.gov.uk/statbase/Product.asp?vlnk=836.

Source: Labour Force Survey, Office for National Statistics

Above average proportions of working-age people without a qualification do not necessarily mean that regions have the most unqualified workforce. Due to differing regional skill requirements, people with recognised qualifications might migrate into other regions, where demand for their qualifications is high, while those without any recognised qualifications might migrate out of these other regions. Also, if employers have a strong demand for lower skills and a good supply of appropriate workers, a low skill equilibrium is created in a region.

Regional Skills Partnerships (RSPs) are groups brought together by Regional Development Agencies in each region of England in response to the National Skills Strategy. RSPs aim to strengthen regional structures to make skills provision more relevant to the needs of employers and individuals, covering private, public and voluntary sectors of the economy. They also aim to give regions the flexibility to tackle their own individual challenges and priorities.

Table 6 presents the RSP core indicators, which help to monitor the health of regional and local labour markets and progress towards national skills targets such as those documented in the Leitch Report. These core indicators will be supported by local, more specific, indicators identified by individual RSPs. The choice of '19 to 64 year olds' for some of the indicators in Table 6 has been influenced by: the increased emphasis on education and training after the age of 16; the plan

to raise the standard school leaving age to 18; and alignment with indicators specified in the Local Area Agreements.

Table 6 Regional Skills Partnerships core indicators: by NUTS1 region

Percentages

Skills outcome indicators	Time period	North East	North West	Yorkshire and The Humber	East Midlands	West Midlands	East of England	London	South East	South West	England
Percentage of employers with business or training plan, or budget for training	2007	70.6	69.2	69.6	67.9	67.5	67.3	70.0	70.6	68.4	69.1
Percentage of staff with skill gaps	2007	6.3	5.3	4.8	6.8	5.4	7.8	6.7	5.8	6.2	6.1
Skill shortage vacancies (SSVI) as percentage of all vacancies	2007	18.8	17.6	20.1	20.2	15.5	19.6	26.1	22.5	20.9	20.9
Percentage of KS4 pupils achieving 5+ A* to C GCSE (inc Maths and English)	2008/09	48.1	49.9	47.3	49.9	48.5	51.9	54.0	53.7	51.8	49.8
Percentage of 19 year olds qualified to Level 2 or above[1]	2008	75.9	74.3	73.2	73.1	74.9	77.0	77.0	79.6	77.0	76.7
Percentage of 19 year olds qualified to Level 3 or above[1]	2008	43.7	46.1	44.4	46.0	46.9	52.4	51.9	56.9	51.0	49.8
Percentage of 19 to 64 year olds with Level 2+	2009	67.6	68.4	67.9	68.2	65.2	68.6	71.5	73.4	72.7	69.7
Percentage of 19 to 64 year olds with Level 3+	2009	45.5	47.6	47.8	47.6	44.7	47.6	55.6	53.6	51.7	49.9
Percentage of 19 to 64 year olds with Level 4+	2009	25.4	28.7	28.2	27.3	26.4	29.0	41.7	34.7	30.9	31.4
Percentage of 19 to 64 year olds with no qualifications	2009	14.4	13.6	12.6	12.7	15.9	11.0	11.4	8.6	8.2	11.7
Percentage of working-age population who undertook job-related training in last 13 weeks	2008	20.9	18.9	19.4	20.2	19.4	18.7	18.2	22.2	23.1	20.0
Percentage of 17 year olds in education or work-based learning	2008	80.0	80.0	76.0	77.0	80.0	79.0	89.0	79.0	79.0	80.0

Note

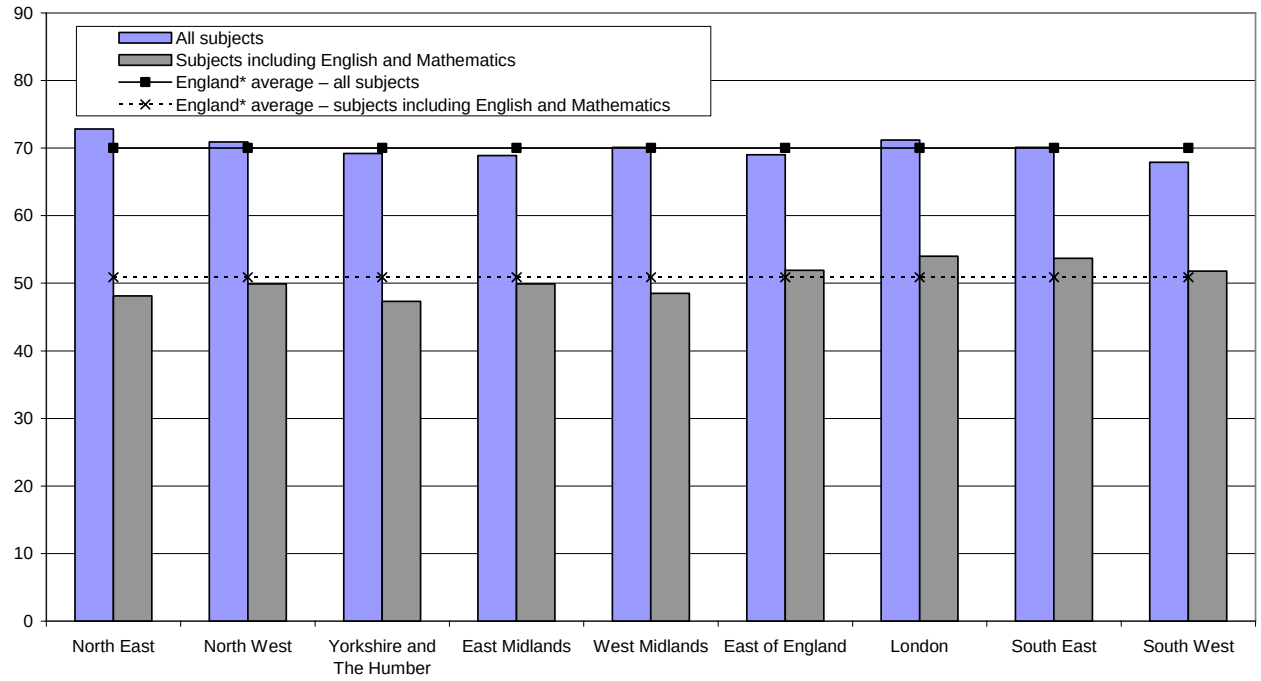
1 Provisional data from DCSF matched datasets.

Source: Office for National Statistics; Labour Force Survey; Department of Business Enterprise and Regulatory Reform; Department for Children, Schools and Families; Department for Innovation Universities and Skills; National Employers Skills Survey 2007.

In order to assess the future capabilities of the labour force, the percentage of pupils achieving five or more grades A* to C at GCSE level or equivalent in each English region can be used as an indicator[2]. Recent focus on literacy and numeracy has led to a new measure being published, of five or more GCSEs grade A* to C in subjects including English and Mathematics. **Figure 11** shows the percentage of pupils achieving at least five grades A* to C at GCSE level or equivalent in any subjects, and in subjects including English and Mathematics. In 2008/2009, the England average for pupils in all schools achieving five or more grades A* to C in any subjects was 70.0 per cent, while it was down to 50.9 per cent if the subjects included English and Mathematics. These were increases of 4.7 and 3.3 percentage points from 2007/08, respectively. Across all English regions, the percentage of pupils achieving at least five grades A* to C in subjects including English and Mathematics was substantially lower compared with achieving the same in any subjects. Also, regional differences were more pronounced when subjects included English and Mathematics.

Figure 11 Pupils achieving five or more grades A* to C at GCSE level or equivalent in (i) all subjects and (ii) subjects including English and Mathematics: by NUTS1 region, 2008/09[1,2]

Percentages



Notes:

1 Revised data, includes attempts and achievements by these pupils in previous academic years.

2 The England average includes all schools, not only local authority maintained schools.

Source: Department for Children, Schools and Families

In the North East the percentage of pupils achieving five or more grades A* to C in any subjects was 2.8 percentage points above the England average, but the percentage dropped 2.8 points below the average when the subjects included English and Mathematics. The opposite held for the South West and the East of England, where the proportion of pupils achieving at least five grades A* to C increased above the England average if the subjects included English and Mathematics while it dropped below national average for achieving five or more grades A* to C in any subject. London and South East were the only two regions which performed above national average on both measures.

Investment

Investment in physical capital, such as machinery, equipment and buildings, enables workers to produce more and higher quality output. Therefore, investment can have a significant positive impact on productivity. Due to quality concerns regarding the regional allocations of investment, which is recorded at the level of the enterprise and not at the local level, this article does not currently include data on investment.

Nevertheless, as Dunnell (2009) has pointed out, inflows of foreign direct investment (FDI) projects and estimated numbers of associated jobs by region can serve as a narrow indicator of investment. However, FDI does not cover all investment in a region and there is no requirement to notify UK Trade & Investment when undertaking FDI.

The labour market

Table 7 shows the seasonally adjusted employment rate, the number of people aged from 16 to 64 in employment, expressed as a proportion of their population, from the Labour Force Survey (LFS).

In quarter two (April to June) of 2010, the UK employment rate was 70.5 per cent, down 0.3 percentage points from a year ago and up 0.3 percentage points from quarter one (January to March) of 2010. Regional rates varied from 74.6 per cent in the South East to 66.4 per cent in Northern Ireland.

Six out of the twelve UK regions experienced annual falls in the employment rate, the largest of which was in the East Midlands at 2.1 percentage points followed by Scotland at 1.9 percentage points. The North East and Northern Ireland increased by 2.6 and 2.4 percentage points respectively.

Table 7 Employment[1] rates for persons of working age: by NUTS1 region

Per cent, seasonally adjusted

		United Kingdom	North East	North West	Yorkshire and the Humber	East Midlands	West Midlands	East of England	London	South East	South West	England	Wales	Scotland	Northern Ireland
2007	Apr-Jun	72.6	69.7	70.8	71.2	73.7	70.8	75.2	68.9	76.9	75.9	72.7	69.9	74.9	68.8
	Jul-Sep	72.7	69.7	70.5	71.2	73.5	71.3	75.2	69.8	77.1	76.2	72.9	69.4	74.1	68.0
	Oct-Dec	72.9	69.6	70.9	71.8	73.3	71.4	76.0	69.4	77.2	77.0	73.1	69.4	74.2	67.9
2008	Jan-Mar	73.0	68.3	70.2	72.1	74.2	71.4	75.5	70.3	77.6	76.7	73.2	69.6	74.3	68.1
	Apr-Jun	72.9	68.4	70.1	71.4	73.5	70.6	75.6	70.8	77.7	76.5	73.1	70.1	74.3	68.6
	Jul-Sep	72.5	68.2	69.8	71.4	73.7	70.0	75.3	70.1	77.0	76.5	72.7	68.4	73.9	68.0
	Oct-Dec	72.2	68.0	69.3	70.4	73.8	69.7	75.5	70.4	76.5	76.0	72.4	68.6	73.3	66.6
2009	Jan-Mar	71.7	67.7	69.6	69.6	73.4	68.5	75.6	69.2	76.0	75.6	71.9	68.6	73.2	64.8
	Apr-Jun	70.9	65.2	69.1	69.1	73.2	68.4	74.9	67.9	75.4	74.4	71.1	67.7	72.1	64.0
	Jul-Sep	70.7	66.1	68.9	69.2	72.8	68.3	74.9	67.9	74.9	73.5	71.0	67.1	71.8	64.3
	Oct-Dec	70.5	67.0	68.4	68.8	72.2	68.8	73.8	67.9	75.1	73.4	70.8	67.0	71.5	65.5
2010	Jan-Mar	70.3	66.9	68.9	68.9	71.1	68.8	73.4	67.5	74.9	73.0	70.6	66.8	70.0	65.9
	Apr-Jun	70.5	67.8	69.1	69.7	71.0	69.3	73.4	68.0	74.6	73.8	70.9	66.7	70.2	66.4

Note

1 Includes employees, self-employed, participants on government-supported training schemes and unpaid family workers.

Source: Labour Force Survey, Office for National Statistics

Table 8 shows the unemployment rate (according to the internationally–consistent International Labour Organisation definition) for persons aged 16 and over from the LFS. The UK rate in the second quarter of 2010 was 7.8 per cent, unchanged from a year ago and down 0.2 percentage points from the last quarter. Regionally, the rates ranged from 9.4 per cent in the North East to 6.1 per cent in both the South East and South West.

Over the year the unemployment rate rose in eight of the twelve regions. Scotland had the largest increase at 1.3 percentage points followed by Wales at 1.2 percentage points. The West Midlands had the largest decrease at 2.4 percentage points followed by the North East and North West which both decreased by 0.5 percentage points.

Table 9 shows economic inactivity rates for persons aged from 16 to 64 from the LFS. The UK rate in the second quarter of 2010 was 23.4 per cent, down 0.2 percentage points from the previous quarter and up 0.3 percentage points on a year earlier. Across the regions, rates varied from 20.5 per cent in the South East to 28.8 per cent in Northern Ireland.

Compared with a year earlier, four regions had a decrease in the inactivity rate, and thus a corresponding increase in the activity rate. Northern Ireland and the North East both had the largest annual fall of 2.6 percentage points. Seven regions had an increase in the economic inactivity rate over the year. The largest annual rise was in the East Midlands at 2.2 percentage points. Wales' rate was unchanged on the year.

Table 10 shows the number of employee jobs, not seasonally adjusted, from the Employers Surveys. The number of UK workforce jobs in June 2010 was 30,801,000 a decrease of 196,000 over the year since. In percentage terms, this was a 0.2 per cent decrease.

There were annual increases in three regions. The largest percentage increase was in the East Midlands (0.5 per cent) whilst the largest percentage decrease was in the West Midlands (2.1 per cent).

Table 11 shows the claimant count rate (referring to people claiming Jobseeker's Allowance benefits as a proportion of the workforce). The UK rate was 4.5 per cent in September 2010, unchanged from August 2010, and down 0.4 percentage points on a year earlier. This national rate masks large variations between regions and component countries of the UK. For September 2010, the North East had the highest claimant count rate in the UK at 6.7 per cent. The North East was followed by Northern Ireland (6.5 per cent) and the West Midlands (5.8 per cent). The lowest claimant count was measured in both the South East and South West at 3.0 per cent. The claimant count rate was 4.8 per cent in Scotland, 4.4 per cent in England and 5.1 per cent in Wales.

Northern Ireland (up by 0.5 per cent) is the only region showing a percentage increase in the claimant count rate compared with a year ago. The largest decrease was in the West Midlands at 0.9 percentage points.

Table 8 Unemployment rates for persons aged 16 and over: by NUTS1 region

Per cent, seasonally adjusted

		United Kingdom	North East	North West	Yorkshire and the Humber	East Midlands	West Midlands	East of England	London	South East	South West	England	Wales	Scotland	Northern Ireland
2007	Apr-Jun	5.4	6.4	5.9	5.5	5.0	6.6	4.6	7.2	4.2	4.0	5.5	5.8	4.6	3.6
	Jul-Sep	5.3	6.2	6.0	5.4	5.7	6.4	5.1	6.1	4.6	3.9	5.4	5.2	5.0	3.9
	Oct-Dec	5.2	5.7	5.8	5.4	5.3	5.9	4.4	6.7	4.4	3.7	5.3	5.1	4.9	4.3
2008	Jan-Mar	5.2	6.5	6.0	5.0	5.4	6.2	4.5	6.8	3.9	3.7	5.3	5.2	4.7	4.5
	Apr-Jun	5.3	7.5	6.4	6.1	5.6	6.2	4.6	6.7	4.1	3.8	5.5	5.2	4.2	3.9
	Jul-Sep	5.9	8.2	6.7	6.8	5.8	6.6	4.8	7.3	4.7	4.2	6.0	6.6	4.8	4.2
	Oct-Dec	6.4	8.4	7.8	6.7	6.3	8.0	5.5	7.3	5.0	4.8	6.5	7.1	5.3	5.3
2009	Jan-Mar	7.1	8.2	7.9	8.0	7.1	9.3	6.0	8.2	5.3	5.9	7.2	7.6	5.9	6.2
	Apr-Jun	7.8	9.9	8.6	8.9	7.3	10.6	6.4	8.9	5.8	6.4	7.9	7.8	7.0	6.5
	Jul-Sep	7.9	9.6	8.6	8.7	7.4	10.0	6.4	9.1	6.2	6.5	7.9	8.8	7.3	7.1
	Oct-Dec	7.8	9.2	8.5	9.1	7.2	9.3	6.5	9.2	6.2	6.4	7.8	8.6	7.6	6.0
2010	Jan-Mar	8.0	9.4	8.6	9.7	7.3	9.3	6.6	9.1	6.3	6.2	7.9	9.3	8.1	6.8
	Apr-Jun	7.8	9.4	8.1	9.1	7.4	8.3	6.8	9.3	6.1	6.1	7.7	9.0	8.4	6.6

Source: Labour Force Survey

Table 9 Economic inactivity rates for persons of working age: by NUTS1 region

Per cent, seasonally adjusted

		United Kingdom	North East	North West	Yorkshire and the Humber	East Midlands	West Midlands	East of England	London	South East	South West	England	Wales	Scotland	Northern Ireland
2007	Apr-Jun	23.2	25.7	24.8	24.7	22.4	24.1	21.1	25.7	19.7	20.9	23.1	25.8	21.5	28.6
	Jul-Sep	23.2	25.6	25.0	24.7	22.0	23.7	20.7	25.7	19.1	20.6	22.9	26.7	22.0	29.2
	Oct-Dec	23.1	26.1	24.6	24.0	22.5	24.1	20.4	25.5	19.2	20.0	22.8	26.9	22.0	29.0
2008	Jan-Mar	23.0	26.9	25.2	24.0	21.5	23.7	20.8	24.5	19.3	20.4	22.7	26.6	22.1	28.6
	Apr-Jun	22.9	26.0	25.0	24.0	22.1	24.6	20.7	24.0	19.0	20.4	22.6	25.9	22.4	28.5
	Jul-Sep	23.0	25.6	25.1	23.3	21.6	25.0	20.8	24.3	19.2	20.1	22.6	26.7	22.4	29.1
	Oct-Dec	22.8	25.7	24.7	24.5	21.2	24.2	20.0	23.9	19.5	20.2	22.5	26.0	22.5	29.6
2009	Jan-Mar	22.8	26.1	24.3	24.2	20.9	24.3	19.5	24.5	19.6	19.6	22.4	25.7	22.1	30.8
	Apr-Jun	23.1	27.6	24.4	24.1	21.0	23.3	19.8	25.4	19.9	20.5	22.7	26.5	22.4	31.4
	Jul-Sep	23.2	26.8	24.6	24.1	21.4	23.9	19.9	25.3	20.1	21.3	22.9	26.3	22.5	30.6
	Oct-Dec	23.4	26.1	25.1	24.2	22.1	24.0	21.0	25.2	19.9	21.5	23.1	26.5	22.5	30.2
2010	Jan-Mar	23.5	26.1	24.4	23.5	23.2	24.1	21.3	25.6	20.0	22.0	23.2	26.2	23.6	29.1
	Apr-Jun	23.4	25.0	24.7	23.1	23.2	24.3	21.2	25.0	20.5	21.3	23.0	26.5	23.2	28.8

Source: Labour Force Survey

Table 10 Employee jobs[1]: by NUTS1 region

Thousands, not seasonally adjusted

	United Kingdom	North East	North West	Yorkshire and the Humber	East Midlands	West Midlands	East of England	London	South East	South West	England	Wales	Scotland	Northern Ireland
Jun 08	31,780	1,166	3,427	2,543	2,169	2,684	2,818	4,809	4,431	2,690	26,737	1,400	2,739	878
Jun 09	30,997	1,174	3,355	2,485	2,092	2,610	2,803	4,788	4,280	2,649	26,236	1,350	2,545	840
Sep 09	30,873	1,173	3,331	2,490	2,120	2,591	2,790	4,709	4,281	2,632	26,117	1,341	2,556	832
Dec 09	30,753	1,168	3,320	2,474	2,105	2,570	2,812	4,680	4,266	2,611	26,006	1,346	2,539	835
Mar 10	30,730	1,164	3,305	2,484	2,099	2,557	2,803	4,684	4,267	2,610	25,973	1,372	2,518	841
Jun 10	30,801	1,162	3,311	2,486	2,102	2,556	2,810	4,751	4,264	2,612	26,054	1,341	2,539	836

Notes

1. Employee jobs are a measure of jobs rather than people. For example, if a person holds two jobs, each job will be counted in the Employee Jobs total. Employee Jobs figures come from quarterly surveys of employers carried out by ONS and administrative sources.

Source: Employer Surveys

Table 11 Claimant count rates[1]: by NUTS1 region

Per cent, seasonally adjusted

		United Kingdom	North East	North West	Yorkshire and the Humber	East Midlands	West Midlands	East of England	London	South East	South West	England	Wales	Scotland	Northern Ireland
2009	Sep	5.0	7.1	5.7	6.0	5.1	6.7	4.2	4.6	3.6	3.5	4.9	5.7	4.8	6.0
	Oct	5.0	7.2	5.7	6.1	5.2	6.7	4.2	4.7	3.6	3.5	5.0	5.7	4.8	6.0
	Nov	5.0	7.1	5.7	6.1	5.1	6.6	4.2	4.7	3.6	3.5	4.9	5.7	4.9	6.0
	Dec	4.9	7.1	5.6	6.0	5.1	6.5	4.1	4.6	3.5	3.4	4.9	5.6	4.9	6.1
2010	Jan	5.0	7.2	5.7	6.1	5.1	6.5	4.2	4.7	3.5	3.4	4.9	5.6	5.0	6.2
	Feb	4.9	7.0	5.5	5.9	4.9	6.3	4.0	4.6	3.4	3.3	4.8	5.5	4.9	6.2
	Mar	4.8	6.8	5.3	5.8	4.8	6.2	4.0	4.5	3.3	3.2	4.7	5.4	4.9	6.2
	Apr	4.7	6.7	5.2	5.7	4.7	6.0	3.9	4.5	3.2	3.1	4.6	5.2	4.8	6.2
	May	4.6	6.5	5.1	5.6	4.5	5.9	3.8	4.4	3.1	3.0	4.5	5.1	4.8	6.2
	Jun	4.5	6.6	5.1	5.5	4.5	5.8	3.7	4.4	3.0	3.0	4.4	5.0	4.8	6.3
	Jul	4.5	6.6	5.1	5.5	4.5	5.8	3.7	4.4	3.0	2.9	4.4	5.0	4.9	6.4
	Aug	4.5	6.6	5.1	5.5	4.4	5.8	3.7	4.4	3.0	3.0	4.4	5.1	4.9	6.5
	Sep	4.5	6.7	5.1	5.5	4.5	5.8	3.8	4.4	3.0	3.0	4.4	5.1	4.8	6.5

Note

1. Count of claimants of Jobseeker's Allowance expressed as a percentage of the total workforce – workforce jobs plus claimants.

Source: Jobcentre Plus administrative system.

Notes

1 UK Regional Trade in Goods Statistics, Quarter 2 2010, HM Revenue and Customs at www.uktradeinfo.com/index.cfm?task=td_regstats_press

2 For a summary of all different levels of qualifications see ‘Notes and definitions’ at www.statistics.gov.uk/statbase/product.asp?vlnk=836

Contact

elmr@ons.gsi.gov.uk

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Appendix

Table A1 Shift–share decomposition of the change in workplace–based gross value[1] added at current prices between 1995 and 2007: by NUTS1[2], NUTS2[3] and NUTS3[4] regions

Table Note

	National Share (NS)	Industry Mix (IM)	Regional Shift (RS)	Total change (per cent)
NUTS Level 1				
NUTS Level 2				
NUTS Level 3				
North East	**89.8**	**-8.5**	**-14.4**	**66.9**
Tees Valley and Durham	*89.8*	*-13.8*	*-22.7*	*53.4*
Hartlepool and Stockton-on-Tees	89.8	-19.9	-27.4	42.6
South Teesside	89.8	-5.8	-26.7	57.2
Darlington	89.8	-1.6	-16.1	72.1
Durham CC	89.8	-16.8	-19.2	53.8
Northumberland and Tyne and Wear	*89.8*	*-4.5*	*-6.3*	*79.1*
Northumberland	89.8	-16.7	-28.4	44.8
Tyneside	89.8	3.2	-5.3	87.7
Sunderland	89.8	-13.6	10.8	87.0
North West	**89.8**	**-6.0**	**-11.3**	**72.5**
Cumbria	*89.8*	*-20.4*	*-15.3*	*54.1*
West Cumbria	89.8	-31.8	-15.2	42.9
East Cumbria	89.8	-12.0	-14.1	63.6
Cheshire	*89.8*	*-10.2*	*-2.6*	*77.0*
Halton and Warrington	89.8	-6.0	0.0	83.8
Cheshire CC	89.8	-13.0	-2.9	73.9
Greater Manchester	*89.8*	*0.0*	*-11.5*	*78.3*

Greater Manchester South	89.8	7.0	0.2	97.0
Greater Manchester North	89.8	-10.7	-30.3	48.8
Lancashire	*89.8*	*-13.9*	*-16.4*	*59.5*
Blackburn with Darwen	89.8	-21.5	-25.3	43.0
Blackpool	89.8	1.4	-55.6	35.6
Lancashire CC	89.8	-15.1	-10.3	64.4
Merseyside	*89.8*	*0.5*	*-19.5*	*70.8*
East Merseyside	89.8	-14.2	3.1	78.8
Liverpool	89.8	6.7	-14.6	81.9
Sefton	89.8	6.5	-48.3	48.0
Wirral	89.8	-2.7	-25.9	61.2
Yorkshire and The Humber	**89.8**	**-7.0**	**-5.5**	**77.3**
East Yorkshire and North Lincolnshire	*89.8*	*-16.9*	*-16.4*	*56.5*
Kingston upon Hull, City of	89.8	-8.2	-28.0	53.6
East Riding of Yorkshire	89.8	-19.1	-9.4	61.3
North and North East Lincolnshire	89.8	-19.5	-15.3	55.0
North Yorkshire	*89.8*	*-5.9*	*1.1*	*85.0*
York	89.8	1.9	-2.3	89.5
North Yorkshire CC	89.8	-10.7	4.2	83.3
South Yorkshire	*89.8*	*-6.1*	*5.3*	*89.1*
Barnsley, Doncaster and Rotherham	89.8	-9.6	12.6	92.8
Sheffield	89.8	0.2	-4.9	85.1
West Yorkshire	*89.8*	*-4.2*	*-9.2*	*76.4*
Bradford	89.8	-9.4	-15.0	65.4
Leeds	89.8	3.4	-5.4	87.8
Calderdale, Kirklees and Wakefield	89.8	-10.5	-9.3	70.0
East Midlands	**89.8**	**-12.0**	**7.0**	**84.8**
Derbyshire and Nottinghamshire	*89.8*	*-13.8*	*2.1*	*78.1*
Derby	89.8	-15.8	37.0	111.0
East Derbyshire	89.8	-11.1	10.4	89.1

South and West Derbyshire	89.8	-23.9	-17.1	48.8
Nottingham	89.8	3.2	-22.4	70.6
North Nottinghamshire	89.8	-22.1	20.8	88.5
South Nottinghamshire	89.8	-9.7	9.9	90.0
Leicestershire, Rutland and Northamptonshire	*89.8*	*-8.5*	*13.4*	*94.7*
Leicester	89.8	-6.3	-20.5	62.9
Leicestershire CC and Rutland	89.8	-15.1	13.6	88.3
Northamptonshire	89.8	-3.3	34.0	120.5
Lincolnshire	*89.8*	*-15.8*	*-3.9*	*70.1*
West Midlands	**89.8**	**-8.5**	**-11.9**	**69.5**
Herefordshire, Worcestershire and Warwickshire	*89.8*	*-7.7*	*2.4*	*84.5*
Herefordshire County of	89.8	-22.5	4.7	72.1
Worcestershire	89.8	-7.4	-12.4	70.0
Warwickshire	89.8	-4.6	17.4	102.6
Shropshire and Staffordshire	*89.8*	*-12.1*	*-3.5*	*74.2*
Telford and Wrekin	89.8	-20.7	2.1	71.1
Shropshire CC	89.8	-8.5	-10.1	71.2
Stoke-on-Trent	89.8	-15.4	-39.5	34.9
Staffordshire CC	89.8	-9.7	11.8	91.9
West Midlands	*89.8*	*-7.0*	*-19.0*	*63.8*
Birmingham	89.8	2.9	-18.1	74.6
Solihull	89.8	10.0	15.9	115.7
Coventry	89.8	-16.8	-13.2	59.8
Dudley and Sandwell	89.8	-14.8	-32.9	42.1
Walsall and Wolverhampton	89.8	-19.8	-22.2	47.8
East of England	**89.8**	**-2.0**	**9.5**	**97.3**
East Anglia	*89.8*	*-5.4*	*10.3*	*94.7*
Peterborough	89.8	2.9	40.9	133.6
Cambridgeshire CC	89.8	-0.1	29.4	119.1
Norfolk	89.8	-6.2	-1.5	82.0
Suffolk	89.8	-11.4	-1.5	76.9

Bedfordshire and Hertfordshire	*89.8*	*2.1*	*8.2*	*100.1*
Luton	89.8	-12.3	16.4	93.9
Bedfordshire CC	89.8	-4.6	-11.6	73.6
Hertfordshire	89.8	7.1	13.3	110.1
Essex	*89.8*	*1.1*	*5.0*	*95.9*
Southend-on-Sea	89.8	13.2	-27.5	75.5
Thurrock	89.8	-23.3	1.4	67.9
Essex CC	89.8	2.4	9.5	101.7
London	**89.8**	**20.0**	**7.7**	**117.5**
Inner London	*89.8*	*27.2*	*20.8*	*137.8*
Inner London - West	89.8	32.7	14.2	136.7
Inner London - East	89.8	15.2	34.8	139.9
Outer London	*89.8*	*6.7*	*-9.8*	*86.7*
Outer London - East and North East	89.8	2.7	-20.1	72.4
Outer London - South	89.8	10.9	-24.0	76.6
Outer London -West and North West	89.8	8.3	3.7	101.8
South East	**89.8**	**4.6**	**8.1**	**102.5**
Berkshire, Buckinghamshire and Oxfordshire	*89.8*	*5.4*	*13.7*	*108.9*
Berkshire	89.8	7.3	32.5	129.6
Milton Keynes	89.8	5.1	32.8	127.7
Buckinghamshire CC	89.8	4.1	-17.9	76.0
Oxfordshire	89.8	2.6	4.6	97.0
Surrey, East and West Sussex	*89.8*	*12.3*	*-6.3*	*95.8*
Brighton and Hove	89.8	16.4	-16.9	89.3
East Sussex CC	89.8	5.0	-22.0	72.8
Surrey	89.8	16.4	9.8	116.0
West Sussex	89.8	6.0	-15.9	79.9
Hampshire and Isle of Wight	*89.8*	*1.2*	*20.8*	*111.8*
Portsmouth	89.8	1.3	22.4	113.5
Southampton	89.8	6.8	-19.7	76.9

Hampshire CC	89.8	1.8	29.4	121.0
Isle of Wight	89.8	-1.4	5.8	94.2
Kent	*89.8*	*-3.6*	*-3.2*	*83.0*
Medway	89.8	-1.7	-6.1	82.1
Kent CC	89.8	-3.6	-3.2	83.0
South West	**89.8**	**-0.9**	**4.9**	**93.8**
Gloucestershire, Wiltshire and North Somerset	*89.8*	*1.6*	*11.6*	*103.0*
Bristol City of	89.8	20.6	-14.4	96.0
North and North East Somerset, South Gloucestershire	89.8	-2.7	36.9	124.1
Gloucestershire	89.8	-2.1	9.5	97.3
Swindon	89.8	-0.4	23.6	113.0
Wiltshire CC	89.8	-5.6	0.4	84.6
Dorset and Somerset	*89.8*	*-3.1*	*4.9*	*91.6*
Bournemouth and Poole	89.8	10.3	2.3	102.4
Dorset CC	89.8	-1.3	0.0	88.5
Somerset	89.8	-13.2	10.1	86.7
Cornwall and Isles of Scilly	*89.8*	*-2.8*	*23.4*	*110.4*
Devon	*89.8*	*-6.0*	*-9.1*	*74.7*
Plymouth	89.8	-9.6	-19.5	60.8
Torbay	89.8	0.9	-42.7	48.0
Devon CC	89.8	-5.3	0.8	85.3
Wales	**89.8**	**-10.9**	**-13.7**	**65.2**
West Wales and the Valleys	*89.8*	*-12.9*	*-19.2*	*57.6*
Isle of Anglesey	89.8	-19.0	13.0	83.8
Gwynedd	89.8	-8.3	-42.7	38.8
Conwy and Denbighshire	89.8	-0.6	-26.1	63.1
South West Wales	89.8	-14.3	-15.8	59.8
Central Valleys	89.8	-20.4	-22.8	46.6
Gwent Valleys	89.8	-19.3	-18.7	51.8
Bridgend and Neath Port Talbot	89.8	-24.5	-4.1	61.2
Swansea	89.8	2.7	-22.3	70.2

East Wales	*89.8*	*-8.1*	*-4.4*	*77.2*
Monmouthshire and Newport	89.8	-3.3	5.2	91.7
Cardiff and Vale of Glamorgan	89.8	9.3	-6.1	93.0
Flintshire and Wrexham	89.8	-31.9	-5.2	52.7
Powys	89.8	-24.3	-16.8	48.8
Scotland	**89.8**	**-4.4**	**-8.2**	**77.3**
Eastern Scotland	*89.8*	*-2.3*	*1.4*	*88.9*
Angus and Dundee City	89.8	-6.9	-23.4	59.5
Clackmannanshire and Fife	89.8	-13.4	0.9	77.3
East Lothian and Midlothian	89.8	-12.8	11.6	88.6
Scottish Borders	89.8	-22.7	-10.0	57.1
Edinburgh, City of	89.8	14.7	-1.6	102.9
Falkirk	89.8	-19.6	29.7	99.9
Perth & Kinross and Stirling	89.8	-1.6	11.8	100.0
West Lothian	89.8	-22.2	22.8	90.4
South Western Scotland	*89.8*	*-4.8*	*-14.8*	*70.3*
East and West Dunbartonshire and Helensburgh & Lomond	89.8	-1.8	-36.8	51.2
Dumfries and Galloway	89.8	-20.9	-14.0	54.8
East Ayrshire and North Ayrshire Mainland	89.8	-23.2	-35.9	30.7
Glasgow City	89.8	10.9	-11.0	89.8
Inverclyde, East Renfrewshire and Renfrewshire	89.8	-11.6	-49.1	29.1
North Lanarkshire	89.8	-10.0	34.9	114.7
South Ayrshire	89.8	-12.6	-14.3	62.8
South Lanarkshire	89.8	-14.5	10.5	85.8
North Eastern Scotland	*89.8*	*-5.2*	*-20.9*	*63.7*
Aberdeen City, Aberdeenshire	89.8	-5.2	-20.9	63.7
Highlands and Islands	*89.8*	*-10.3*	*4.2*	*83.7*
Caithness & Sutherland and Ross & Cromarty	89.8	-6.2	2.5	86.1
Inverness & Nairn and Moray, Badenoch & Strathspey	89.8	-12.7	24.5	101.6
Lochaber, Skye & Lochalsh and Argyll and the Islands	89.8	-9.1	-18.2	62.4
Eilean Siar (Western Isles)	89.8	-6.6	7.1	90.3
Orkney Islands	89.8	-25.5	-8.1	56.2
Shetland Islands	89.8	-19.3	-9.8	60.8

Northern Ireland	**89.8**	**-9.4**	**12.9**	**93.3**
Belfast	89.8	10.3	-2.3	97.7
Outer Belfast	89.8	-6.2	17.5	101.0
East of Northern Ireland	89.8	-20.5	13.1	82.4
North of Northern Ireland	89.8	-13.8	5.3	81.3
West and South of Northern Ireland	89.8	-16.6	32.0	105.2

Notes

1 Unadjusted workplace based GVA at current basic prices

2 Estimates of the NUTS1 shift–share factors are based on 16 industries

3 Estimates of the NUTS2 shift–share factors are based on 15 industries

4 Estimates of the NUTS3 shift–share factors are based on 6 broad industry groups

Source: Office for National Statistics

Methods Explained

Methods explained is a collection of short articles explaining statistical issues and methodologies relevant to ONS and other data. As well As defining the topic area, the notes explain why and how these methodologies are used.

Temporal disaggregation

Graeme Chamberlin
Office for National Statistics

Summary

National statistics institutions often face the task of producing timely data, such as monthly and quarterly time series, even though sources are less timely. Temporal disaggregation is the process of deriving high frequency data from low frequency data, and is closely related to benchmarking and interpolation. This article describes and demonstrates some of the available techniques.

What is temporal disaggregation and why is it used?

Users of economic statistics often require data more frequently than the availability of the sources from which they are compiled. For example, the Office for National Statistics (ONS) publishes a quarterly measure of Gross Domestic Product (GDP) and a monthly estimate of the Index of Services (IoS) despite source data for some industries, such as public services, only being available annually. Just publishing an annual estimate of GDP though would be detrimental to policy and decision making, especially where frequent and up–to–date readings of the economy are required such as in the setting of monetary policy. So although lower frequency data are usually more precise and provide a better description of long–term trends, National Statistics institutions face a strong user demand to also provide data at shorter horizons.

Temporal disaggregation is the process of deriving high frequency data from low frequency data, and if available, related high frequency information. Not only is it useful in the National Accounts framework, but also for producing flash estimates and forecasts for a range of economic and other indicators. The process of temporal disaggregation shares similar properties to benchmarking and interpolation where the same kind of techniques are often applied, albeit in a slightly different way. This article describes some of these temporal disaggregation techniques and demonstrates their use in producing a monthly time series for GDP.

Stocks, flows and index series

Stocks series measure the level of something at a particular point in time (for example unemployment, money stock, public sector debt). Flows series measure how much of something has happened over a period of time (such as exports, production, household consumption). It is possible to express both stocks and flows as an index.

Creating more frequent measures for a stocks series, which is recorded at a specific point in time, is essentially the same as having a time series with missing data points. Here the data is **interpolated** by fitting a curve that is constrained to pass through the lower frequency observations.

For flows data the same properties of smoothness and continuity are desirable, but even more important is that temporal additivity is observed. In the case of flows data, the original series is not 'point in time' observations, so temporal disaggregation cannot proceed by simply joining the dots. This means that the higher frequency data must *add* or *average* to the lower frequency data. Index series are therefore treated as flows regardless of whether the series relates to stock or a flow.

Therefore, if Y_t is an observed quarterly series where $t = 1,...,n$ denotes each quarter, then the monthly disaggregated data $y_{t,q}$ where $q = 1,2,3$ denotes each month in the quarter must observe temporal additivity for a flow series:

$$Y_t = \sum_{q=1}^{3} y_{t,q} \qquad (1)$$

and temporal averaging for an index series:

$$Y_t = \frac{1}{3}\sum_{q=1}^{3} y_{t,q} \qquad (2)$$

The application of one of these two constraints, which are essentially the same (in this example averaging is just additivity divided by three), is the fundamental difference between interpolation and temporal disaggregation. The focus of this article is on the temporal disaggregation of flows series as these are more applicable to the production of economic statistics such as National Accounts.

Techniques for temporal disaggregation

There are many different methods for temporally disaggregating a time series (see Chen 2007 for a good survey). The choice of method will critically depend on the basic information available as well as preferences. But the fundamental objective is to construct a new time series that is consistent with the low frequency data whilst preserving the short–term movements in the higher frequency indicator series (if available).

This article considers a number, although not an exhaustive, selection of techniques for deriving higher frequency data. If no higher frequency indicator is available then a smoothing method will be required such as:

- Cubic spines
- Boot, Feibes and Lisman (BFL) smoothing method

However, when a higher frequency indicator is available not only can the smoothing methods be applied but also a range of statistical methods. In particular three variants of the Chow–Lin regression method are frequently used:

- Fernandez random walk model
- Litterman random walk Markov model
- AR(1) model

It is not always the case that an indicator variable is required in order to produce a lower frequency data series – this could after all be achieved by fitting a smooth and continuous curve through the lower frequency benchmark points. Smoothing approaches assume no other information than that contained in the higher frequency series, but this might be the preferred option if a suitable and well–behaved indicator series is unavailable. It is not always the case that an indicator approach is necessarily the better way and there needs to be a strong case for rejecting a smoothing model. Furthermore, two time series that are strongly correlated at a lower frequency need not be strongly correlated at a higher frequency, so judgement should be used as to the appropriate choice of indicators.

Revisions to disaggregated data

There are essentially three sources of revisions to disaggregated data:

- revisions to low frequency benchmarks
- revisions to high frequency indicators
- arrival of new benchmark data – requiring temporal models to be updated

The first two are intuitively obvious. The low frequency benchmark data generally defines the long–term trend of the disaggregated data whereas the indicator variables (if used) have a bearing on the short–term data movements. Revisions to either will therefore impact on the derived disaggregated data.

The final reason for data revision is more specific to disaggregation techniques that rely on smoothing approaches. These typically work like moving averages, so as the new low frequency or benchmark data arrives it will affect the previously estimated time series. More importantly, it is the data towards the end of the sample that is most susceptible to revision – an issue referred to as the *end point problem*.

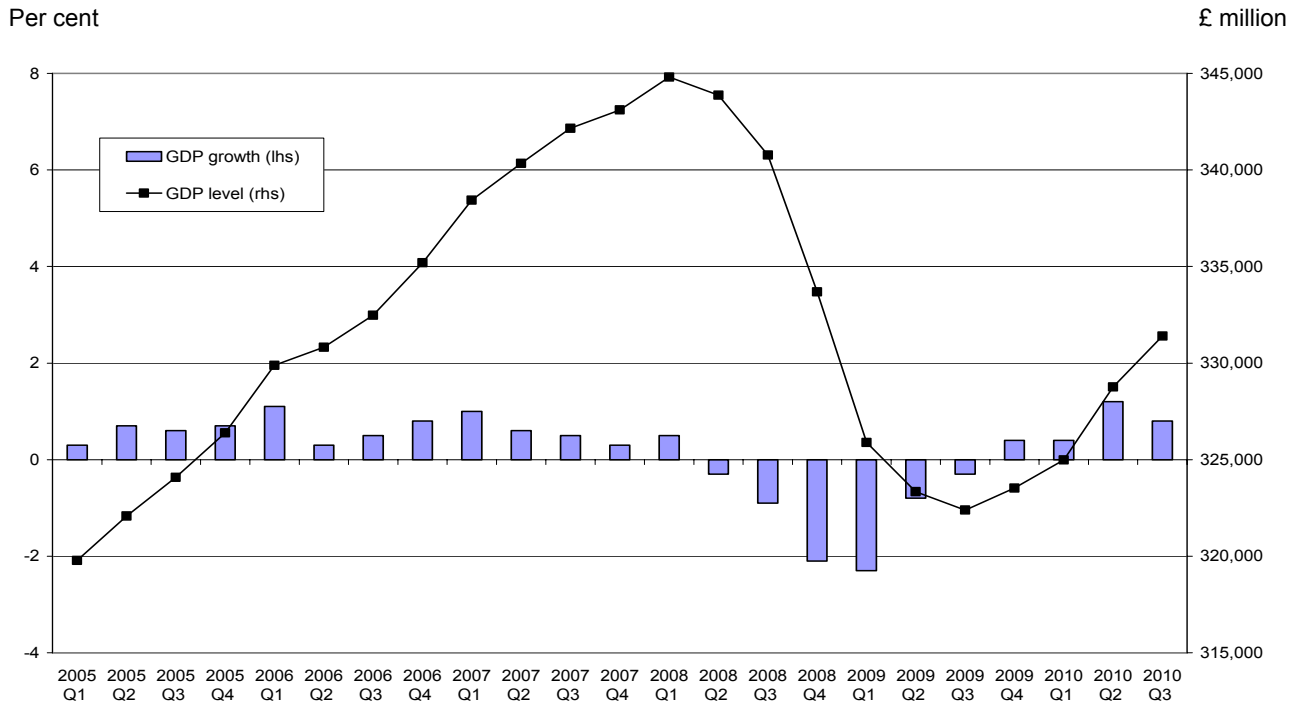
Smoothing approaches generally work on the basis of a centred moving average, meaning that estimates are based on both forward and past data. This preserves symmetry with the underlying data source. If the moving average procedure was simply backward looking, then movements in the derived time series would tend to lag the benchmark – known as *phase shifting*. (See

Chamberlin 2006 for a discussion on end point problems and phase shifting in deriving time series trends.) The crux of the end point problem is that forward looking observations are always required, but these are not available towards the end of the sample. Therefore the benchmark series needs to be extended by forecasting sufficient future observations. However, as these forecasts are replaced with actual data outruns the disaggregated times series will be recalculated and are liable to revision. The data at the end of the sample, which is normally the part of the time series of most interest to policy– and other decision makers, is likely to be the least stable.

Application: Monthly GDP

To demonstrate the application of various temporal disaggregation techniques this article explores the creation of a monthly GDP time series from the published quarterly data (see Yeend, 1996 for earlier ONS thoughts on this subject). The quarterly levels and quarter–on–quarter growth rates of GDP are plotted in **Figure 1**. If each temporal disaggregation approach is to meet the temporal additivity constraint then these levels and growth rates should be preserved.

Figure 1 **GDP: quarterly levels and growth**



Source: Office for National Statistics

Some of the techniques considered here have been applied using ECOTRIM (Barcellan and Buono 2002), a computer program developed by Eurostat for temporal disaggregation of time series. This software is available for download from http://circa.europa.eu/Public/irc/dsis/ecotrim/library

Cubic spline

Using spline functions to produce higher frequency data is routine practise in the National Accounts. For example, ONS currently uses spline functions in the Index of Services following a methodology laid out by Baxter (1998).

The basic premise of a spline function is to link sections of a cubic polynomial together at joins subject to additivity constraints being satisfied. As each is a function of time, sub–period estimates can then be simply derived from each spline. Following Baxter (1998), a five period (in this case quarters) is initially taken with each represented by a cubic polynomial of time:

$$f_1(t) = a_1 + b_1 t + c_1 t^2 + d_1 t^3$$

$$f_2(t) = a_2 + b_2 t + c_2 t^2 + d_2 t^3$$

$$f_3(t) = a_3 + b_3 t + c_3 t^2 + d_3 t^3$$

$$f_4(t) = a_4 + b_4 t + c_4 t^2 + d_4 t^3$$

$$f_5(t) = a_5 + b_5 t + c_5 t^2 + d_5 t^3$$

These 20 coefficients are then solved subject to three constraints.

Constraint 1

The levels and slopes of adjacent sections of cubic polynomial are equal where they meet. This forms a continuous (that is no jumps or other form of discontinuity) curve.

Constraint 2

The sum of the values of the spline over each sub–period (monthly) is equal to the observed quarterly data. This is the temporal additivity constraint that is applied to flow data.

Constraint 3

The spline function is constructed to be as smooth as possible subject to the two previous constraints. This is achieved by minimising the speed at which the gradient of the spline changes over its whole length. Technically speaking, over the whole range, the integral of the square of the second derivative of the splines is minimised so as to reduce the incidence of sharp changes in the time series

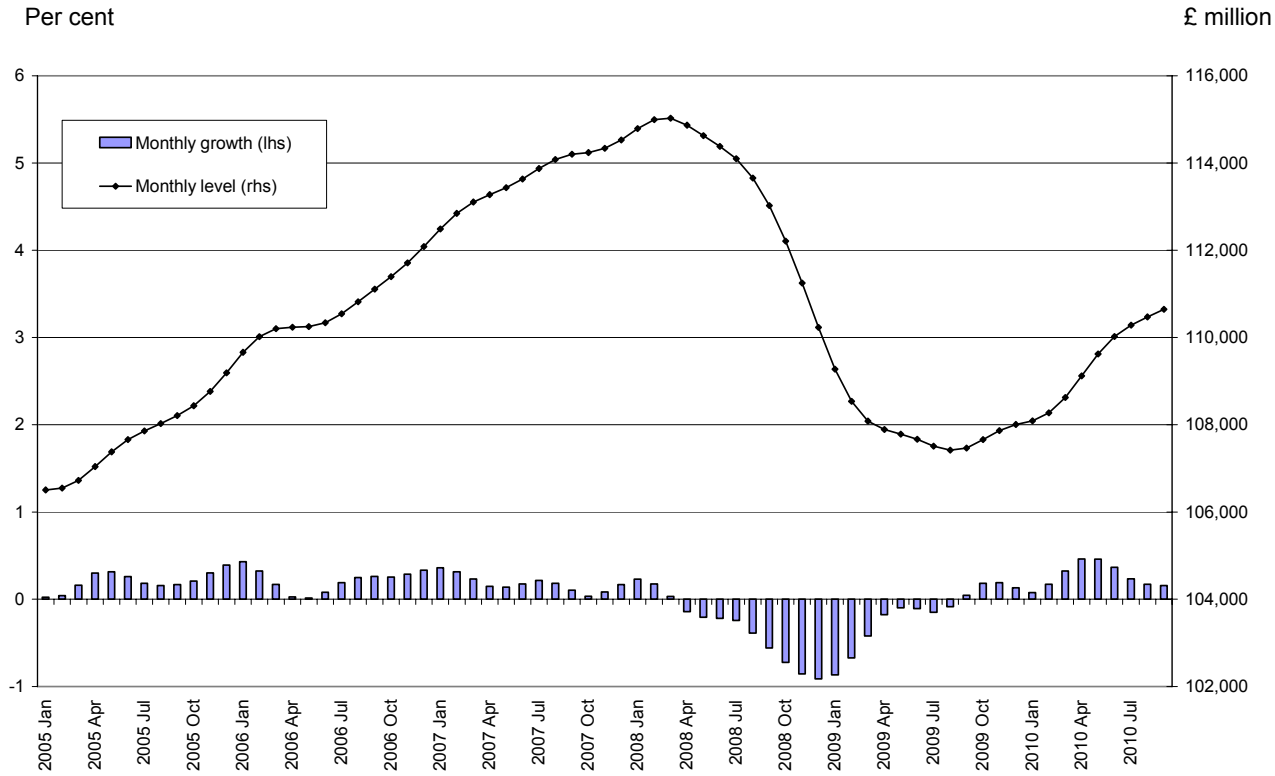
$$\int_0^5 \left(\frac{\partial^2 f}{dt^2} \right)^2 dt = \sum_{i=1}^{5} \int_{i-1}^{i} \left(\frac{\partial^2 f_i}{\partial t^2} \right)^2 dt$$

Cubic splines can be fitted to a data series of any length, and be refitted as new data becomes available. A temporally disaggregated series can be found in the same way for up to five periods by using a reduced number of data points and equations. When more than five periods of data are available the spline is extended one period at a time using a five period base, with revision of the

spline function in the previous three periods. This means that the addition of a sixth period sees the spline and hence estimates for the third, fourth and fifth periods revised. The new spline function for periods 3 to 6 is still calculated on a five period base to maintain the continuity with the spline in the first two periods. The spline in period 2 feeds into calculation of the spline for periods 3 to 6 but in a way that itself remains fixed.

Figure 2 shows a monthly time series of GDP, derived from the quarterly series shown in Figure 1. These results are compared to the levels and growth rates of a naïve temporal disaggregation approach in **Figures 3** and **4** respectively. Here the quarterly level has simply been divided by three and allocated to each month within the quarter – known as pro–rata adjustment. It is clear, from looking at the step pattern in the level time series that this approach simply loads all the change in the time series to the monthly growth rate between the final month of the quarter and the first month of the proceeding quarter – with these growth rates corresponding to those of the quarterly series.

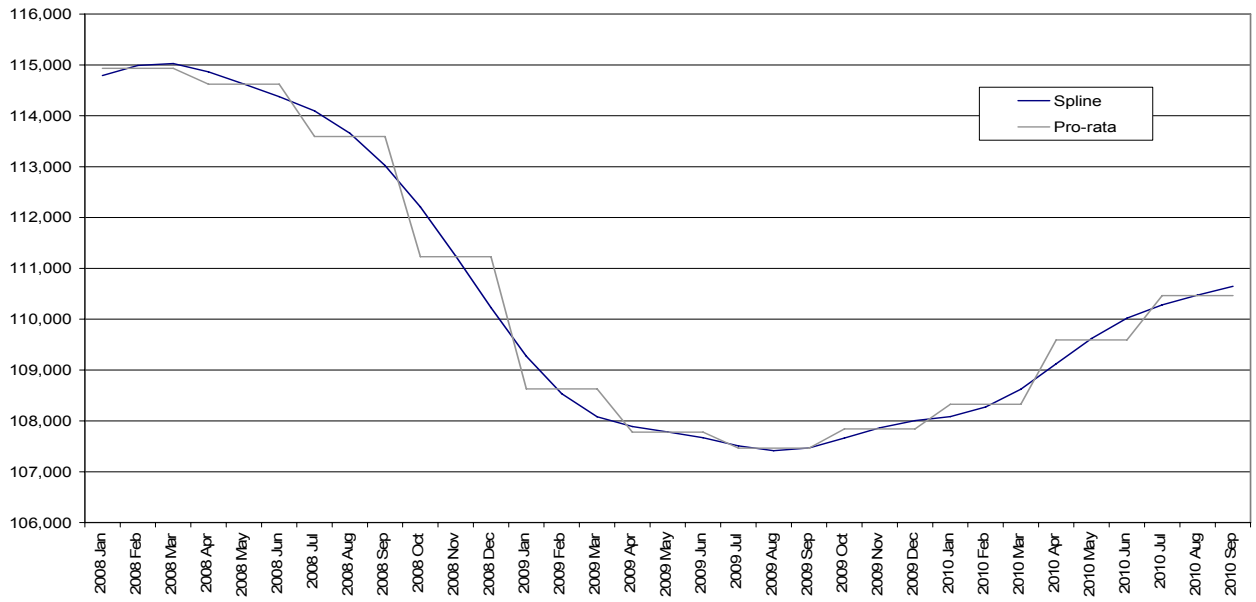
Figure 2 Cubic spline and monthly GDP



Source: Office for National Statistics

Figure 3 Pro–rata (naïve) monthly GDP levels

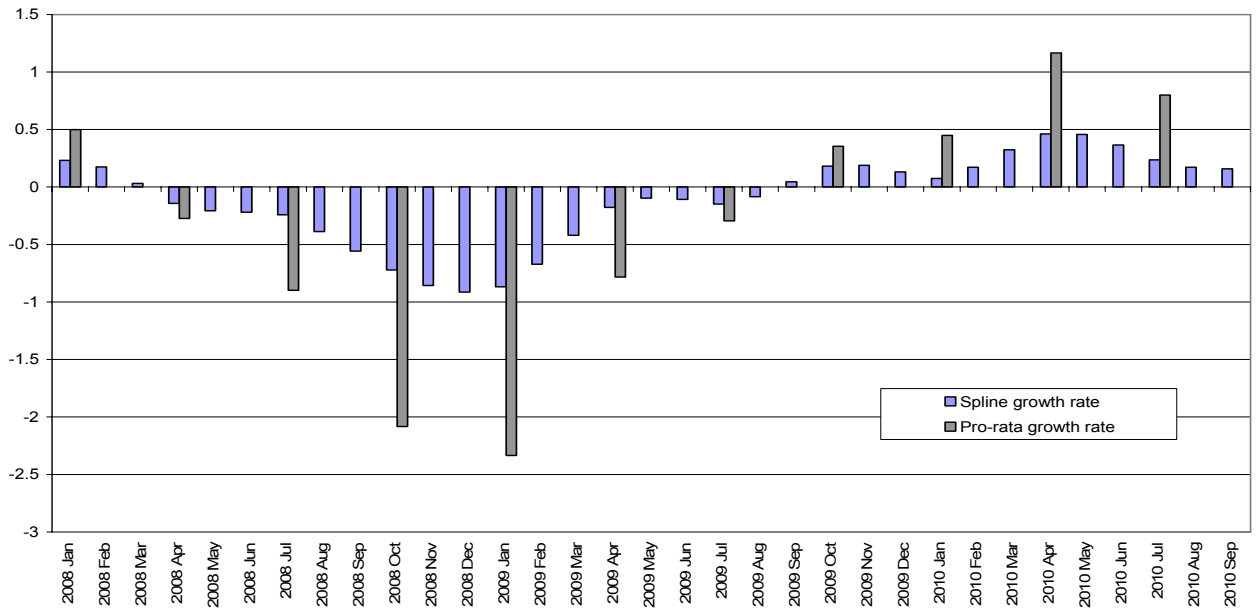
Per cent



Source: Office for National Statistics

Figure 4 Pro–rata (naïve) monthly GDP growth

Per cent



Source: Office for National Statistics

Splines with indicator series

Cubic splines can be applied where there are no sub–period indicators to guide on the short–term movements of the data. However, they can also be adapted to cases where such indicators are available. In this case the spline is not attached to the lower frequency benchmark data, but to the benchmark–indicator (BI ratio). Where benchmark data (GDP) is quarterly and indicator data (I) is monthly this ratio is:

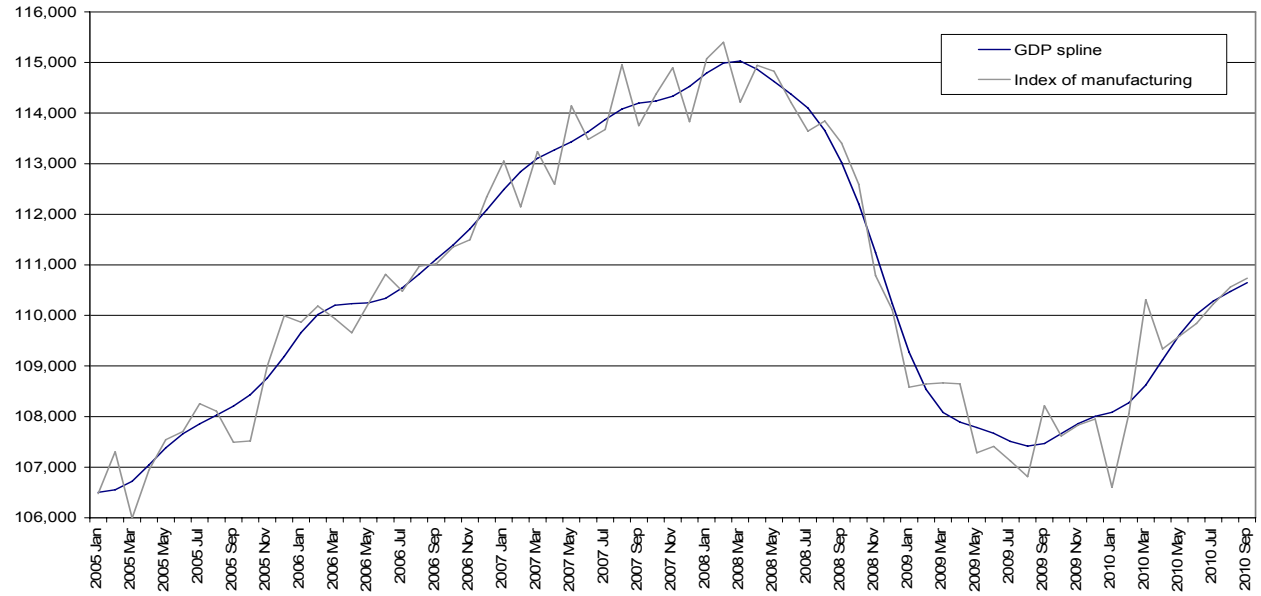
$$BI_t = \frac{GDP_t}{\sum_{i=1}^{3} I_{it}}$$

Monthly estimates of GDP can then be produced by multiplying the splined monthly values of the BI ratio by the monthly indicator series. In this case, dealing with end point problems requires the BI ratio and not the benchmark data to be extrapolated.

The Index of Manufacturing, Index of Services and Retail Sales index are three possible indicators of monthly movements in GDP. **Figures 5**,**6** and **7** show how these indicators compare to the spline function in Figure 2. In all cases the monthly path becomes less smooth and reflective of monthly changes in each indicator series. Temporal additivity conditions apply so the quarterly sums are consistent with the data in Figure 1.

Figure 5 **Monthly GDP – spline using the Index of manufacturing**

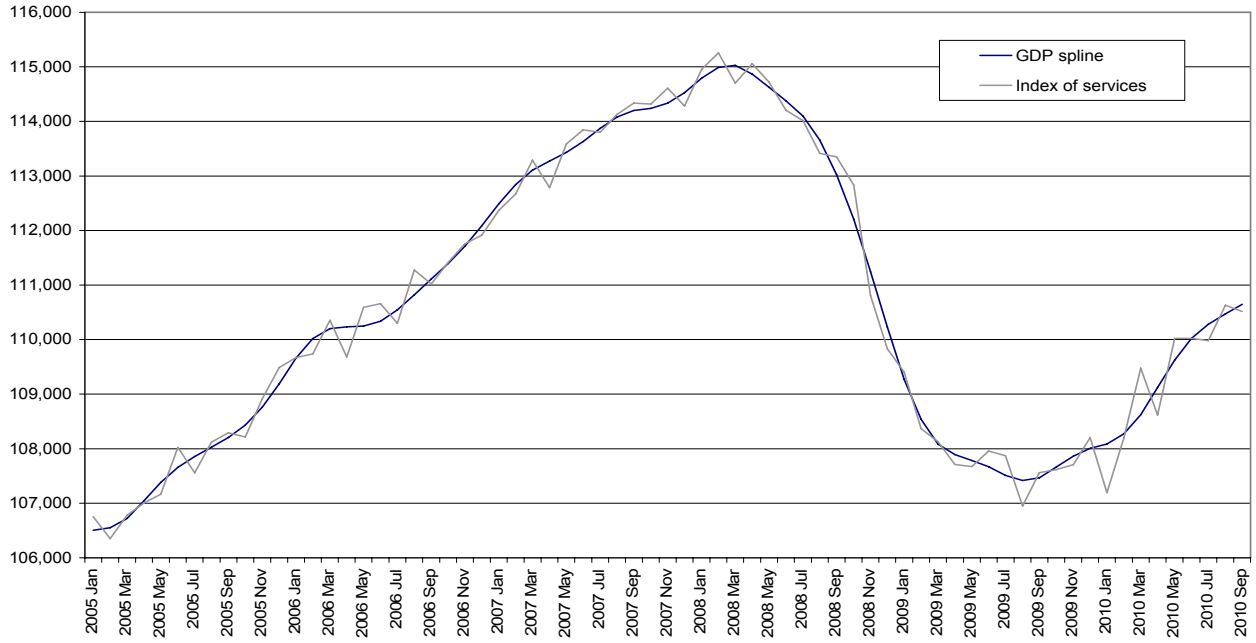
£ million



Source: Office for National Statistics

Figure 6 Monthly GDP – spline using the Index of services

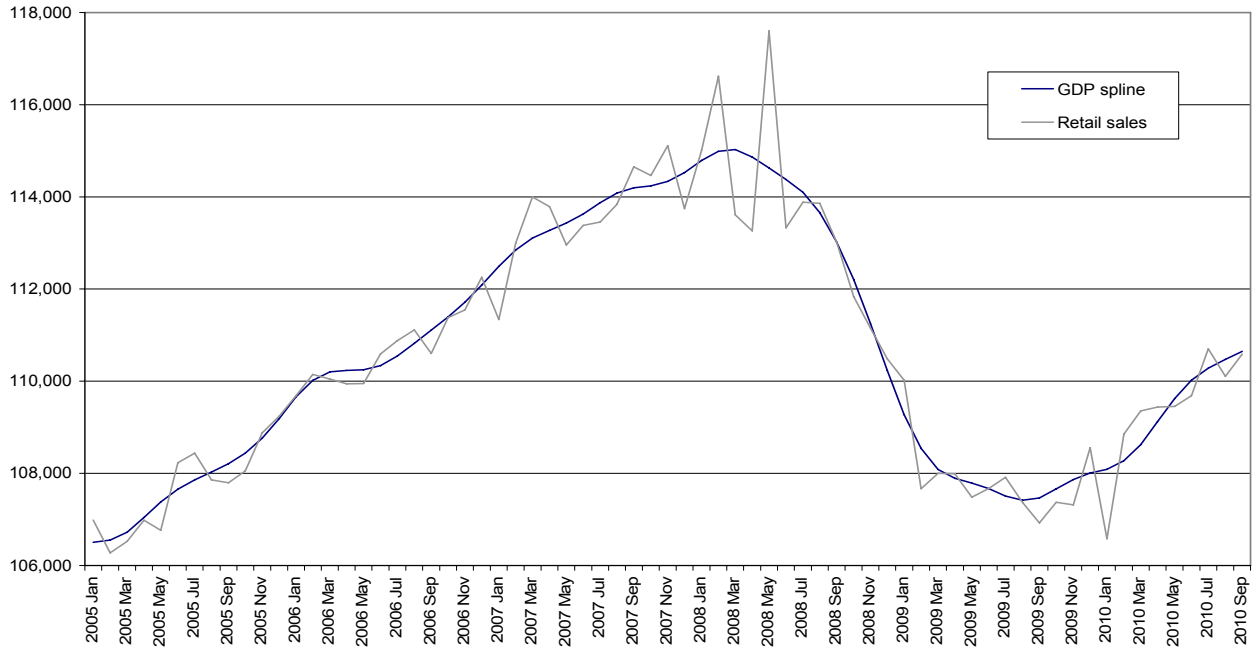
£ million



Source: Office for National Statistics

Figure 7 Monthly GDP – spline using the Retail sales index

£ million



Source: Office for National Statistics

Whereas the cubic spline methodology aims to produce a smooth curve that maintains temporal additivity while preserving the long–term trend in the low frequency data, using a high frequency indicator series produces a time series that reflects the short–term movements inherent in that indicator.

The examples in Figures 5,6 and 7 also show the similarities between temporal disaggregation and **benchmarking**. Benchmarking is the process of constraining a higher frequency time series to a lower frequency benchmark series, and therefore is really just the mirror image of temporal disaggregation. As a result the same techniques discussed in this article are also often used for benchmarking.

Boot, Feibes and Lisman (BFL) smoothing method

The BFL approach is also based on a smoothing algorithm. ECOTRIM supports estimation of both the first and second difference models.

The first difference approach estimates a monthly time series $y = (y_1,....,y_T)$ to minimize the period–to–period change in the level of final monthly estimates subject to the additivity constraints holding. Basically:

$$\min_y P(y) = \sum_{t=2}^{T} (y_t - y_{t-1})^2 \qquad (3)$$

subject to

$$Y_t = \sum_{q=1}^{3} y_{t,q} \qquad (4)$$

where Y_t is the quarterly benchmark level of GDP.

The second difference model is similar, but in this case aims to keep the period–to–period change in Δy_t as linear as possible, which is achieved by minimizing the sum of squares of $\Delta^2 y_t = (\Delta y_t - \Delta y_{t-1})$ subject to additivity constraints.

$$\min_y P(y) = \sum_{t=2}^{T} [\Delta(y_t - y_{t-1})]^2 \qquad (5)$$

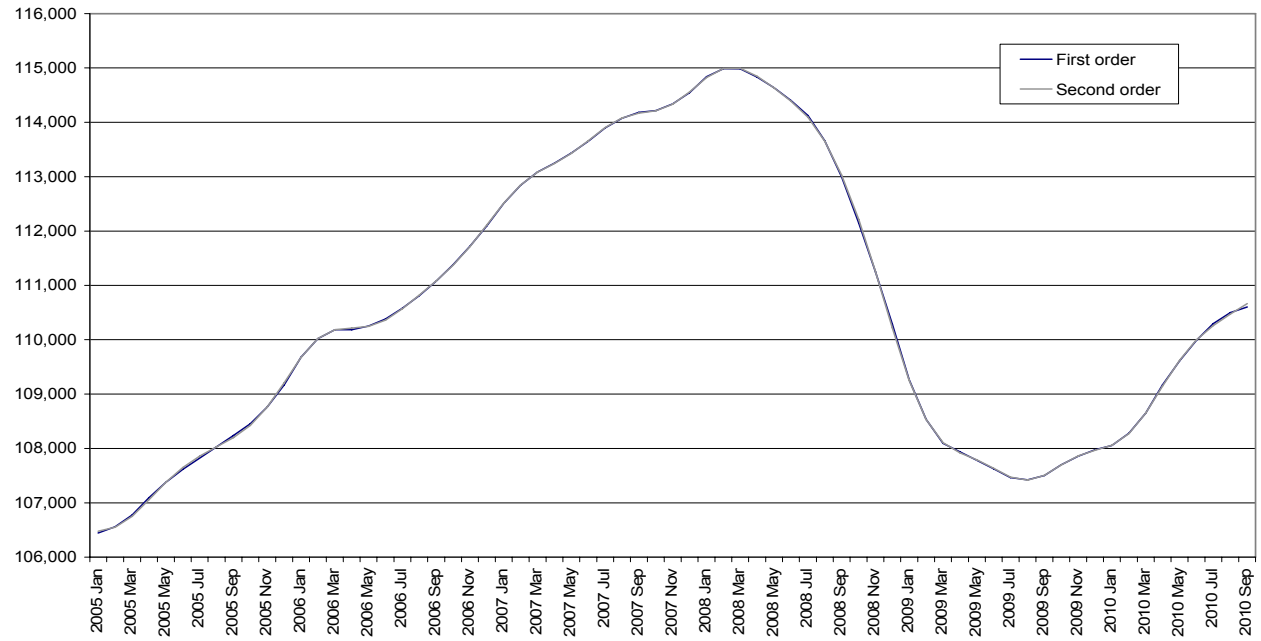
subject to (4)

Both methods therefore aim to fit the smoothest possible curve to the low frequency data by minimising period–to–period movements in the data. Estimates of monthly GDP using the first and second difference BFL smoothing methods are shown in **Figure 8**. There is no discernable

difference between the two approaches in this case, and the derived monthly time series is very similar to the spline in Figure 2.

Figure 8 Monthly GDP estimates derived by BFL smoothing

£ million



Source: Office for National Statistics

The BFL smoothing model can also be used with indicator series in a similar way as the cubic spline to produce time series with different short–term characteistics.

BFL is just one of many mathematical approaches to producing temporally disaggregated data. The Denton adjustment method and its variants (such as Causey–Trager) are based on the principle of movement preservation – meaning that sub–period estimates $y = (y_1,....,y_T)$ should preserve the movement in the indicator series $x = (x_1,....,x_T)$ so as to minimize a penalty function $P(y,x)$ subject to the temporal aggregation constraints. The penalty function can take a number of forms depending on the preferences of the modeller – that is the desirable properties of the high frequency data that is to be created . Monthly GDP estimates using Denton adjustment approaches are not produced here but are briefly described in **Box 1**, as well as being covered in more detail in Chen (2007).

Box 1 Denton adjustment methods and its variants

The Denton adjustment method and its variants are based on the principle of movement preservation between sub–period estimates and indicator time series.

Additive first difference variant

$$P(y,x)=\sum_{t=1}^{T}\left[\Delta(y_t-x_t)\right]^2$$

This preserves the period–to–period change in the level of the final sub–period estimates and the indicator values (y-x). As a result $y=(y_1,....,y_T)$ tends to be parallel to $x=(x_1,....,x_T)$.

Proportional first difference variant

$$P(y,x)=\sum_{t=1}^{T}\left[\left(\frac{y_t}{x_t}-\frac{y_{t-1}}{x_{t-1}}\right)\right]^2$$

This preserves the proportional period–to–period change in the final sub–period estimates and the indicator series (y/x). As a result $y=(y_1,....,y_T)$ tends to have the same period–to–period growth rate as $x=(x_1,....,x_T)$.

Additive second difference variant

$$P(y,x)=\sum_{t=1}^{T}\left[\Delta^2(y_t-x_t)\right]^2$$

This preserves period–to–period changes in Δ(y-x).

Proportional second difference variant

$$P(y,x)=\sum_{t=1}^{T}\left[\Delta\left(\frac{y_t}{x_t}-\frac{y_{t-1}}{x_{t-1}}\right)\right]^2$$

This preserves period–to–period changes in Δ(y/x).

Causey-Trager growth preservation model

$$P(y,x)=\sum_{t=1}^{T}\left[\left(\frac{y_t}{y_{t-1}}-\frac{x_t}{x_{t-1}}\right)\right]^2$$

This aims to preserve the period–to period change in the indicator series. As a result the period–to–period percentage change in $y=(y_1,....,y_T)$ tends to be very close to that in $x=(x_1,....,x_T)$.

Regression approaches to temporal disaggregation

This approach to temporal disaggregation, following Chow–Lin, seeks to exploit a statistical relationship between low frequency data and higher frequency indicator variables through a regression equation.

$$y_t = x_t\beta + u_t \qquad (6)$$

subject to the usual aggregation constraints

$$Y = B'y \qquad (7)$$

Substituting (6) into (7) gives an equation for the observed quarterly time series in relation to the monthly indicator series:

$$Y = B'y = B'x\beta + B'u \qquad (8)$$

The regression coefficients can then be calculated using the Generalised Least Squares (GLS) estimator

$$\hat{\beta} = \left[x'B\left(B'VB\right)^{-1}B'x\right]^{-1}x'B\left(B'VB\right)^{-1}Y \qquad (9)$$

And the estimated sub–period (monthly in this case) time series can be derived as

$$\hat{y} = x\hat{\beta} + VB\left(B'VB\right)^{-1}\left[Y - B'x\hat{\beta}\right] \qquad (10)$$

This can be explained in more basic terms for the specific example of deriving monthly GDP from the quarterly series with the use of monthly indicator series. Equation (6) postulates a simple linear relationship between monthly GDP and a set of monthly indicators. Equation (7) is simply the temporal additivity constraint relating monthly GDP to quarterly GDP. Aggregating the monthly indicators into a quarterly series in the same way means that a simple linear regression can be computed between quarterly GDP and the quarterly aggregates of the indicators. Using the GLS estimator, the regression coefficients $\hat{\beta}$ are calculated in (9). These coefficients can then be used to map the monthly indicator series into monthly GDP estimates $\left(\hat{y}\right)$ in (10). Equation (10) consists of two parts. The first part describes the linear relationship between the monthly indicator series and monthly GDP time series ($x\hat{\beta}$). However, to ensure that the additivity constraint holds, quarterly discrepancies between the regression's fitted values and the actual data needs to be allocated across each month in the quarter – which is represented by $VB\left(B'VB\right)^{-1}\left[Y - B'x\hat{\beta}\right]$.

When there is no serial correlation in the residuals $\left(u_t\right)$ this adjustment simply reduces to allocating the quarterly discrepancy evenly across the three months of the quarter. Unfortunately, the assumption of no serial correlation in the residuals is generally not supported, in which case the Chow–Lin approach would lead to step changes in the monthly GDP estimates across different

quarters. As a result, a number of variants of the Chow–Lin approach have been developed which allow for serial correlation in the residuals. These include the following three common approaches:

Fernandez random walk model

$$u_t = u_{t-1} + \varepsilon_t$$

Litterman random walk Markov model

$$u_t = u_{t-1} + \varepsilon_t$$

$$\varepsilon_t = \alpha\varepsilon_{t-1} + e_t$$

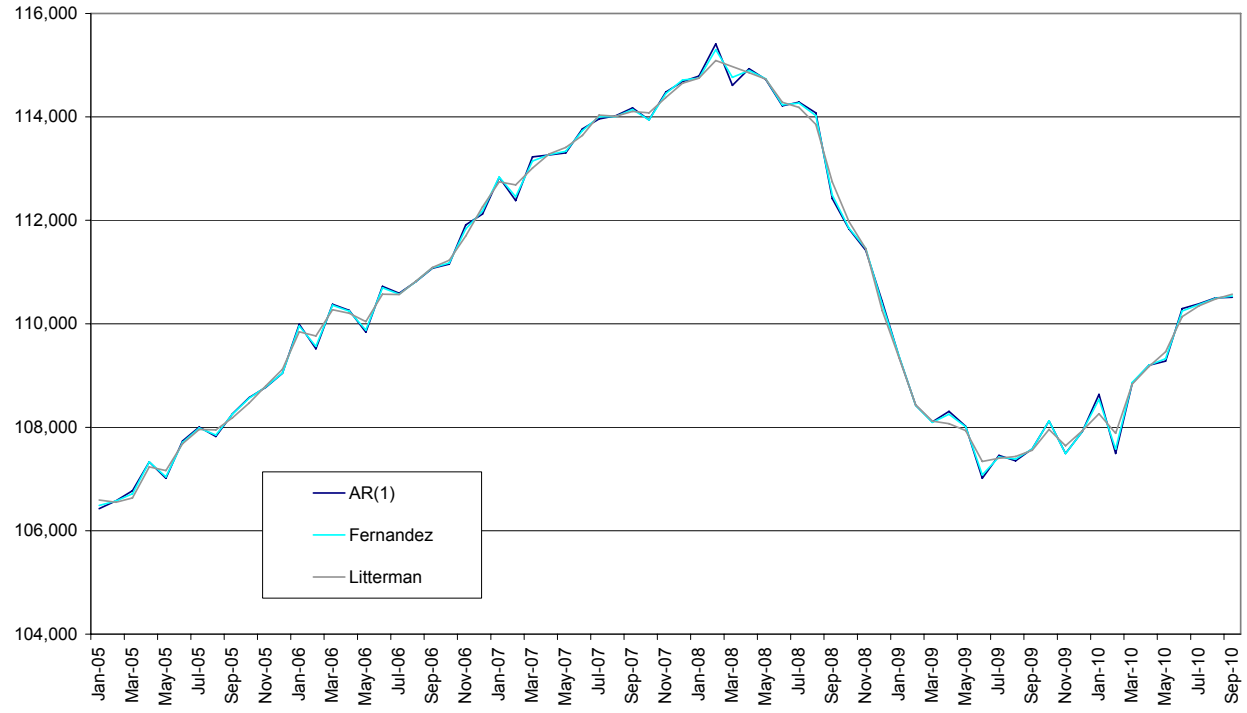
AR(1) model

$$u_t = \rho u_{t-1} + \varepsilon_t$$

One of the main advantages of the regression approach is that a number of indicator series can be used to deduce the short–term movements in the disaggregated time series. **Figure 9** presents estimates of monthly GDP based on these three approaches and the three monthly indicators (Index of manufacturing, Index of services and Retail sales) used earlier. The underlying regression results are included in **Table 1**.

Figure 9 Monthly GDP estimates from regression approaches

£ million



Source: Office for National Statistics

Table 1 Regression results used to derive monthly GDP estimates

Variable	Estimate	Standard error	t-statistics
Fernandez			
Constant	20064	5607.29	3.58
Index of manufacturing	52.91	52.55	1.01
Index of services	1014.98	80.09	12.67
Retail sales	-162.78	71.88	-2.26
Litterman			
Constant	26720	8109.35	3.29
Index of manufacturing	-11.11	58.51	-0.19
Index of services	944.98	135.81	6.96
Retail sales	-103.89	100.57	-1.03
AR(1)			
Constant	59045	9656.65	6.11
Index of manufacturing	-122.9	53.63	-2.29
Index of services	592.24	154.15	3.84
Retail sales	-18.89	113.18	-0.17

The three monthly GDP time series in Figure 9 show the same patterns. This is not unsurprising as the intrinsic differences between the three methods are not that great, and as shown in Table 1, the monthly time series in each case have been predominantly driven by the Index of services. The significance of the other two indicators is mixed, with the Index of manufacturing and the Retail sales index only having limited significance in accounting for short–term movements in monthly GDP.

The significance of the Index of services in monthly GDP largely stems from its relatively strong correlation at the quarterly level – which is unsurprising given its large share in GDP. However, it is a matter of judgement as to whether the correlation is just as strong at the monthly level and therefore that this is the most appropriate indicator for forming a monthly GDP time series.

Advance estimates of quarterly GDP and final remarks

This article has set out to demonstrate several methods of temporal disaggregation by showing how they can be applied to construct a monthly GDP time series from the published quarterly data.

This can be achieved either by fitting a smooth curve through the data subject to temporal additivity constraints, or by using monthly indicators to inform on short–term data movements. The application of these methods is important in the National Accounts, but can also be applied generally across a broad range of economics and other statistics.

Temporal disaggregation techniques are also useful in forecasting and the production of flash (advance/preliminary) estimates of economic data. For example, GDP is published quarterly so usually a forecast model will be based on quarterly data, even though in the meantime a number of potentially useful monthly indicators may have been published. Temporal disaggregation models therefore enable this higher frequency, and usually more timely data, to be incorporated into the forecast process to provide more rapid and potentially accurate estimates. Although ONS is not in the business of providing forecasts, this is the basic approach behind the monthly GDP and early quarterly estimates of GDP published by the National Institute of Economic and Social Research (see Mitchell et al 2004).

Contact

elmr@ons.gov.uk

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Key time series

1. National Accounts aggregates

Last updated 26/10/10

Seasonally adjusted

	£ million		Indices (2006 = 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
2008	1,445,580	1,295,663	108.8	109.5	104.3	102.6	102.7	106.0	106.6
2009	1,392,634	1,255,192	104.8	106.0	98.9	97.5	97.8	107.5	108.4
2008 Q2	363,264	323,679	109.4	109.4	105.2	103.5	103.7	105.6	105.5
2008 Q3	361,466	325,041	108.8	109.8	103.8	102.6	102.6	106.1	107.1
2008 Q4	358,848	324,009	108.1	109.5	100.9	100.5	100.5	107.5	108.9
2009 Q1	349,324	316,469	105.2	106.9	99.8	98.1	98.3	107.2	108.8
2009 Q2	344,359	310,982	103.7	105.1	97.0	97.4	97.6	106.5	107.7
2009 Q3	347,372	312,536	104.6	105.6	98.9	97.1	97.4	107.7	108.4
2009 Q4	351,579	315,205	105.9	106.5	100.1	97.4	97.9	108.7	108.8
2010 Q1	359,302	320,301	108.2	108.2	98.4	97.9	98.2	110.6	110.3
2010 Q2	364,148	324,552	109.7	109.7	100.8	99.0	99.3	110.8	110.4
2010 Q3						99.8	100.1		
			Percentage change, quarter on corresponding quarter of previous year						
			IHYO	ABML[4]	YBGO[4]	IHYR	ABMM[4]	IHYU	ABML/ABMM[4]
2008 Q2	3.9	3.9	3.9	3.9	2.1	1.0	1.1	2.9	2.8
2008 Q3	2.4	3.4	2.4	3.4	0.3	-0.4	-0.6	2.9	4.0
2008 Q4	0.5	1.6	0.5	1.6	-5.2	-2.7	-2.8	3.3	4.6
2009 Q1	-3.5	-2.0	-3.5	-2.0	-6.9	-5.5	-5.5	2.1	3.7
2009 Q2	-5.2	-3.9	-5.2	-3.9	-7.8	-6.0	-5.9	0.8	2.1
2009 Q3	-3.9	-3.8	-3.9	-3.8	-4.8	-5.4	-5.0	1.6	1.3
2009 Q4	-2.0	-2.7	-2.0	-2.7	-0.9	-3.0	-2.6	1.0	-0.1
2010 Q1	2.9	1.2	2.9	1.2	-1.4	-0.3	-0.1	3.1	1.4
2010 Q2	5.7	4.4	5.7	4.4	3.9	1.7	1.8	4.0	2.5
2010 Q3						2.8	2.8		

Notes

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. Derived from these identification (CDID) codes.

2. Gross Domestic Product: by category of expenditure

Last updated 26/10/10

£ million, chained volume measures, reference year 2006, seasonally adjusted

	Domestic expenditure on goods and services at market prices											
	Final consumption expenditure			Gross capital formation								
	Households	Non-profit institutions1	General government	Gross fixed capital formation	Changes in inventories2	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 product at market prices
	ABJR	HAYO	NMRY	NPQT	CAFU	NPJR	YBIM	IKBK	ABMG	IKBL	GIXS	ABMI
2008	842,174	32,338	293,464	232,777	130	1,290	1,402,173	372,104	1,774,277	411,138	0	1,363,139
2009	813,791	31,764	296,287	197,548	-15,416	1,222	1,325,195	330,809	1,656,004	360,749	-96	1,295,159
2008 Q1	213,214	8,292	72,104	59,619	3,228	206	356,664	93,858	450,522	105,712	0	344,809
2008 Q2	211,525	8,183	73,334	59,779	872	440	354,134	94,284	448,418	104,550	0	343,868
2008 Q3	210,330	8,018	73,473	57,254	645	367	350,088	93,918	444,005	103,226	0	340,780
2008 Q4	207,105	7,845	74,553	56,125	-4,615	277	341,287	90,044	431,332	97,650	0	333,682
2009 Q1	204,245	8,045	74,078	51,404	-4,454	420	333,737	82,533	416,271	90,373	-5	325,893
2009 Q2	202,770	7,956	74,129	48,578	-3,501	239	330,171	81,266	411,437	88,079	-15	323,343
2009 Q3	202,531	7,888	73,776	49,288	-4,139	212	329,556	82,002	411,558	89,138	-29	322,391
2009 Q4	204,245	7,875	74,304	48,278	-3,322	351	331,731	85,008	416,738	93,159	-47	323,532
2010 Q1	204,219	7,825	74,792	49,664	-1,112	267	335,654	84,416	420,070	94,992	-96	324,982
2010 Q2	205,585	7,878	75,545	50,352	88	375	339,824	86,328	426,152	97,269	-114	328,769
2010 Q3												331,399
	Percentage change, quarter on corresponding quarter of previous year											
2008 Q1	2.9	0.1	0.8	-1.9			1.8	3.7	2.2	3.1		1.9
2008 Q2	1.4	-1.5	1.9	-1.4			1.2	2.7	1.5	3.1		1.0
2008 Q3	0.1	-4.1	1.2	-6.0			-1.3	0.5	-0.9	-2.5		-0.4
2008 Q4	-2.1	-6.9	2.5	-10.5			-4.4	-2.7	-4.1	-8.4		-2.7
2009 Q1	-4.2	-3.0	2.7	-13.8			-6.4	-12.1	-7.6	-14.5		-5.5
2009 Q2	-4.1	-2.8	1.1	-18.7			-6.8	-13.8	-8.2	-15.8		-6.0
2009 Q3	-3.7	-1.6	0.4	-13.9			-5.9	-12.7	-7.3	-13.6		-5.4
2009 Q4	-1.4	0.4	-0.3	-14.0			-2.8	-5.6	-3.4	-4.6		-3.0
2010 Q1	0.0	-2.7	1.0	-3.4			0.6	2.3	0.9	5.1		-0.3
2010 Q2	1.4	-1.0	1.9	3.7			2.9	6.2	3.6	10.4		1.7
2010 Q3												2.8

Notes

1. Non–profit institutions serving households
2. This series includes a quarterly alignment adjustment

3. Labour Market summary

Last updated 13/10/10

United Kingdom (thousands) seasonally adjusted

			Headline indicators					
	LFS household population[1]		Employment		Unemployment		Inactivity	
			Level	Rate[2]	Level	Rate[3]	Level	Rate[4]
	All aged 16 & over	All aged 16 to 64	All aged 16 & over	All aged 16 to 64	All aged 16 & over	All aged 16 to 64	All aged 16 & over	All aged 16 to 64
People	MGSL	LF2O	MGRZ	LF24	MGSC	MGSX	LF2M	LF2S
Jun–Aug 2008	49,102	39,599	29,429	72.6	1,783	5.7	9,090	23.0
Jun–Aug 2009	49,482	39,820	28,917	70.7	2,472	7.9	9,207	23.1
Sep–Nov 2009	49,580	39,870	28,905	70.6	2,460	7.8	9,296	23.3
Dec–Feb 2010	49,679	39,921	28,843	70.3	2,486	7.9	9,389	23.5
Mar–May 2010	49,777	39,972	28,980	70.5	2,469	7.8	9,346	23.4
Jun–Aug 2010	49,873	40,021	29,158	70.7	2,448	7.7	9,280	23.2
Change on quarter	97	49	178	0.2	-20	-0.1	-66	-0.2
Change on quarter %	0.2	0.1	0.6		-0.8		-0.7	
Change on year	391	201	241	0.0	-23	-0.1	73	0.1
Change on year %	0.8	0.5	0.8		-1.0		0.8	
Men	MGSM	YBTG	MGSA	MGSV	MGSD	MGSY	YBSO	YBTM
Jun–Aug 2008	23,907	19,699	15,883	78.4	1,050	6.2	3,217	16.3
Jun–Aug 2009	24,111	19,813	15,441	75.7	1,536	9.0	3,301	16.7
Sep–Nov 2009	24,166	19,839	15,395	75.3	1,511	8.9	3,409	17.2
Dec–Feb 2010	24,220	19,866	15,368	75.0	1,517	9.0	3,469	17.5
Mar–May 2010	24,275	19,893	15,483	75.5	1,492	8.8	3,405	17.1
Jun–Aug 2010	24,329	19,920	15,615	75.8	1,436	8.4	3,389	17.0
Change on quarter	54	26	132	0.4	-56	-0.4	-16	-0.1
Change on quarter %	0.2	0.1	0.9		-3.8		-0.5	
Change on year	217	107	175	0.2	-100	-0.6	88	0.4
Change on year %	0.9	0.5	1.1		-6.5		2.7	
Women	MGSN	LF2P	MGSB	LF25	MGSE	MGSZ	LF2N	LF2T
Jun–Aug 2008	25,195	19,900	13,545	66.8	733	5.1	5,874	29.5
Jun–Aug 2009	25,371	20,007	13,477	65.8	936	6.5	5,906	29.5
Sep–Nov 2009	25,415	20,031	13,510	65.9	949	6.6	5,887	29.4
Dec–Feb 2010	25,459	20,055	13,476	65.7	969	6.7	5,921	29.5
Mar–May 2010	25,502	20,079	13,497	65.6	977	6.7	5,941	29.6
Jun–Aug 2010	25,545	20,101	13,543	65.7	1,013	7.0	5,891	29.3
Change on quarter	43	23	46	0.1	36	0.2	-50	-0.3
Change on quarter %	0.2	0.1	0.3		3.7		-0.8	
Change on year	174	94	66	-0.1	77	0.5	-15	-0.2
Change on year %	0.7	0.5	0.5		8.2		-0.2	

Notes

1. The Labour Force Survey (LFS) is a survey of the population of private households, student halls of residence and NHS accommodation.

2. The headline employment rate is the number of people aged 16 to 64 in employment divided by the population aged 16 to 64.

3. The headline unemployment rate is the number of unemployed people (aged 16+) divided by the economically active population (aged 16+). The economically active population is defined as those in employment plus those who are unemployed.

4. The headline inactivity rate is the number of people aged 16 to 64 divided by the population aged 16 to 64.

Note on headline employment, unemployment and inactivity rates

The headline employment and inactivity rates are based on the population aged 16 to 64 but the headline unemployment rate is based on the economically active population aged 16 and over. The employment and inactivity rates for those aged 16 and over are affected by the inclusion of the retired population in the denominators and are therefore less meaningful than the rates for those aged from 16 to 64. However, for the unemployment rate for those aged 16 and over, no such effect occurs as the denominator for the unemployment rate is the economically active population which only includes people in work or actively seeking and able to work.

Note on headline employment, unemployment and inactivity levels

The headline employment and unemployment levels are for those aged 16 and over; they measure all people in work or actively seeking and able to work. However, the headline inactivity level is for those aged 16 to 64. The inactivity level for those aged 16 and over is less meaningful as it includes elderly people who have retired from the labour force.

4. Prices

Last updated 12/10/10

Percentage change over 12 months, Not seasonally adjusted

	Consumer prices						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]	PLLv[3,4]	RNNK[3,4]	RNNQ[3,4]
2009 Jan	3.0	4.5	4.1	0.1	2.4	3.4	3.5	4.0	1.7	10.8
2009 Feb	3.2	4.6	4.2	0.0	2.5	3.5	3.0	3.7	0.8	8.9
2009 Mar	2.9	4.3	3.9	-0.4	2.2	3.2	2.0	3.2	-0.4	7.5
2009 Apr	2.3	3.8	3.4	-1.2	1.7	2.7	1.3	2.5	-5.8	2.6
2009 May	2.2	3.6	3.3	-1.1	1.6	2.6	-0.3	1.2	-8.8	0.2
2009 Jun	1.8	3.1	2.9	-1.6	1.0	1.9	-1.0	0.3	-12.0	-2.9
2009 Jul	1.8	3.1	2.8	-1.4	1.2	2.1	-1.3	0.2	-12.2	-3.4
2009 Aug	1.6	2.9	2.7	-1.3	1.4	2.3	-0.3	0.8	-7.7	-2.1
2009 Sep	1.1	2.2	2.1	-1.4	1.3	2.0	0.4	1.3	-6.2	-1.2
2009 Oct	1.5	2.6	2.5	-0.8	1.9	2.8	1.8	2.1	0.5	0.9
2009 Nov	1.9	3.0	2.9	0.3	2.7	3.5	2.9	2.0	4.2	0.8
2009 Dec	2.9	2.8	2.6	2.4	3.8	3.8	3.5	2.5	7.4	1.1
2010 Jan	3.5	1.9	1.7	3.7	4.6	3.3	3.8	2.6	7.7	1.4
2010 Feb	3.0	1.4	1.2	3.7	4.2	2.9	4.2	3.0	7.8	2.4
2010 Mar	3.4	1.8	1.6	4.4	4.8	3.5	5.0	3.7	10.5	4.4
2010 Apr	3.7	2.0	1.9	5.3	5.4	3.9	5.9	4.5	12.8	6.3
2010 May	3.4	1.7	1.6	5.1	5.1	3.8	5.5	4.4	11.7	7.2
2010 Jun	3.2	1.6	1.5	5.0	5.0	3.8	5.1	5.0	10.6	7.1
2010 Jul	3.1	1.4	1.3	4.8	4.8	3.5	5.0	4.7	10.8	7.6
2010 Aug	3.1	1.4	1.3	4.7	4.7	3.4	4.7	4.6	8.7	6.6
2010 Sep	3.1	1.5	1.4	4.6	4.6	3.4	4.4	4.6	9.5	6.4

Notes

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.

4 These derived series replace those previously shown.

Notes to tables

Identification (CDID) codes

The four-letter identification code at the top of each data column is the ONS reference for this series of data on our time series database. Please quote the relevant code if you contact us requiring any further information 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 as shown. Although figures may be given in unrounded form to facilitate the calculation of percentage changes, rates of change etc by users, 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 (less than half the final digit shown)
P	provisional
—	break in series
R	revised
r	series revised from indicated entry onwards

Labour market statistics 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 force summary table

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

Weblink: www.statistics.gov.uk/StatBase/Product.asp?vlnk=14692

Title	Frequency of update
1. UK economic accounts	
Weblink: www.statistics.gov.uk/elmr/downloads/elmr1.pdf	
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 Index of Services	M
2. Selected labour market statistics	
Weblink: www.statistics.gov.uk/elmr/downloads/elmr2.pdf	
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 weekly earnings - total pay	M
2.16A Average weekly earnings - bonus pay	M
2.17 Average weekly earnings - regular pay	M
2.18 Productivity and unit wage costs	M
2.19 Regional labour market summary	M
2.20 International comparisons	M
2.21 Labour disputes	M
2.22 Vacancies by size of enterprise	M
2.23 Vacancies by industry	M
2.24 Redundancies: levels and rates	M
2.25 Redundancies: by industry	Q
2.27 Employment levels by country of birth and nationality	M
2.28 Working age employment rates by country of birth and nationality	Q
2.29 Lone parent claimants of Jobseekers Allowance by age of youngest child	M
2.30 Key out of work benefits	M
2.31 Production industry employee jobs	M
2.32 Public sector employment by industry	Q

3. Prices

Weblink: www.statistics.gov.uk/elmr/downloads/elmr3.pdf

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

4. Selected output and demand indicators

Weblink: www.statistics.gov.uk/elmr/downloads/elmr4.pdf

4.01 Output of the production industries	M
4.02 Construction output	M
4.03 Construction new orders	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 Retail sales and credit business	M

5. Selected financial statistics

Weblink: www.statistics.gov.uk/elmr/downloads/elmr5.pdf

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 MFI lending to UK residents	M
5.08 Interest rates and yields	M
5.09 A selection of asset prices	M

6. Further labour market statistics

Weblink: www.statistics.gov.uk/elmr/downloads/elmr6.pdf

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 Workforce jobs by industry	M
6.05 Employee jobs by industry	Q
6.06 Workforce jobs by region and industry	Q
6.07 Key productivity measures by industry	Q
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 (discontinued Q4 2007)	Q
6.12 Average Earnings Index by industry: excluding and including bonuses	M
6.13 Average Earnings Index: effect of bonus payments by industry	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 and unemployment	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 Annual
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.nomis.web
- Labour Force Survey tables are available from www.statistics.gov.uk/statbase/Product.asp?vlnk=11771
- Annual Survey of Hours and Earnings data are available from www.statistics.gov.uk/StatBase/Product.asp?vlnk=13101

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- Labour productivity measures from the ABI: 1998 to 2007
- The economic impact of tourism across regions and nations of the UK
- Regional economic indicators with a focus on gross disposable household income

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- Healthcare productivity
- Methods explained: Real time data

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- Measuring investment in intangible assets in the UK: results from a new survey
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- Services Producer Price Indices – First quarter 2010

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- There's more to life than GDP but how can we measure it?
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- Multi–factor productivity: estimates for 1994 to 2008
- Revisions to Workforce Jobs

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- The experimental tourism satellite account for the United Kingdom (E–UKTSA)
- A proposed methodology for nowcasting the demand and supply estimates of tourism activities
- Estimating regional exports of services trade for the UK
- Total public service output, inputs and productivity
- Quality adjusted labour input: new estimates for 1993 to 2008
- Volume of capital services: annual estimates for 1950 to 2008 and new quarterly series

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List is provisional and subject to change

- Enhancing the coverage of financial sector activity
- Financial statistics for policy – an update
- Measuring the green economy
- Googling the present
- Okun's Law: the relationship between output and unemployment in the UK
- USA or Eurozone: where lies the UK's special relationship?
- Standard Industrial Classification 2007 update
- The rise of China and its impact on UK trade
- On–call workers in the labour market
- Small and medium enterprises