

Editorial

Welcome to this sample issue of *Economic & Labour Market Review* (ELMR). ELMR is a new monthly flagship journal from the Office for National Statistics (ONS) which brings together features from two of our best-known existing journals, *Economic Trends* and *Labour Market Trends*. Both of these journals will cease publication after their December issues this year.

ELMR will be an unparalleled source of up-to-date and relevant commentary, analysis and data for users of both economic and labour market statistics, and will provide access to the wealth of official UK economic and labour market data available on the National Statistics website. It will draw on the full range of economic and labour market analysis undertaken by ONS and include a mix of feature articles, a regular economic review, key indicators, independent forecasts, news on statistical developments, a small set of time series data, and information on publications, data releases and online data.

ELMR has been developed through a joint project across several areas within ONS, the original concept coming from a publications portfolio review in 2004. An extensive, specially commissioned, research study was subsequently conducted with users and key stakeholders of both *Economic Trends* and *Labour Market Trends*. The range and style of content for ELMR have been developed based on their views and opinions. As a result, most economic and labour market data will now be available online, with the current extensive range of tables published on the National Statistics website and accessible via an online directory. A prototype copy was presented at a number of focus groups held at the beginning of this year.

This sample issue contains a selection of features that will appear in the production journal: a short version of the Economic Review; a subset of key indicators; a feature article on ICT deflation and productivity measurement; a subset of the full directory of tables; and a tear-out order form.

The first edition of ELMR is scheduled for publication in January 2007.

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Economic Review

September 2006

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Summary

These pages are a sample of what to expect in the monthly Economic Review. A round-up of all that's happening in the UK economy and labour market, the Review covers important developments in areas such as employment and unemployment; productivity and earnings; prices; financial markets; and trade and the balance of payments. GDP growth in the second quarter of 2006 was 0.8 per cent, up from 0.7 per cent in the previous quarter. Growth was mainly driven by services, led by retail sales. This was offset in part by negative growth in industrial production. From the demand perspective, consumer and government expenditure rebounded in 2006 quarter two. The labour market showed a mixed but overall weakening picture. Business investment rose, continuing the trend from quarter one. Producer output price inflation and input price inflation fell in July; consumer price inflation also fell but remains above the Government's 2 per cent target. Public sector net debt continued to rise in 2006 quarter two and the UK trade deficit narrowed.

also showed a significant fall in quarter two, at 0.2 per cent compared with 0.7 per cent in 2006 quarter one. This was mainly due to exports and a sharp contraction in public spending.

In contrast, growth in the two biggest mainland EU economies – Germany and France – showed a strengthening picture. German GDP growth was 0.9 per cent in 2006 quarter two, an acceleration from 0.7 per cent growth in quarter one, with investment the main driver. French GDP growth accelerated markedly in 2006 quarter two, rising by 1.1 per cent, up from 0.5 per cent in quarter one. Private consumption expenditure was the main engine of growth. There was also a rebound in investment growth following weak growth in the previous quarter. Italy in contrast recorded a modest growth rate of 0.5 per cent, down from 0.7 per cent in the previous quarter.

OUTPUT

Services sector drives economic growth

Second quarter growth in 2006 is being driven by strong growth in the services sector. Some of this is being offset by decelerating growth in construction and falls in industrial production.

Construction is estimated to have grown by 0.5 per cent, following growth of 0.9 per cent in the previous quarter. Comparing the same quarter a year ago, output fell by 0.4 per cent after a 0.6 per cent fall in the previous quarter. External surveys of construction tell a mixed picture compared with official statistics. The CIPS survey echoes the subdued growth. The RICS survey reports that construction market activity accelerated in 2006 quarter two for the third successive quarter. The workload balance was plus 24, up from plus 23 in the previous quarter.

Total output from the production industries fell by 0.2 per cent in 2006 quarter two, reversing some of the expansion of 0.8 per cent in the previous quarter. The output of the electricity, gas and water supply industries fell by 3.0 per cent after virtually flat growth in the previous quarter. Mining and quarrying (including oil and gas extraction)

GROSS DOMESTIC PRODUCT

Second quarter growth of 0.8 per cent

GDP growth in the second quarter of 2006 is estimated at 0.8 per cent, unchanged from the preliminary estimate. This is up from 0.7 per cent in the previous quarter. The annual rate of growth rose by 2.6 per cent, up from 2.3 per cent in the previous quarter (Figure 1).

OTHER MAJOR ECONOMIES

Strong growth in Germany and France

Preliminary data for 2006 quarter two are available for the other major OECD economies and show a mixed picture of the world economy. US GDP growth showed a weakening, at 0.6 per cent, a marked deceleration from 1.4 per cent in quarter one. This slowdown was mainly due to a fall in domestic demand. Japan's growth

Figure 1

Gross Domestic Product

Quarterly growth (per cent)

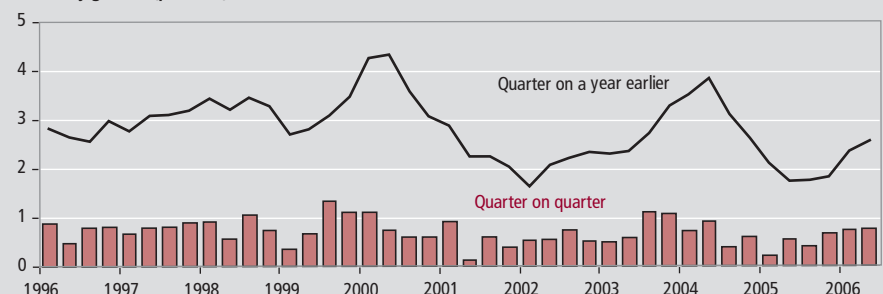


Figure 2
Manufacturing output

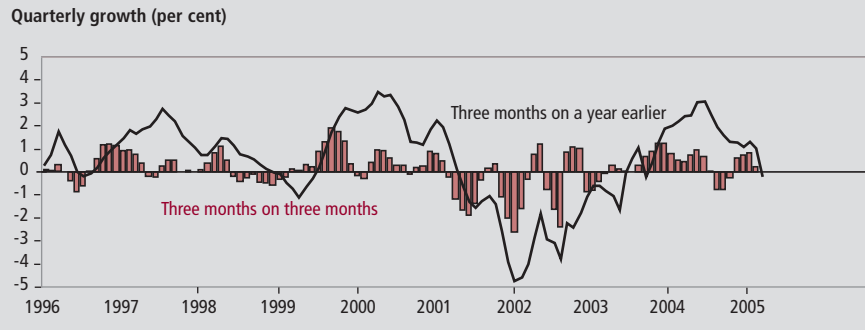
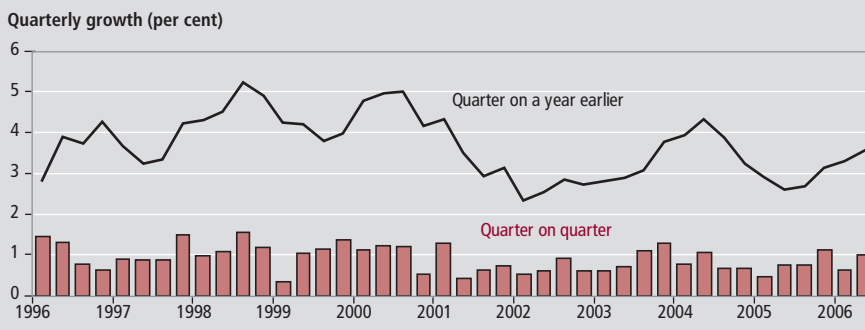


Figure 3
Services output



contracted by 4.0 per cent following growth of 0.5 per cent in the previous quarter, mainly due to maintenance shutdowns. This was offset by modest growth in output of the manufacturing sector, which grew by 0.8 per cent, compared with 0.9 per cent in the previous quarter (Figure 2). The output of the agriculture, forestry and fishing industries fell by 1.2 per cent after growth of 0.7 per cent in 2006 quarter one.

External surveys of manufacturing for 2006 quarter two show a generally mixed picture. The CIPS average headline index for manufacturing for July shows continued robust growth, at 53.8. The BCC and CBI report an overall weak picture in 2006 quarter two. The CBI in its latest August Industrial Trends Survey report that manufacturers' order books were at their best for 20 months, led by improving domestic demand.

Overall, the service sector, by far the largest part of the UK economy and the main driver of UK growth recently, accelerated in 2006 quarter two. Growth was 1.0 per cent compared with 0.7 per cent in the previous quarter (Figure 3). Within the sector, growth was broad based. Business services and finance continued to grow strongly; growth was 1.3 per cent in

2006 quarter two compared with 1.0 per cent in the previous quarter. The output of the distribution, hotels and catering industries also saw rapid growth during this period of 0.8 per cent, a jump from 0.5 per cent in the previous quarter.

The external surveys on services showed a more mixed picture in July 2006. The CIPS headline balance was a robust 57.9. The CBI report that consumer services' firms saw a rise in business volumes while professional and business firms saw a fall. The BCC reported an improvement in domestic balances but a worsening in export balances.

HOUSEHOLD DEMAND

Consumer spending strengthening

Household consumption expenditure growth strengthened in 2006 quarter two to 1.0 per cent compared with 0.3 per cent in the previous quarter. Growth compared with the same quarter a year ago was 2.4 per cent, up from 1.5 per cent in the previous quarter (Figure 4). Growth has generally been subdued since the last quarter of 2004, partly due to weak retail sales. The bounce back in the latest quarter is mainly due to buoyant retail sales, possibly due to the effects of the World Cup. The increase in expenditure is due to sharp increases in both durable and semi-durable goods which rose by 3.8 and 3.2 per cent respectively in 2006 quarter two. It remains to be seen whether household expenditure can maintain its upward momentum given the dropping out of the World Cup factor.

The latest available retail sales figures, for July, show a continued robustness despite a slight fall from June (Figure 5). According to these figures, the volume of retail sales in the three months to July 2006 was 1.8 per cent higher than in the previous three months. This followed growth of 2.0 per cent in the three months to June. On an annual basis, retail sales grew by 3.9 per cent in the three months to July compared with 3.6 per cent in the three months to June.

External surveys for retail sales echo the official picture. The CBI, in its quarterly Distributive Trades survey, report in August that retailers achieved their fastest year-on-year growth rate for 20 months. The sales balance was plus 12. The British Retail Consortium also report a similar story; like-for-like retail sales increased by 3.4 per cent in July compared with 2.3 per cent in June.

Figure 4
Household demand

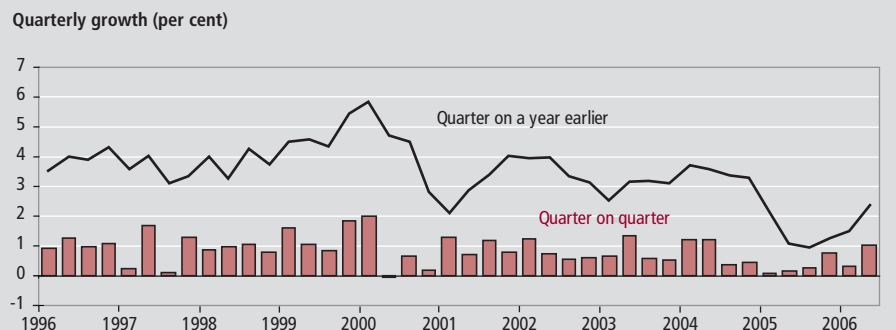
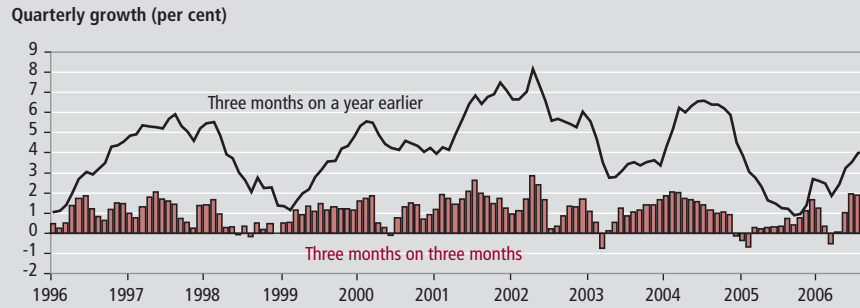


Figure 5
Retail sales



Indicators for consumer expenditure appear to be uncertain for 2006 quarter three but may be tending towards the downside. Oil and petrol prices are still hovering at relatively high levels and this may be leading to a displacement of expenditure on consumption goods. The labour market shows a mixed but overall weakening picture with subdued wage growth. Indices of consumer confidence such as MORI and GfK generally report a negative picture in the second quarter and in the beginning of the third quarter of 2006. The effects of actual and potential increases in utility and council tax bills may decrease real disposable income, thereby dampening household expenditure. However, the main impact on consumer expenditure may come from the August increase in interest rates from the Bank of England which rose by 0.25 percentage points to 4.75 per cent. This rise implies an increase in borrowing costs for both secured and unsecured borrowing.

EMPLOYMENT

Working-age employment rate down

The latest Labour Force Survey employment figures show that the working-age employment rate in May to July 2006 stood at 74.6 per cent, down 0.1 percentage points from the previous three months. By sex, the employment rate for men was 78.8 per cent, down 0.1 percentage points from the previous quarter, while the employment rate for women was unchanged at 70.1 per cent. The overall trend in the working-age employment rate may be starting to rise.

VACANCIES

Vacancies rise by 14,800

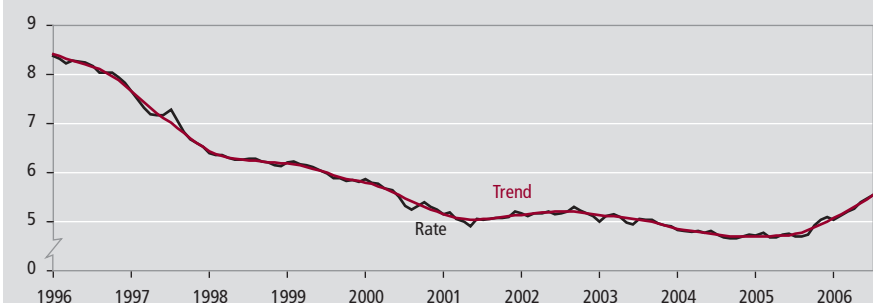
The number of job vacancies is regarded as a leading indicator of the demand for labour. Job vacancies rose by 14,800 in the three months to August 2006 compared with the previous three months and fell by 7,400 compared with the same period last year. The number of vacancies in the three months to August stood at 608,800 and the latest data suggest that the trend in the number of vacancies remains broadly flat.

UNEMPLOYMENT

Increasing trend

The latest unemployment figures for May to July 2006 suggest that the trend in the unemployment rate continues to increase. The rate for people aged 16 and over was up 0.3 percentage points over the quarter, to stand at 5.5 per cent, the last time it was higher being March to May 2000 (Figure 6).

Figure 6
Unemployment rate



By age, the rise in the latest unemployment figures was mainly among 18 to 24 year olds, where it increased by 50,000 over the quarter, or 10.5 per cent. The unemployment rate for 25 to 34 year olds rose from 4.7 to 5.0 per cent, while for 35 to 49 year olds it increased from 3.5 to 3.7 per cent, and for 18 to 24 year olds from 11.9 to 12.9 per cent.

EARNINGS

Earnings growth up slightly

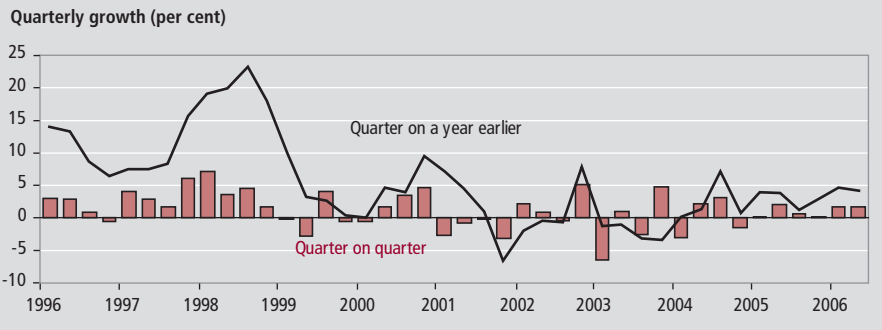
The latest whole economy (including bonuses) annual growth rate in earnings stood at 4.4 per cent in the three months to July – up from 4.3 per cent in the three months to June. This slight pick up was due to stronger earnings growth in the public sector, offset by weaker growth in manufacturing and production in general.

BUSINESS DEMAND

Business investment accelerates

Total investment on an annual basis accelerated in 2006 quarter two to 6.8 per cent from 5.0 per cent in the previous quarter. Business investment (Figure 7) for the second quarter of 2006 has somewhat continued the momentum from the previous quarter, showing a strengthening picture, with growth of 1.7 per cent the same as in the previous quarter. On an annual basis it was 4.2 per cent, down from 4.6 per cent in the previous quarter. The annual growth was broadly driven, led by an increase in dwellings investment.

Figure 7
Total fixed business investment



GOVERNMENT DEMAND

Budget deficit falls

Government final consumption expenditure accelerated in 2006 quarter two to 1.0 per cent, from 0.1 per cent in the previous quarter. Growth quarter on quarter a year ago was 2.0 per cent, slightly down from 2.1 per cent in the previous quarter.

The latest figures on the public sector finances report in the current financial year to July 2006 and show an improvement. Over the financial year April to July 2006/07, the current budget was in deficit by £4.4 billion compared with one of £5.7 billion for financial year April to July 2005/06. Over the financial year to July 2006/07, net borrowing was £10.0 billion; this compares with net borrowing of £10.3 billion in the same period of 2005/06.

PRICES

Consumer price inflation falls to 2.4 per cent

The divergence between input and output price inflation for producers has continued in 2006 quarter three from 2006 quarter two, but has narrowed compared with June 2006. Input price grew by 9.7 per cent in the year to July, down from 11.2 per cent in June. The main driver remains energy, particularly oil prices, although these eased further in July, contributing partly to the slowdown in input prices. Producer output inflation, which has been considerably lower, rose by 2.8 per cent in July, down from 3.4 per cent in June.

Growth in the consumer prices index (CPI) – the Government’s target measure of inflation – fell to 2.4 per cent in July, down

from 2.5 per cent in June, but still continued to exceed the 2 per cent target. The largest downward effect came from household equipment and routine maintenance, due to special offers in July for furniture and furnishings being greater than a year ago, particularly for some items of bedroom and lounge furniture, following larger than usual price increases in June. There were also large downward effects from air fares and petrol prices which rose less than last year. The only large upward contribution to the CPI annual rate came from price changes for food and non-alcoholic beverages due to upward effects from fruit, dairy products and meat. The RPI remained unchanged in July at 3.3 per cent; the RPIX was 3.1 per cent, unchanged from June (Figure 8).

TRADE AND BALANCE OF PAYMENTS

Current account deficit narrows

The publication of the latest quarterly Balance of Payments shows that the current account deficit narrowed in 2006 quarter one to £8.3 billion from one of £9.1 billion in the previous quarter. As a proportion of GDP, the deficit fell to 2.6 per

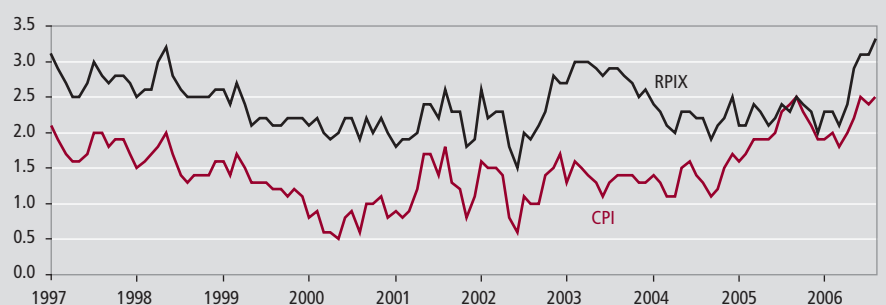
cent from 2.9 per cent in 2005 quarter four. The narrowing of the deficit was accounted for by a higher surplus on investment income, partially offset by a higher deficit on trade in goods.

The UK continues to have a large trade deficit in goods with imports rising faster than exports.

The deficit in the trade in goods narrowed to £12.2 billion in 2006 quarter two from £12.6 billion in the previous quarter. Exports rose by £7.7 billion while imports rose by £5.1 billion. In terms of growth, exports increased by 7.0 per cent over the quarter and imports by 6.2 per cent.

However, these figures need to be treated with caution because as much as half of the growth reflects distortions as a result of VAT Missing Trader Intra-Community (MTIC) Fraud. Changes to the pattern of trading associated with VAT MTIC fraud make it difficult to analyse trade figures as increases inflate both imports and exports. EU import figures for trade in goods include adjustments made by ONS to allow for the impact of this fraud.

Figure 8
Month on month a year earlier growth (per cent)



Key Indicators

The data in this table support the Economic Review by providing some of the latest estimates of key indicators. They are a subset of the key indicators that will be available.

Seasonally adjusted unless otherwise stated

	Source CDID	2004	2005	2005 Q4	2006 Q1	2006 Q2	2006 May	2006 Jun	2006 Jul
GDP growth - chained volume measures (CVM)									
Gross domestic product at market prices	ABMI	3.3	1.9	0.7	0.7	0.8	..	..	..
Output growth - chained volume measures (CVM)									
Gross value added (GVA) at basic prices	ABML	5.9	4.1	2.5	0.8	2.2	..	..	..
Industrial production	CKYW	0.8	-1.8	-0.7	0.8	-0.2	0.3	-0.1	0.1
Manufacturing	CKYY	2.0	-1.0	-0.9	0.9	0.6	0.6	0.2	0.2
Construction	GDQB	4.0	1.3	-0.3	0.9	0.5	..	..	..
Services	GDQS	3.9	2.8	1.1	0.6	1.0	..	..	..
Oil and gas extraction	CKZO	-8.4	-9.7	0.3	-0.1	-4.7	-1.6	-3.8	0.4
Electricity, gas and water supply	CKYZ	1.1	-0.3	0.0	0.1	-3.0	-0.8	0.8	0.4
Business services and finance	GDQN	5.1	4.1	1.4	1.0	1.3	..	..	..
Household demand									
Retail sales volume growth	EAPS	5.9	2.1	1.7	-0.5	2.0	0.7	0.7	0.0
Household final consumption expenditure growth (CVM)	ABJR	3.5	1.3	0.8	0.3	1.0	..	..	..
GB new registrations of cars (thousands) ¹	BCGT	2,599	2,443	474	662	570	189	218	169
Labour market^{2,3}									
Employment: 16 and over (thousands)	MGRZ	28,409	28,676	28,769	28,896	28,938	28,899	28,938	28,975
Employment rate: working age (%)	MGSU	74.8	74.7	74.5	74.7	74.6	74.6	74.6	74.6
Workforce jobs (thousands)	DYDC	30,572	30,810	30,926	30,993	31,058	..	..	..
Total actual weekly hours of work: all workers (millions)	YBUS	910.9	921.3	922.0	924.6	926.9	923.9	926.9	926.7
Unemployment: 16 and over (thousands)	MGSC	1,426	1,425	1,541	1,586	1,677	1,648	1,677	1,699
Unemployment rate: 16 and over (%)	MGSX	4.8	4.7	5.1	5.2	5.5	5.4	5.5	5.5
Claimant count (thousands)	BCJD	854	862	900	923	950	951	955	957
Economically active: 16 and over (thousands)	MGSF	29,835	30,101	30,310	30,482	30,615	30,547	30,615	30,673
Economic activity rate: working age (%)	MGSO	78.6	78.5	78.6	78.8	79.0	78.9	79.0	79.1
Economically inactive: working age (thousands)	YBSN	7,848	7,934	7,952	7,866	7,821	7,848	7,821	7,790
Economic inactivity rate: working age (%)	YBTL	21.4	21.5	21.4	21.2	21.0	21.1	21.0	20.9
Vacancies (thousands)	AP2Y	..	..	..	..	..	594.0	598.4	603.5
Redundancies (thousands)	BEAO	128	139	143	144	139	147	139	142
Productivity and earnings growth⁴									
Whole economy productivity growth (output per worker)	A4YM	2.2	1.0	0.9	0.3	..	..	..	..
Manufacturing productivity growth (output per job)	LNNX	6.3	2.5	-0.2	1.9	1.2	0.6	0.4	0.3
GB average earnings growth (including bonuses) ³	LNNC	..	..	3.6	4.2	4.3	4.1	4.3	4.4
GB average earnings growth (excluding bonuses) ³	JQDY	..	..	3.7	3.9	3.8	3.8	3.8	3.7
Unit wage costs growth: whole economy	LNNK	1.2	2.7	0.7	0.5	..	..	..	..
Unit wage costs growth: manufacturing	LNNQ	-2.5	1.0	1.5	-0.2	-0.1	-0.9	0.1	0.6
Business demand									
Business investment growth (CVM)	NPEL	2.3	3.0	0.1	1.7	1.7	..	..	..
Government demand									
Government final consumption expenditure growth	NMRY	3.2	2.6	0.2	0.1	1.0	..	..	..
Prices (12 monthly percentage change – except oil prices)									
Consumer prices index ¹	D7G7	1.3	2.1	2.1	1.9	2.3	2.2	2.5	2.4
Retail prices index ¹	CZBH	3.0	2.8	2.4	2.4	3.0	3.0	3.3	3.3
Retail prices index (excluding mortgage interest payments)	CDKQ	2.2	2.3	2.3	2.2	2.8	2.9	3.1	3.1
Producer output prices (excluding FBTP ⁵)	EUAA	1.9	2.1	1.5	1.9	2.4	2.4	2.8	2.5
Producer input prices	EUAB	3.9	11.8	13.6	14.4	13.5	13.9	11.5	9.6
Oil price: sterling (£ per barrel)	ETXR	20.7	30.4	32.9	35.8	38.6	38.0	37.9	40.3
Oil price: dollars (\$ per barrel)	ETXQ	37.9	55.0	57.6	62.7	70.5	71.0	69.9	74.3

Notes

1 Not seasonally adjusted.

2 Annual data are averages of calendar quarters, except for redundancies, which are the average of April to June.

3 Monthly data are for the three months ending in the month shown.

4 As with other sections of this table, the growth rates shown are annual growth, quarterly growth and monthly growth except for average earnings.

5 FBTP: food, beverages, tobacco and petroleum.

FEATURE

Gavin Wallis
Office for National Statistics

ICT deflation and productivity measurement

Summary

Constant price productivity growth is generally the object of interest for productivity analysis. The rapid value added growth in the ICT sector relative to the whole economy, the rapid growth in ICT capital formation, and the remarkable and rapid advances in the characteristics and capabilities of ICT products, mean that reliable productivity analysis depends strongly on good measures of deflation for ICT products. These ICT deflators need to reflect pure price change, so measured prices need to be adjusted for quality change. This article looks at the impact and importance of ICT deflation that accounts for quality change on the measurement of productivity, with examples and analysis drawn from recent Office for National Statistics (ONS) work. The article also looks at the development of input measures for multifactor productivity work, highlighting the importance of good quality deflators for ICT capital.

Measures of productivity growth are commonly used as core indicators of economic growth, prosperity and competitiveness. The simplest definition of productivity, and the one most commonly used, is the ratio of a volume measure of output to a volume measure of input. This simple definition does, however, conceal the various types of productivity measures that exist. A common distinction is between single-factor productivity measures, which relate output to a single measure of input, and multifactor productivity (MFP), which relate output to a set of inputs. In practice, the most common measure of productivity used is labour productivity, partly due to the difficulty of obtaining good measures of capital input. When capital inputs can be measured, long-term trends in capital-labour MFP often becomes the productivity measure of choice, as it is regarded as being a good measure of the long-term growth opportunities of an economy and also an indicator of inflationary pressures.

Whichever productivity measure we choose to focus on, it is clear that constant price productivity growth is the object of interest. We need both input and output to be measured in volume terms, meaning that good deflation becomes an essential part of accurate productivity measurement. This is particularly important when measuring productivity in high tech industries, which are generally intense users of Information and Communication Technology (ICT), where price change can be rapid.

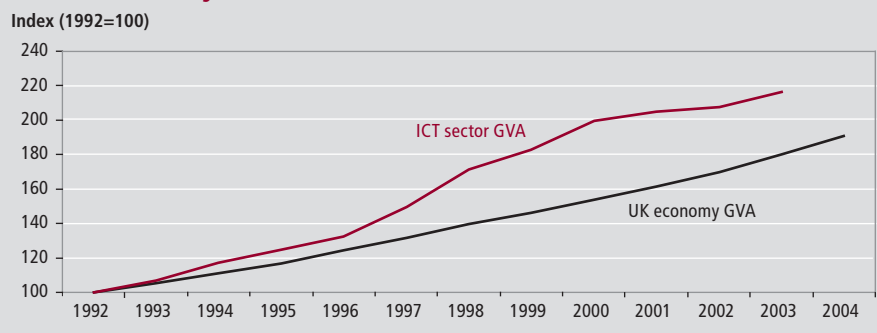
This article focuses on what are probably the two main challenges for statisticians and economists wishing to produce accurate and policy-relevant measures of productivity. These two challenges are the development of good price indices for the measurement of the volume of output and improved measurement of capital input, especially ICT capital. ICT deflation clearly plays a big part in both these challenges.

Growth in ICT

The rapid growth in ICT production and ICT use in major industrialised countries has been well documented. The contribution ICT makes to GDP and productivity growth needs to be considered in three different ways. The first is the direct effect on gross value added (GVA) of the ICT-producing industries. The second is the indirect effect of ICT investment on the GVA of ICT-consuming industries. The final consideration in terms of productivity analysis is the impact that ICT use has on the volume of capital input.

Figure 1 looks at the first effect and shows the growth of ICT sector GVA compared with the growth of UK economy GVA. The definition of the ICT sector used here is the one agreed by the OECD Committee for Information, Computer and Communications Policy (ICCP) in September 1998 and outlined in OECD (2002). This definition covers both goods, such as office machinery and communication equipment, and services, such as telecommunication and computer services.

Figure 1
Gross value added (GVA) at current basic prices: ICT sector relative to the UK economy



Source: Office for National Statistics, United Kingdom Input-Output Analyses, 2006 Edition

Figure 1 shows that, throughout the 1990s, ICT sector GVA grew rapidly compared with the growth in UK GVA. This illustrates the importance of ICT production and investment in driving UK economic and productivity growth. The problem with Figure 1 is that it shows GVA at current basic prices. To assess the full contribution of the ICT sector to productivity growth, we need a constant price output measure. Figure 1 is based on UK input-output data, which are currently only available at current prices. As noted in OECD (2001a), the development of constant price input-output tables is an important step in producing more reliable productivity measures, especially at the industry level.

Given what we know about the rapid fall in the prices of ICT products over the period 1990 to 2004, Figure 1 is understating the importance of the ICT sector in terms of economic and productivity growth. Some GVA volume measures are available for the UK to support this conclusion. They are not available at the disaggregated level required to identify the ICT sector, but are available for broad service industries. Figure 2

shows GVA volume measures for selected service industries and also for services as a whole. Real estate, renting and business activities includes two of the identified ICT-producing industries defined in OECD (2002); ‘renting of office machinery and equipment including computers’ and ‘computers and related activities’ (UK input-output group names are used here). Post and telecommunication includes another of the key ICT-producing sectors ‘telecommunications’.

It is clear from Figure 2 that volume growth in the service industries which include ICT producers, such as post and telecommunication, has been very rapid compared with general services growth and also relative to other service industries.

It is important to be aware that the broad service industries shown in Figure 2 encompass both ICT-producing industries and also ICT-consuming industries. This brings us to the second way in which ICT makes a contribution to GDP and productivity growth: the indirect effect of ICT investment on the GVA of ICT-consuming industries. Figure 2 shows that financial intermediation has also grown more quickly than services in general.

Financial intermediation is one of the main ICT-consuming industries and is an industry that invested heavily in ICT during the 1990s. Recent work using firm level microdata (Bloom *et al* (2005), Clayton (2005), Sadun (2005)) has shown that industries and sectors that intensively use ICT have enjoyed more rapid productivity growth. This suggests that the indirect effect of ICT investment is contributing significantly to volume growth in some industries.

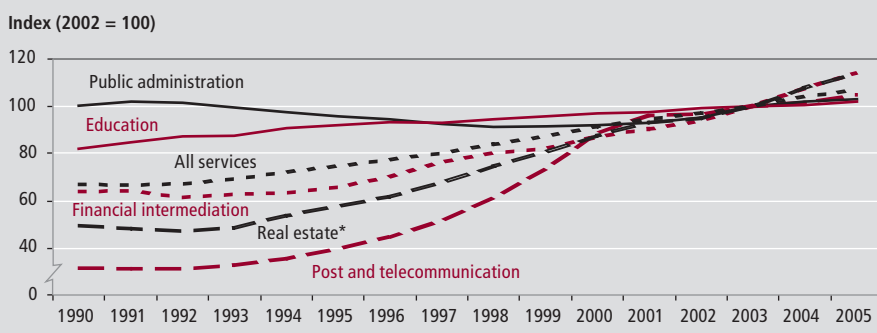
The discussion so far has focused on the growth of ICT in terms of its effect on output. In terms of long-run productivity growth and productivity measurement, it is important to also consider how the rapid growth in ICT has impacted on the volume of capital input. The starting point is understanding the importance of ICT investment relative to total investment in the economy. Measurement of the volume of capital input is discussed below.

Figure 3 shows ICT gross capital formation relative to total gross capital formation. The rapid investment in ICT in the late 1990s is obvious. In 1992, ICT accounted for just over 13 per cent of total gross capital formation. By 2000, this had increased to just below 21 per cent. Since 2000 there has been an obvious turnaround with ICT accounting for just over 14 per cent of total gross capital formation in 2004. The common explanation for this pattern is that firms over invested in ICT in the run-up to the year 2000, due to fears over the well-publicised ‘millennium bug’. Such overinvestment would account for the weaker ICT investment growth after 2000.

Another way to look at the importance of ICT is at its share of operating surplus (or profit) over time. Figure 4 shows the composition of profit shares for the period 1950 to 2004 for the UK. These profit shares are taken from Wallis (2005), which reports capital services estimates for the UK.

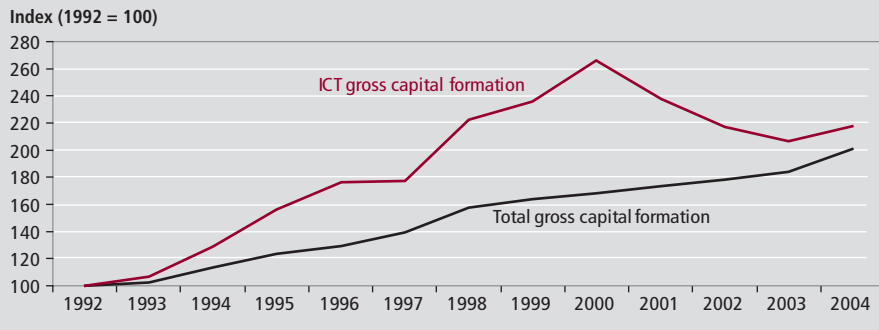
In Figure 4, only computers are identified as a separate asset, with other ICT assets not separately identified from plant and machinery. However, Figure 4 does show the rapid rise in the profit share of computers in recent years, from virtually zero in 1980–84 to around 10 per cent in the period 2000–04. This suggests that such ICT products have become an increasingly important part of capital input in the economy.

Figure 2
GVA chained volume measures for selected service industries



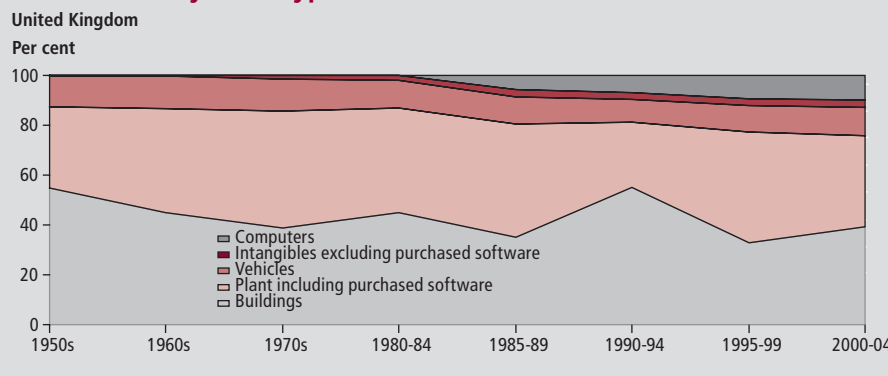
* Real estate, renting and business activities
 Source: Office for National Statistics

Figure 3
Gross capital formation: ICT relative to total



Source: Office for National Statistics, United Kingdom Input-Output Analyses, 2006 Edition

Figure 4
Profit shares by asset type, 1950–2004



Source: Office for National Statistics, Wallis (2005)

ICT deflation and quality change

The purpose of a deflator is to adjust nominal (current price) data into real (constant price) data. A traditional deflator (price index) is a matched model index using price quotes that track the price of the same good or service over time. The remarkable and rapid advances in the characteristics and capabilities of ICT present two problems in terms of price measurement. The first is how to deal with quality change and the second is how to account for the introduction of new goods and services. These two problems are clearly not mutually exclusive, as the distinction between a ‘new’ good and a new (and better quality) variety of an existing good is not clear.

For the purposes of deflation we are interested in the ‘pure price change’. Observed prices will incorporate both pure price change as well as quality change (observed price change = pure price change + quality change). For many goods and services, quality change is either very slow or non-existent and so observed price change coincides with pure price change. For many ICT goods, quality change is

rapid, so to get a deflator that measures pure price change, we need to adjust observed price change for quality changes.

The importance of quality adjusting ICT deflators is most evident in computer hardware. Holdway (1999) reports that between 1993 and 1998, observed prices from desktop computers were fairly stable, but during this time CPU speed (MHz) increased by 1,263 per cent, system memory increased by 1,500 per cent, hard drive capacity increased by 3,700 per cent, and monitor size increased by 13 per cent. It is clear that, although observed prices fell very little, pure prices, once adjusted for rapid quality improvements, fell much more rapidly.

There are various ways of quality adjusting deflators, including matched models and hedonic regressions, but the underlying objective of all of these methods is to ensure that the estimated deflator reflects pure price change only. An accompanying article to this, Fenwick (2006), describes the adoption and use of hedonic techniques for the quality adjustment of computer equipment in the UK consumer prices index (CPI) and producer prices index (PPI).

At this point it is worth mentioning double deflation. If we are interested in accurately measuring the impact of ICT on productivity and output, we need to ensure that both our output and input deflators are reflecting pure price change. Many ICT deflators fall quite rapidly and this increases the volume of real output for ICT-producing industries. For an industry that is a consumer of ICT, GVA and productivity would be inflated if the input price series for ICT were not quality adjusted. For this reason, both input and output price indices for ICT goods and services should be quality adjusted, a process known as double deflation. This is particularly important for productivity analysis as it ensures consistency between GDP and industry output.

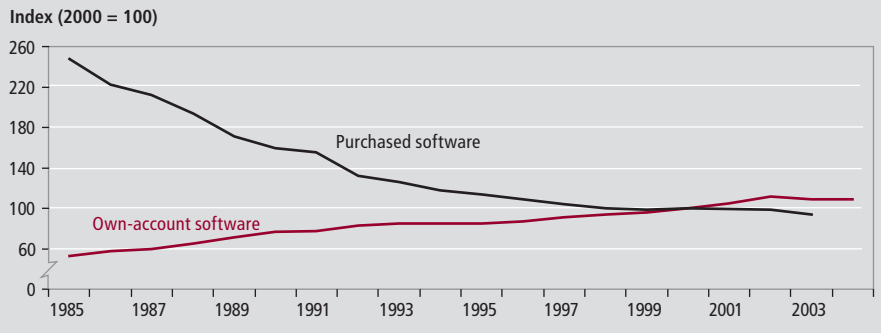
Measuring the volume of output

The basic problem with using deflators that do not reflect pure price change, but also incorporate some quality improvement, is that volume measures of output will be underestimated. This will mean that traditional measures of productivity growth, such as labour productivity, will also be underestimated. Obviously this is particularly important for ICT-producing industries. For example, the quality adjusted producer price index (PPI) for computers and other data processing equipment has fallen from 385.8 in 1992 to 47.5 in 2004, where 2000 = 100.

Vaze (2001) presented ONS work on the impact of different treatments of ICT goods and services on measures of UK economic growth. It primarily considered the impact of using different price indices for ICT on UK growth. The analysis was conducted at a time when ONS did not use hedonic methods to quality adjust price indices. Using US ICT deflators, the analysis highlighted the sensitivity of economic growth to the choice of ICT deflator and also to the method used to adjust ICT deflators for quality change. UK growth was estimated to be 0.1 per cent per year higher over the period 1992 to 1998 when using the US ICT deflator.

Vaze (2001) also highlighted the importance of correctly identifying where the various ICT goods and services that are available appear in the National Accounts aggregates as mentioned previously. The output of the ICT sector falls partly in capital formation, which adds to GDP, and partly in intermediate consumption, which

Figure 5
Purchased software and own-account software deflators



Source: Office for National Statistics

does not. The correct allocation between the two categories is necessary to avoid biases on the level and growth of GDP.

The UK adopted hedonic techniques to quality adjust computer equipment in 2003, as described in Ball and Allen (2003), and clearly this will have improved the measurement of the volume of output for the UK, especially for the ICT-producing industries. More recent work has looked at measures of software investment in the UK and accompanying software deflators (Chamberlin and Chesson (2006)).

Estimating software deflators, for deflating both input and output, that reflect pure price change presents a unique challenge. This is because software investment takes three different forms:

- pre-packaged purchased software: off-the-shelf purchased software
- own-account software: software developed and used in-house
- custom software: purchased software that can be customised in-house to better meet user requirements

A quality adjusted deflator for the first type of software can be produced using standard methods, such as hedonics. Own-account is much more difficult and generally has to be based on wage costs of labour working on own-account production. A deflator for customer software is generally a weighted combination of the own-account and pre-packaged software deflators.

The own-account and purchased software deflators from Chamberlin and Chesson (2006) are shown in **Figure 5**. It should be noted that the purchased software deflator is based on the US software price index, rather than a direct estimate for the UK using hedonic techniques. This is due to a shortage of the necessary historical data.

The US software price index is quality adjusted. For detail about the construction of these deflators, see Chamberlin and Chesson (2006).

Figure 5 shows that the price of purchased software has fallen rapidly. This reflects the fact that the quality of purchased software has increased over time. The price of own-account software has shown a steady increase over the period shown. This illustrates the fact that it is based on the wage costs of labour working on own-account production. Own-account employees have enjoyed above average wage growth over the period. Figure 5 highlights both the importance and difficulty of measuring ICT deflation; the two different software deflators show very different patterns and these differences should be reflected within National Accounts aggregates for good productivity measurement.

The new estimates of software investment and software deflators in Chamberlin and Chesson (2006) are yet to be incorporated into the UK National Accounts, but they are expected to add around 1 per cent to GDP in current price terms. This will clearly have implications for the measurement of UK

productivity growth and the adoption of a quality adjusted price index for software will clearly be a step forward.

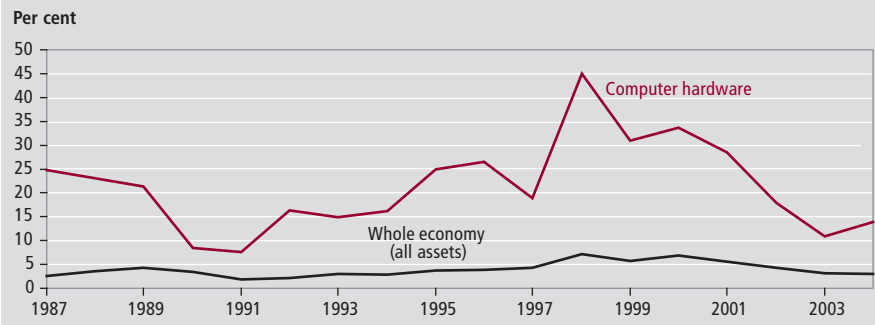
Measuring the volume of capital input

Quality changes are generally positive for ICT goods and services, so failure to use deflators that reflect observed price change rather than pure price change will lead to the underestimation of capital input. This will in turn lead to overestimation of productivity measures that include capital as a factor of production.

MFP is probably the most common productivity measure that includes capital as a factor of production. MFP apportions growth in output to growth in the factor inputs, capital and labour, and growth in a residual which represents technical change. MFP analysis requires good measures of labour and capital input. ONS has been developing these input measures as part of its wider development of productivity estimates (see Camus and Lau (2006)). Results for a quality-adjusted labour input measure can be found in Wallis *et al* (2005) and Goodridge (2006) and for capital services in Wallis (2005).

Capital services are the measure of capital input that is suitable for analysing and modelling productivity, including MFP analysis. This is because capital services are a direct measure of the flow of productive services from capital assets rather than a measure of the stock of those assets. In essence, capital services are a measure of the actual contribution of the capital stock of assets to the production process in a given year. This is in contrast to the wealth-based estimates of capital in the National Accounts, gross and net capital stock, which are essentially a measure of the value of the capital stock of assets.

Figure 6
Annual growth in capital services, computer hardware and whole economy (all productive assets), 1987–2004



Source: Office for National Statistics, Wallis (2005)

The use of capital services for productivity analysis, rather than gross or net capital stock, is particularly important in light of the growing use of ICT. The remarkable and rapid advances in the characteristics and capabilities of ICT capital mean that prices have fallen rapidly and also that the ICT capital stock depreciates quickly. This means that the rental rates for ICT capital, which under perfect competition reflect the marginal product of capital, are very high relative to other assets. ICT capital provides a large stream of capital services, relative to other assets, over a short period of time.

Figure 6 shows capital services growth for computer hardware over the period 1987 to 2004. Capital services from computer hardware grew rapidly over the whole period, with an average growth rate of over 21 per cent. This compares with an average of just 3.6 per cent for whole economy capital services. Annual growth is lowest in 1991, but at nearly 8 per cent is still comfortably above growth in capital services from other assets for this period. See Wallis (2005) for further results.

As shown in Wallis (2005), the time trend of capital services growth for computers also differs dramatically from other assets. The other asset types saw a fall in capital services growth in the early 1990s, associated with the recession in the UK. From Figure 6 it is clear that there is not a fall in capital services growth in the early 1990s for computers, and indeed growth in capital services actually shows a sustained increase in growth from 1991 to 2000. This is because the capital services estimates reflect both the increased quality of computer power as well as changes in the level of investment. For some of the years in the period 1991 to 2000, investment

declined year on year, but capital services still increased due to increased quality of computer power. Peak capital services growth occurs in 1998 with an annual growth rate of around 45 per cent.

When estimating capital services, the calculation of rental rates is key. The rental rate should reflect the marginal productivity of capital and, as such, the rental rate for computer hardware should reflect quality change, as long as the quality change has an impact on the marginal productivity of capital. With this in mind, it is informative to compare the rental rate for computers with the PPI for computers. We know that in terms of productivity measurement, if capital services are estimated correctly, then they provide the best measure of capital input and the rental rate reflects the price of that capital input. Figure 7 compares the rental rate for computer hardware with the PPI for computers.

Since 1997 the two series have moved very much in line. This is a good sign and suggests that the PPI for computers is an accurate measure of the price of capital input. Before 1997 the series diverge somewhat. Computers were first introduced into the PPI in 1996 and at the same time explicit methods of quality adjustment were introduced to replace the implicit methods used previously. With this in mind, it is not surprising that the PPI tracks the rental rate more closely after 1996. Calculation of capital services and rental rates is a complex modelling process and so we would not expect an exact fit of the PPI and the rental rate. However, the comparison in Figure 7 is informative as it suggests that better quality adjustment of deflators, which is a feature of the PPI for computers after 1996, and more so from 2003 onwards with the introduction of hedonics, does improve the accuracy of input deflators.

Conclusions

ICT products have become an increasingly important part of capital input in the economy and are making a major contribution to GDP and productivity growth. For accurate productivity measurement there is a need to ensure ICT deflators reflect pure price change. The remarkable and rapid advances in the characteristics and capabilities of ICT capital mean that pure prices have fallen rapidly. This means that measured prices need to be adjusted for quality change in order that both volume measures of output and input are accurate.

Using deflators that do not reflect pure price change, but also incorporate some quality improvement, will lead to volume measures of output being underestimated. This will mean that traditional measures of productivity growth, such as labour productivity, will also be underestimated. On the other hand, capital input will be underestimated leading to overestimation of productivity measures that include capital as a factor of production.

The simple conclusion is that reliable productivity analysis depends strongly on good measures of deflation for ICT products. The impact of using poor quality deflators for ICT products depends, however, on which of the various measures of productivity are being used.

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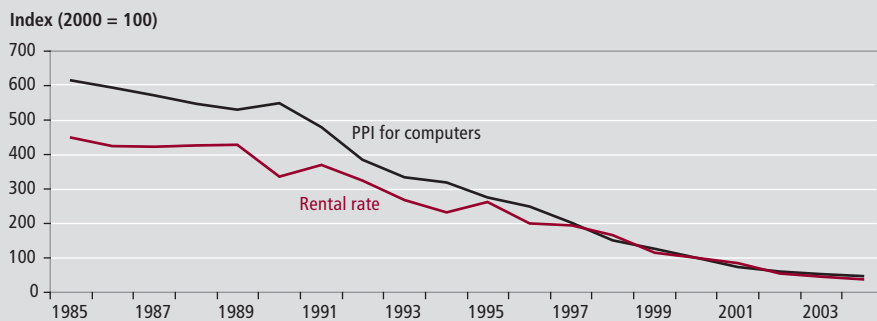
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Figure 7
Comparison of rental rate for computer hardware and quality adjusted PPI for computers



Source: Office for National Statistics

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Directory of Online Tables

This list is a subset of the online tables that will be available.

Title	Frequency of update	Updated since last month
UK economic accounts		
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National Accounts aggregates	M	✓
Gross domestic product and gross national income	M	✓
Gross domestic product, by category of expenditure	M	✓
Gross domestic product, by category of income	M	✓
Gross domestic product and shares of income and expenditure	M	✓
Balance of payments: current account	M	✓
Measures of variability of selected economic series	Q	-
Selected labour market statistics		
Weblink: www.statistics.gov.uk/elmr		
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Employment by age	M	✓
Workforce jobs	Q	✓
Unemployment by age and duration	M	✓
Claimant count levels and rates	M	✓
Economic activity by age	M	✓
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Vacancies	M	✓
Prices		
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Harmonised Indices of Consumer Prices: EU comparisons	M	✓
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Retail sales, new registrations of cars and credit business	M	✓
Selected financial statistics		
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Sterling exchange rates and UK reserves	M	✓
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Further labour market statistics**Weblink:** www.statistics.gov.uk/elmr

Working-age households	B	-
Local labour market indicators by unitary and local authority	Q	✓
Key productivity measures by industry	Q	✓
Total workforce hours worked per week	Q	✓
Index of wages per head: international comparisons	M	✓
Claimant count area statistics: UK parliamentary constituencies	M	✓
Redundancies by Government Office Region	Q	✓

Notes

A Annually
B Biannually
Q Quarterly
M Monthly