Office for National Statistics

Article

Multi-factor productivity estimates: Experimental estimates to Quarter 3 (July to September) 2018

Growth accounting estimates for the UK market sector and 10 industry groups.

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Release date:
9 January 2019

Next release:
5 April 2019

Notice

9 January 2019

We previously commented on the identification of notable revisions to growth in the services industries between quarter 4 1997 and quarter 1 1998, advising users to treat the data with caution while we investigated the revisions.

We have now completed our investigation and have discovered a discontinuity in a low-level data source feeding into the financial services industry (industry 64). Due to the annual benchmarking process, this has caused level shifts across the services sector between quarter 4 1997 and quarter 1 1998.

Please note that top level estimates of GDP are unaffected by this discontinuity.

These services sector series will be updated in the Blue Book consistent Quarterly National Accounts due for publication in September 2019, in line with the National Accounts Revisions Policy. In the meantime, we maintain the advice that users treat the services sector data contained within the low level aggregates spreadsheet prior to 1998 with caution.

We apologise for any inconvenience caused.

Table of contents

1 . Main points

- This is the third release of experimental estimates of quarterly multi-factor productivity (MFP) for the UK market sector, and the second to be published on the same timetable as our regular labour productivity estimates; a simple guide to MFP is also available.
- Compared with the same quarter in 2017, MFP in Quarter 3 (July to Sept) 2018 is estimated to have decreased by 0.1%; this contrasts with trend growth in MFP of around 1% per year prior to the financial crisis.
- The difference between this and the growth of labour productivity (0.5% across the market sector on an output per hour basis) reflects strengthening labour composition (for example, an increase in the share of hours worked by workers with higher education qualifications).
- Capital services per hour worked has also been exceptionally weak by historic standards, reflecting sluggish growth in investment and, until recently, buoyant growth in hours worked, with zero impact on the growth of labour productivity in the year to Quarter 3 2018.
- This release includes new industry contributions to MFP, similar to those provided in our labour productivity release; this analysis shows that, since the financial crisis, non-financial services have made a positive contribution to MFP, while all other sectors have made negative contributions.
- Users who previously used our stand-alone quality-adjusted labour input (QALI) or volume indices of capital services (VICS) articles should find any previously published data under this article.

2 . Things you need to know about this release

This release presents new experimental quarterly multi-factor productivity (MFP) estimates for the UK market sector, which may not be fully consistent with our other published data. MFP estimates are compiled within a growth accounting framework, which decomposes changes in economic output (in this case, of the UK market sector) into contributions due to changes in measured inputs of factors of production (labour and capital) and a residual element known as MFP.

In the growth accounting framework, the contribution of labour to changes in economic output takes account of changes in labour composition or “quality” of the employed labour force, as well as changes in the “volume” of labour measured by hours worked.

Movements in capital inputs are captured through capital services. Conceptually, this is analogous to the treatment of labour input insofar as weights are given to different forms of capital (such as machinery and software) to reflect their estimated contribution to the production process. However, unlike labour, where hours worked can be directly observed, there is no equivalent of a standard unit of capital service, and so there is no distinction between the volume and quality of capital.

This is the third edition of what is intended to be a routine quarterly series of MFP publications, decomposing changes in UK market sector output into contributions from measured changes in labour and capital inputs and a residual MFP component. This is the second set of estimates to be published on the same timetable as our regular labour productivity quarterly release. This timetable is usually one week after the publication of the quarterly national accounts (QNA) and around 14 weeks after the reference quarter, although it is slightly later on this occasion due to QNA being published before the Christmas break, on 21 December 2018.

Initially, these experimental quarterly estimates will be restricted to the aggregate UK market sector and 10 component industries to allow us to strengthen these estimates ready for National Statistics badging. We will also investigate the feasibility of publishing a more granular quarterly breakdown by industry in future releases. This release also includes experimental annual MFP estimates for the period 1970 to 2017 for the aggregate market sector and 16 component industries.

The regular quarterly MFP publications replace our previous pattern of publishing separate annual articles on quality-adjusted labour input (QALI), volume indices of capital services (VICS) and MFP.

Users should be aware that all percentage changes in this release are expressed as changes in (natural) logarithms, which can differ slightly from the discrete percentage changes typically used in our other statistical releases. The use of log changes allows our productivity decompositions to be exactly additive across components.

Whilst we are publishing quarterly data, we advise focusing on quarter-on-quarter a year ago, as this will better expose underlying trends that may be obscured by volatility in the quarter-on-quarter data.

Hours worked in the UK market sector are aggregated from estimates of each component industry, as set out in Developing improved estimates of quality-adjusted labour inputs using the Annual Survey of Hours and Earnings: a progress report, published in July 2017. These estimates for market sector hours and the corresponding estimates for market sector output per hour currently differ slightly from those in our labour productivity release, although we are working towards aligning the two estimates in future releases.

QALI estimates in this release are updated from those in the previous release on 5 October 2018, principally to take account of detailed hourly earnings estimates from the 2018 Annual Survey of Hours and Earnings.

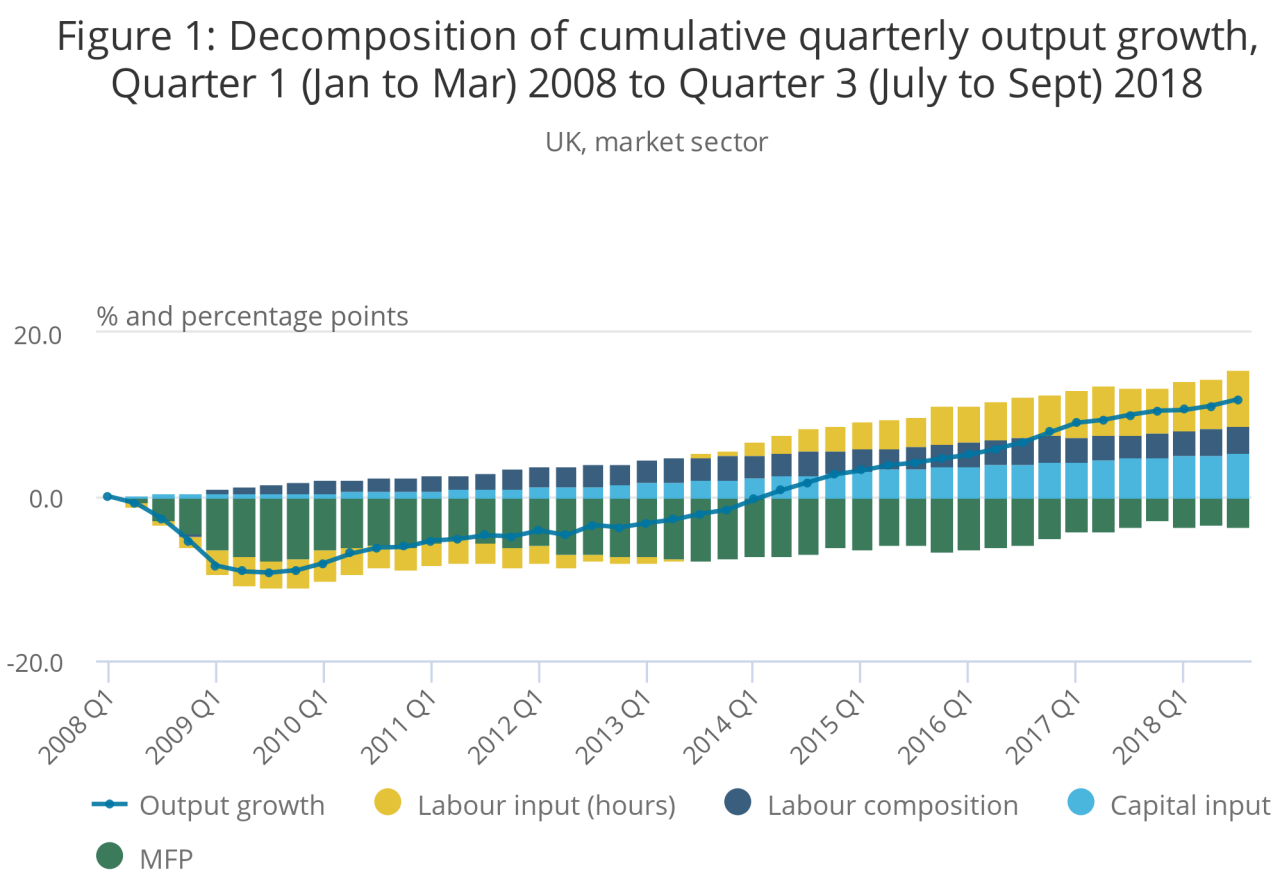
Estimates of capital services have been compiled using new processes and source data, as described in Volume index of UK capital services (experimental): estimates to Quarter 2 (Apr to June) 2017 (published in February 2018). These changes allow estimation of capital services on a quarterly frequency, whereas previously, quarterly capital services could only be derived by interpolation of annual series. The quarterly capital services system is still subject to development and testing.

3 . Multi-factor productivity estimated to have decreased by 0.3% in Quarter 3 2018 and be lower than in 2008

Figure 1 decomposes cumulative quarterly market sector output growth since Quarter 1 (Jan to Mar) 2008 into contributions from capital and labour input growth (the latter separated into contributions from hours and labour composition) and the residual multi-factor productivity (MFP) contribution.

Figure 1: Decomposition of cumulative quarterly output growth, Quarter 1 (Jan to Mar) 2008 to Quarter 3 (July to Sept) 2018

UK, market sector



Source: Office for National Statistics

Notes:

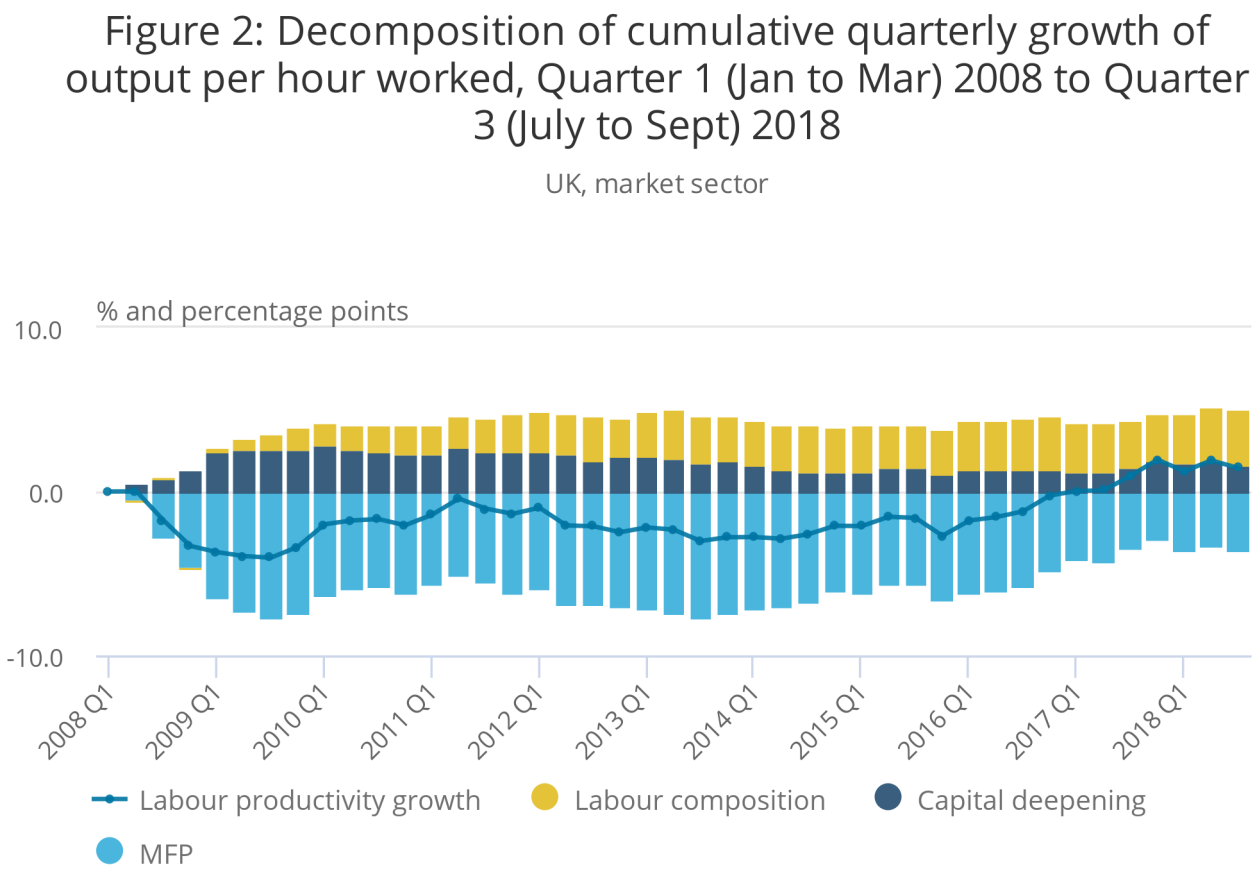
1. Output growth is the cumulative quarter-on-quarter log change in market sector gross value added (GVA).
2. Columns show contributions of components, calculated by weighting log changes in each component by its factor income share.
3. MFP is calculated by residual.

The upward trend in market sector gross value added (GVA) over recent quarters has been roughly matched by increases in hours worked and improvements in labour composition. Capital inputs have also increased, albeit at a very slow pace by historic standards. This implies that the faint upward trend in MFP that began in late 2015 has stalled in recent quarters. Further information is available in the dataset published alongside this release.

The growth accounting framework can be re-arranged to provide a decomposition of movements in labour productivity measured by output per hour, as shown in Figure 2. In this presentation, the capital contribution reflects changes in capital services per hour worked (known as capital deepening). The contributions of labour composition and of MFP are identical between Figures 1 and 2.

Figure 2: Decomposition of cumulative quarterly growth of output per hour worked, Quarter 1 (Jan to Mar) 2008 to Quarter 3 (July to Sept) 2018

UK, market sector



Source: Office for National Statistics

Notes:

1. Labour productivity growth is the cumulative quarter-on-quarter log change in market sector gross value added (GVA) per hour worked.

2. Columns show contributions of components, calculated by weighting log changes in each component by its factor income share.

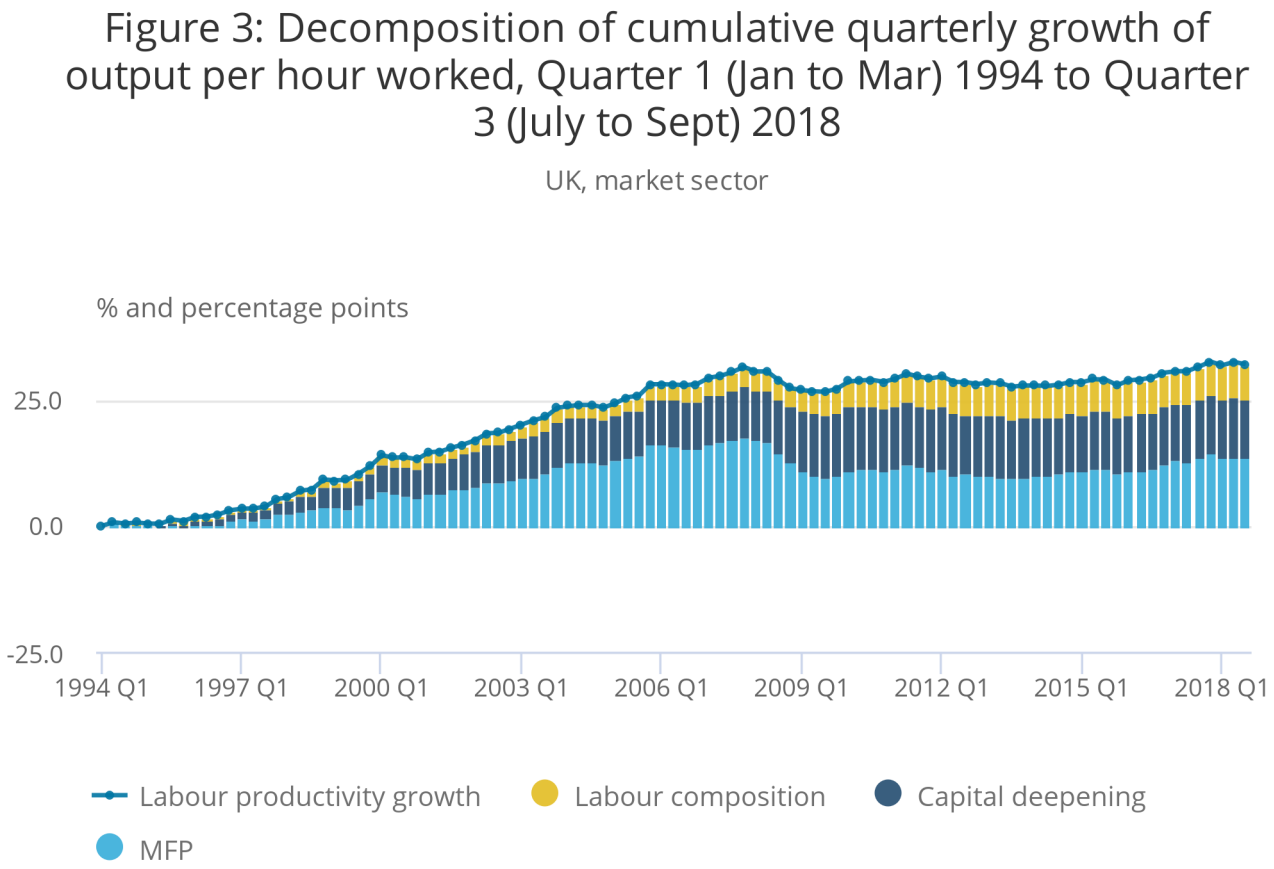
3. MFP is calculated by residual.

Figure 2 highlights the prolonged weakness of market sector labour productivity since the economic downturn. More than 10 years on, output per hour worked is only just ahead of its level in 2008. MFP is still almost 4 percentage points lower than in 2008, having grown only slowly and intermittently since 2009. This contrasts with trend growth in MFP of around 1% per year prior to the economic downturn (Figure 3). Capital deepening has also been exceptionally weak by historic standards, reflecting sluggish growth in investment and, until recently, buoyant growth in hours worked. On the other hand, labour composition has steadily improved over the last 10 years.

Further information is available in the dataset published alongside this release.

Figure 3: Decomposition of cumulative quarterly growth of output per hour worked, Quarter 1 (Jan to Mar) 1994 to Quarter 3 (July to Sept) 2018

UK, market sector



Source: Office for National Statistics

Notes:

1. Labour productivity growth is the cumulative quarter-on-quarter log change in market sector gross value added (GVA) per hour worked.

2. Columns show contributions of components, calculated by weighting log changes in each component by its factor income share.

3. MFP is calculated by residual.

Figure 3 highlights the structural break at the time of the 2008 recession, where capital deepening ceased growing and MFP demonstrated a level-shift downwards, which incremental growth from labour composition and MFP has so far failed to materially exceed.

4 . Labour quality increased in Quarter 3 2018 for the fourth consecutive quarter

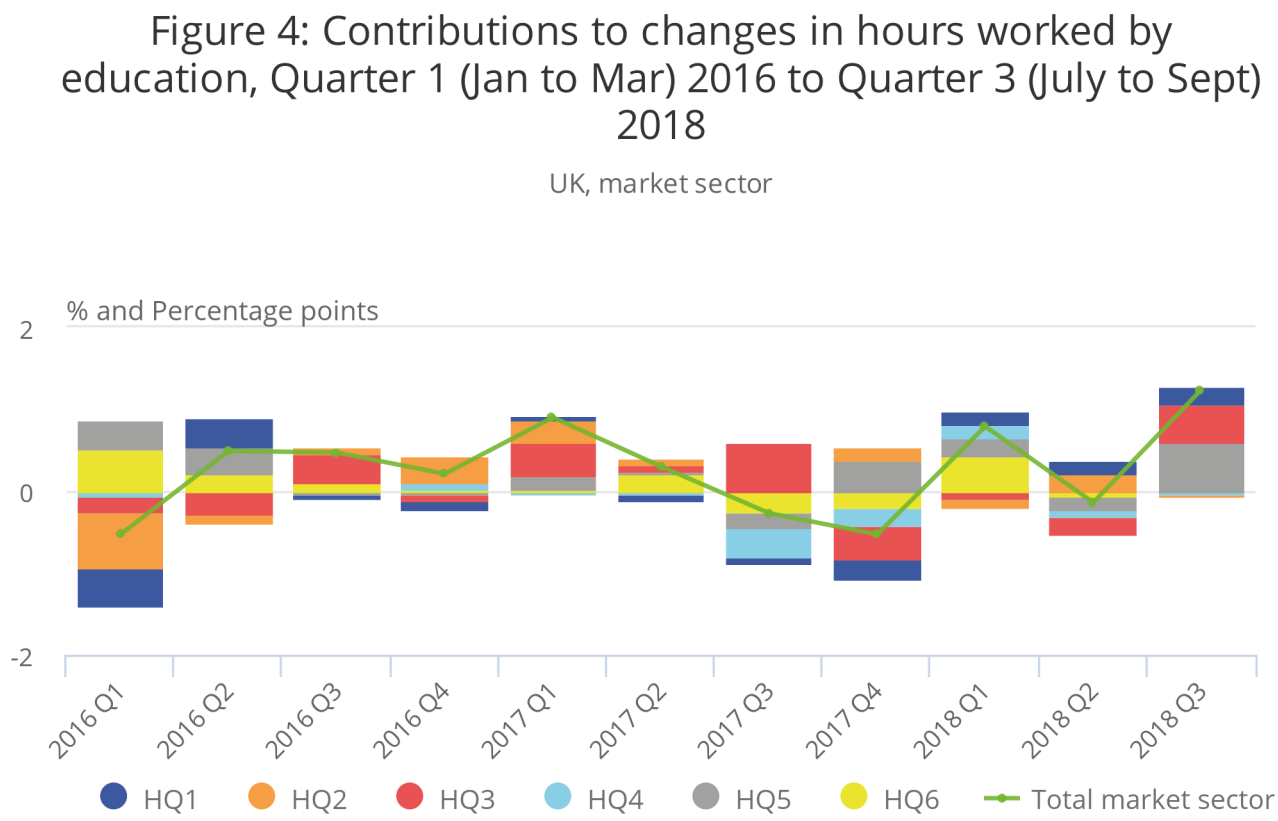
The increase in labour composition (or quality) in Quarter 3 (July to Sept) 2018 was the fourth consecutive increase following a period of weakly declining labour quality since the start of 2016.

Figure 4 shows quarterly changes in hours worked broken down by highest education qualification. In general, there is a strong positive correlation between level of education and hourly earnings, so a shift in hours worked towards workers with higher qualifications will typically materialise as an increase in labour quality. Therefore, in Quarter 3 2017, there was a fall in labour quality as hours worked by higher-qualified workers declined, while in Quarter 1 (Jan to Mar) 2018, most of the increase in hours worked was accounted for by graduates and post-graduates, with a corresponding uptick in labour quality.

Further information on hours worked and labour composition, including industry components, is available in the dataset published alongside this release.

Figure 4: Contributions to changes in hours worked by education, Quarter 1 (Jan to Mar) 2016 to Quarter 3 (July to Sept) 2018

UK, market sector



Source: Office for National Statistics

Notes:

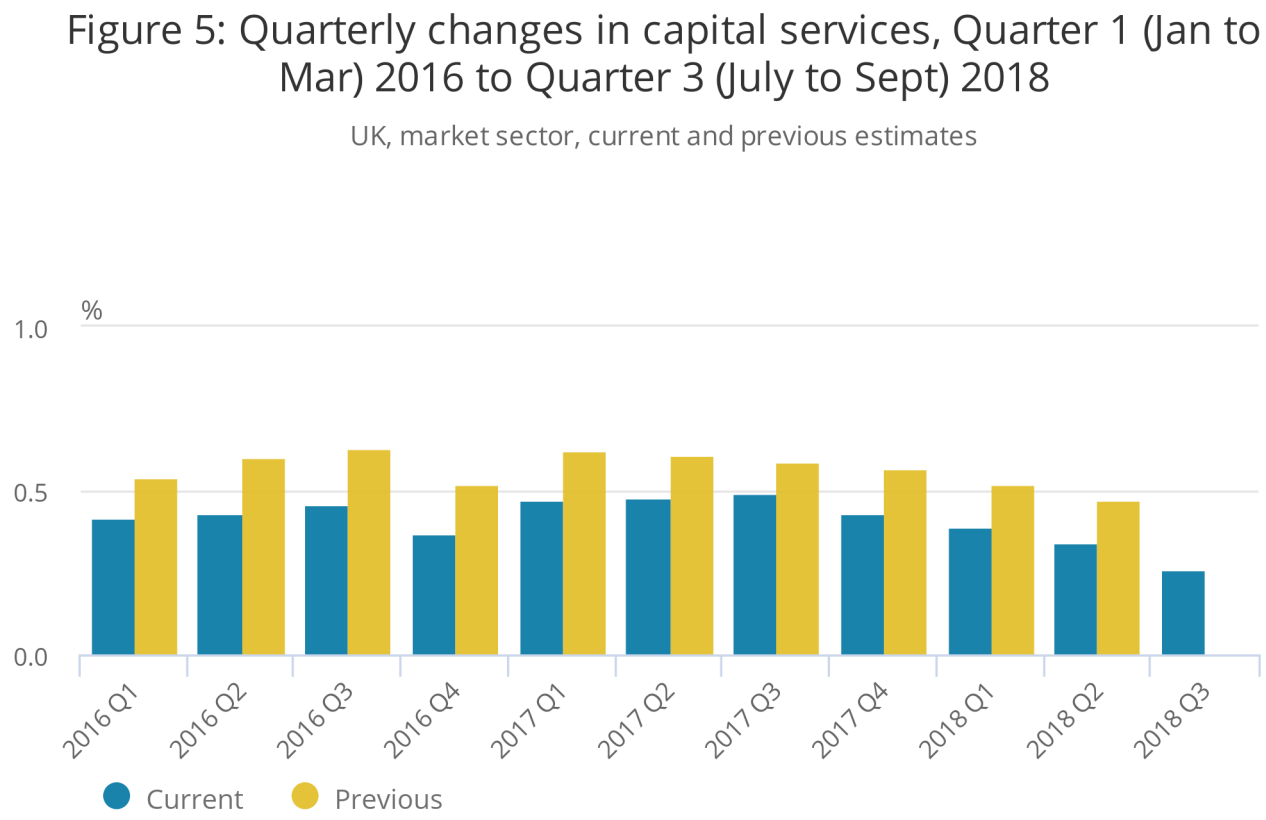
1. HQ1 is No qualifications.
2. HQ2 is GCSEs and equivalent.
3. HQ3 is A-levels or trade apprenticeships.
4. HQ4 is Certificates of education or equivalent.
5. HQ5 is First and other degrees.
6. HQ6 is Masters and doctorates.

We no longer plan to publish stand-alone articles on quality-adjusted labour input (QALI) but we are publishing all the estimates previously included in QALI articles alongside this article. These include a full set of QALI estimates at the whole economy level (including QALI estimates by industry, education, age group and sex), as well as a full set of QALI estimates for the market sector. Users should note that market sector estimates for labour composition used in multi-factor productivity (MFP) are seasonally adjusted, while those in the QALI stand-alone datasets are not seasonally adjusted.

5 . Capital services grew in Quarter 3 2018 but at a decelerating pace

Figure 5: Quarterly changes in capital services, Quarter 1 (Jan to Mar) 2016 to Quarter 3 (July to Sept) 2018

UK, market sector, current and previous estimates



Source: Office for National Statistics

Notes:

1. Previous is version published on 5 October 2018

We have revised growth of capital services down since the last MFP release in October 2018. This reflects revised gross fixed capital formation (GFCF) estimates and methodological improvements. GFCF estimates used in capital services are based on the same source data used in national accounts estimates of business investment, although the breakdown by asset and industry anticipates improvements scheduled to be introduced into the national accounts in Blue Book 2019.

Business investment fell by 1.1% in Quarter 3 (July to Sept) 2018, following falls of 0.4% in Quarter 2 (Apr to June) 2018 and 0.7% in Quarter 1 (Jan to Mar) 2018. Our estimates show capital services continuing to grow over these quarters, albeit at a decelerating rate. This suggests that lower levels of investment were still sufficient to more than offset declines in the stock of productive capital due to wear and tear and retirements.

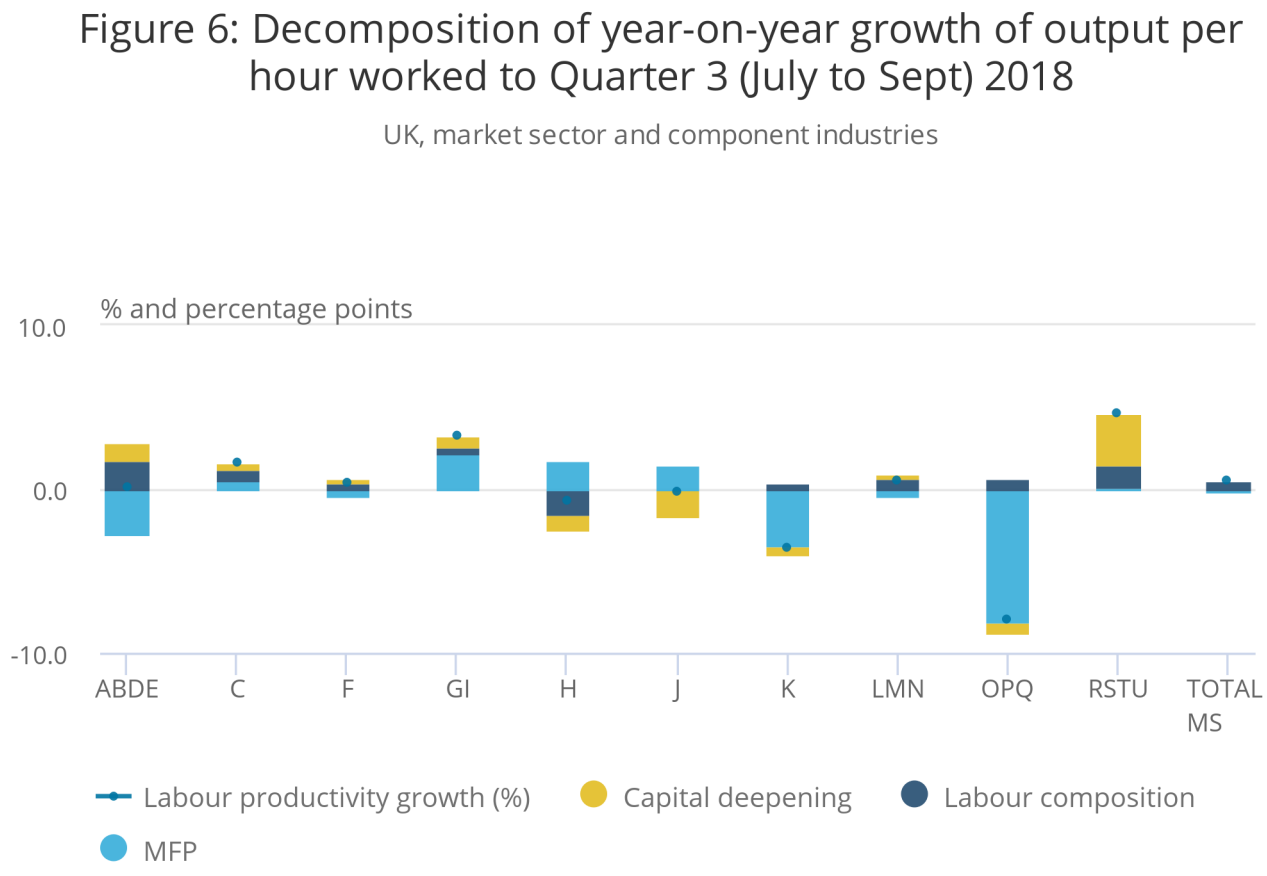
Further information including industry components is available in the dataset published alongside this release.

We no longer plan to publish stand-alone articles on volume indices of capital services (VICS) but we are publishing all the estimates previously included in VICS articles alongside this article. These include VICS estimates at the A64 industry breakdown (with some very small industries suppressed) and VICS estimates by asset. Users should note that VICS estimates used in MFP are seasonally adjusted while those in the stand-alone VICS dataset are not seasonally adjusted.

6 . Industry breakdown

Figure 6: Decomposition of year-on-year growth of output per hour worked to Quarter 3 (July to Sept) 2018

UK, market sector and component industries



Source: Office for National Statistics

Notes:

1. ABDE is: Agriculture, forestry and fishing; Mining and quarrying; Electricity, gas, steam and air conditioning supply and water supply; and Sewerage, waste management and remediation activities.
2. C is Manufacturing.
3. F is Construction.
4. GI is: Wholesale and retail trade; Repair of motor vehicles and motorcycles; and Accommodation and food service activities.
5. H is Transportation and storage.
6. J is Information and communication.
7. K is Financial and insurance activities.
8. LMN is: Real estate activities; Professional, scientific and technical activities; and Administrative and support service activities.
9. OPQ is: Public administration and defence; Compulsory social security; Education; and Human health and social work activities.
10. RSTU is: Arts, entertainment and recreation; and Other services.
11. TOTAL MS is the whole market sector.

Multi-factor productivity (MFP) decompositions by industry can be volatile, particularly over short time periods. Figure 6 shows considerable variation in all components: labour composition is positive in eight industries, negative in one (transportation and storage) and negligible in the remaining industry (information and communication). Capital deepening is positive in six industries, negative in four industries and negligible overall. Movements in MFP are positive in five industries but negative in the other five industries.

Further information including industry components is available in the dataset published alongside this release.

7 . What’s changed in this release?

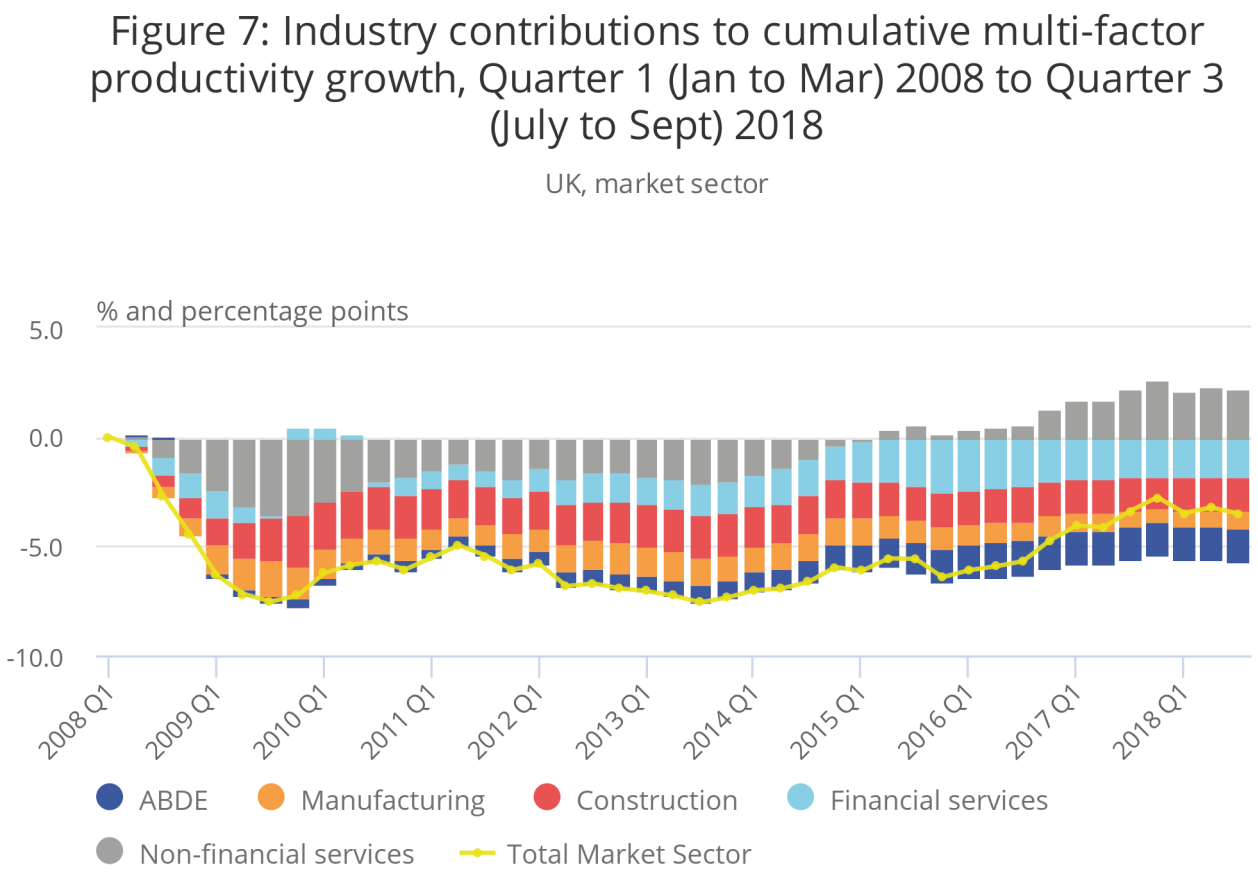
The dataset published alongside this release includes new breakdowns of aggregate market sector multi-factor productivity (MFP) into contributions due to individual industries, following the methodology set out by Diewert (2015) in Decompositions of productivity growth into sectoral effects. This is an extension and generalisation of the Tang and Wang (2004) methodology used in our labour productivity release.

Figure 7 shows some illustrative results from the Diewert (2015) methodology, breaking down the cumulative movement in multi-factor productivity (MFP) since 2008 into five broad industry groups. According to this analysis, only non-financial services has made a positive contribution to MFP over this period.

The Diewert (2015) methodology can also be used to decompose movements in MFP into “within” industry and “between” industry elements. We welcome views from users on whether this would be helpful.

Figure 7: Industry contributions to cumulative multi-factor productivity growth, Quarter 1 (Jan to Mar) 2008 to Quarter 3 (July to Sept) 2018

UK, market sector



Source: Office for National Statistics

Notes:

1. ABDE is: Agriculture, forestry and fishing; Mining and quarrying; Electricity, gas, steam and air conditioning supply and water supply; and Sewerage, waste management and remediation activities.

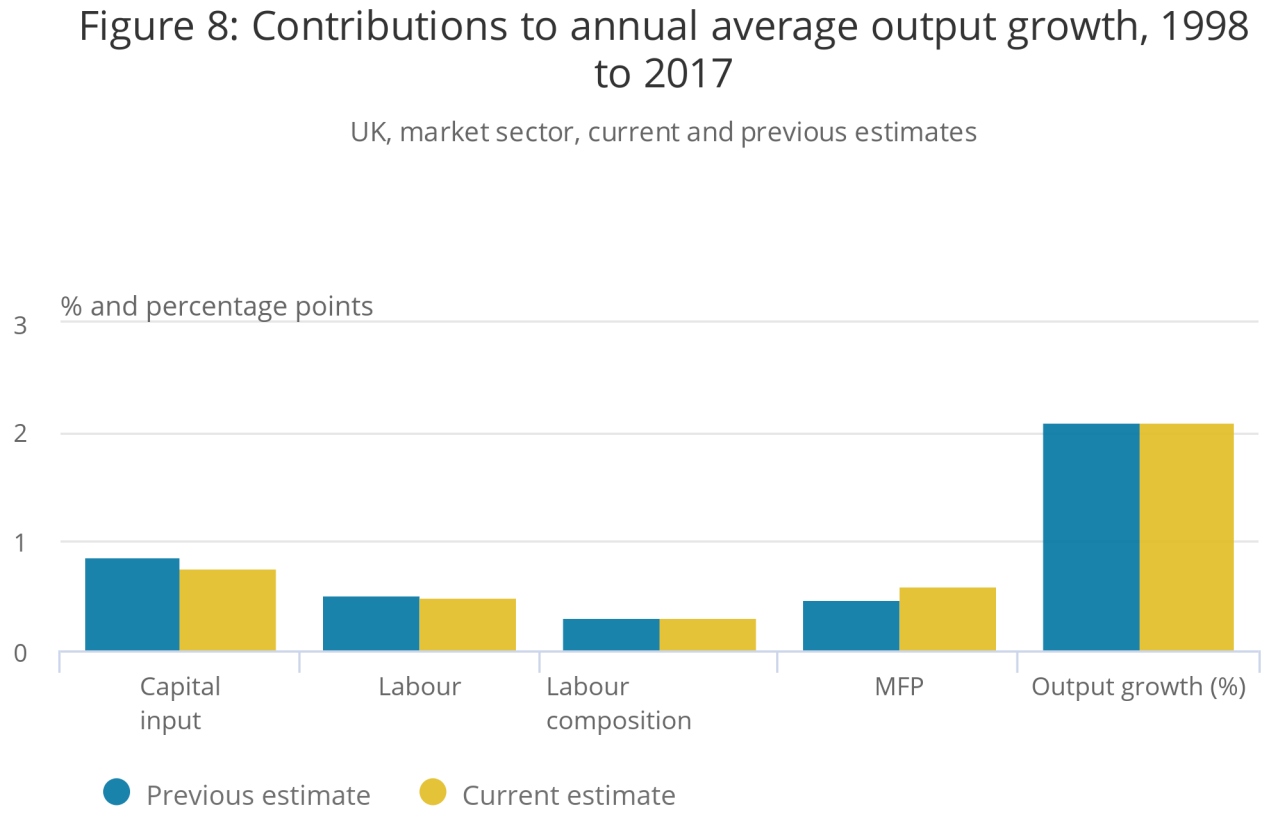
To support this publication additional datasets, providing more detail on the underlying quality-adjusted labour input (QALI) and volume indices of capital services (VICS) estimates (and including QALI estimates on a whole economy basis as well as the market sector series used in MFP), are also being made available. Users who previously used the stand-alone QALI or VICS articles should find any previously published data under this article. Comments on the usability of this article and supporting tables are welcome via email to productivity@ons.gov.uk.

For the market sector as a whole, revisions to our MFP estimates since our last MFP release in October 2018 mainly reflect revisions to capital services. Revisions at component industry level additionally reflect revised estimates of hours worked (and, to a lesser extent, of labour composition) and, from 2017 onwards, revisions to gross value added (GVA) and factor income weights.

Figure 8 provides a summary of revisions to average annual growth rates since October 2018. Average growth of capital input has been revised down, with an offsetting upward revision to MFP growth, because MFP is calculated by residual.

Figure 8: Contributions to annual average output growth, 1998 to 2017

UK, market sector, current and previous estimates



Source: Office for National Statistics

8 . Next steps

As set out in our Productivity development plan, published in July 2018, we are working towards compiling more detailed multi-factor productivity (MFP) estimates by industry. In the first instance, these may be published at an annual rather than quarterly frequency, pending assessment of the properties of the new series.

Other development priorities related to growth accounting, as set out in the development plan, are further developments to capital stocks and capital services and development of wider measures of MFP. This will build on work in our national accounts division to compile supply and use tables in constant prices as well as in current prices. This will allow industry-level decompositions of real gross output, identifying the separate contribution of real intermediate consumption.

9 . Links to related statistics

- Productivity economic commentary: July to September 2018 draws together the main findings from official statistics and analysis of UK productivity to present a summary of recent developments (published 9 January 2019)

- Labour productivity, UK: July to September 2018 contains the latest estimates of labour productivity for the whole economy, the UK regions at NUTS1 level and a range of industries, together with estimates of unit labour costs (published 9 January 2019).

- Multi-factor productivity estimates: Experimental estimates to quarter 3 (July to September) 2018 presents quarterly estimates of multi-factor productivity (MFP), capital services and quality-adjusted labour input (QALI), including a range of industry breakdowns and analysis (published 9 January 2019).

- A simple guide to multi-factor productivity explains the concept and measurement of multi-factor productivity through simple stylised examples (published 5 October 2018).

- Quarterly UK public service productivity (Experimental Statistics): July to September 2018 contains the latest experimental estimates for quarterly UK total public service productivity, inputs and output (published 9 January 2019).

- Public service productivity: total, UK, 2016 presents updated measures of output, inputs and productivity for public services in the UK between 1997 and 2015, in addition to new estimates for 2016 (published 9 January 2019).

- Public service productivity: healthcare, UK, 2016 presents updated estimates of output, inputs and productivity for public service healthcare in the UK between 1995 and 2015, and new estimates for 2016 (published 9 January 2019).

- Public service productivity: healthcare, FYE 2017 presents estimates of output, inputs and productivity for public service healthcare in England on a financial year basis up to FYE 2017 (published 9 January 2019).

- Improving estimates of Labour Productivity and International Comparisons discusses recent OECD findings showing that the methodologies, data sources and adjustments used to estimate the number of persons, jobs and hours worked varied significantly across countries, and explores these differences and the impact on our ICP (published 9 January 2019).

- Productivity development plan: 2018 to 2020 builds on recent improvements to our productivity statistics and looks at introducing new outputs, further improving our productivity statistics and consolidating our improvements to date (published 6 July 2018).

- How productive is your business? is an interactive tool which aids businesses to calculate their productivity and compare their performance to other businesses in Great Britain (published 6 July 2018).

Related content

In October 2018 the ONS informed users we will no longer be publishing estimates on International comparisons of UK productivity, due to an ongoing review of the methodology. In December 2018 the OECD published a working paper "International productivity gaps: Are labour input measures comparable?" which showed the methodologies, data sources and adjustments used to estimate labour inputs varied significantly across countries. The ONS published an article exploring these differences and the impact they had on our international comparisons of UK productivity (ICP) statistics.

We publish experimental estimates of multi-factor productivity (MFP), which decompose output growth into the contributions that can be accounted for by labour and capital inputs. In these estimates, the contribution of labour is further decomposed into quantity (hours worked) and quality dimensions.

The Economic Review covers recent developments in the UK economy, featuring our latest economic statistics as well as in-depth analysis of current issues.

Experimental indices of labour costs per hour differ from the concept of labour costs used in the unit labour cost estimates in the labour productivity release. The main difference is that experimental indices of labour costs per hour relate to employees only, whereas unit labour costs also include the labour remuneration of the self-employed.

Lastly, we publish a range of Public service productivity measures and related articles. These measures define productivity differently from that used in our labour productivity and MFP estimates. Further information can be found in the Economic and Labour Market Review, No. 5, May 2010 and in an information note published on 4 June 2015.

More information on the range of our productivity estimates can be found in the ONS Productivity Handbook.