Article

Multi-factor productivity estimates: Experimental estimates to Quarter 2 (Apr to June) 2018

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

Notice

5 October 2018

We previously commented on the identification of notable revisions to growth in the services industries between Quarter 4 (Oct to Dec) 1997 and Quarter 1 (Jan to Mar) 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 gross value added (GVA) 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.

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1 . Main points

- This is the second release of experimental estimates of quarterly multi-factor productivity (MFP) for the UK market sector, and the first to be published on the same timetable as our regular labour productivity estimates; a new simple guide to MFP is also available.

- Compared with the same quarter in 2017, MFP is estimated to have grown by 0.8%, compared with growth of 1.7% for output per hour over this period; 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.

- In Quarter 2 (Apr to June) 2018, multi-factor productivity (MFP) in the UK market sector is estimated to have grown by 0.2% compared with the previous quarter.

- The difference between this and the growth of labour productivity (0.7% across the market sector on an output per hour basis) reflects strengthening labour composition (for example, an increase in the share of workers with higher education qualifications) and capital services per hour worked, which together account for 0.5 percentage points of the growth of labour productivity.

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.

Alongside this release we have published a simple guide to MFP.

This is the second 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. The first release was on 6 April 2018 and included estimates up to Quarter 2 (Apr to June) 2017, that is, with a time lag of around nine months after the final reference quarter. This release shortens that time lag by publishing estimates on the same timetable as our regular labour productivity quarterly release. This timetable is about one week after the publication of the quarterly national accounts and around 14 weeks after the reference quarter.

Initially, these quarterly estimates will be restricted to the aggregate UK market sector and 10 component industries. We will investigate the feasibility of publishing a more granular quarterly breakdown by industry in future releases. This release also includes 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.

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 plan to align the two estimates in future releases.

QALI estimates are updated from our most recent QALI publication in October 2017, principally to take account of earnings estimates from the 2017 Annual Survey of Hours and Earnings and labour income estimates from the Blue Book 2018.

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 grown by 0.2% in the second quarter but still below level 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 2 (Apr to June) 2018

UK, market sector

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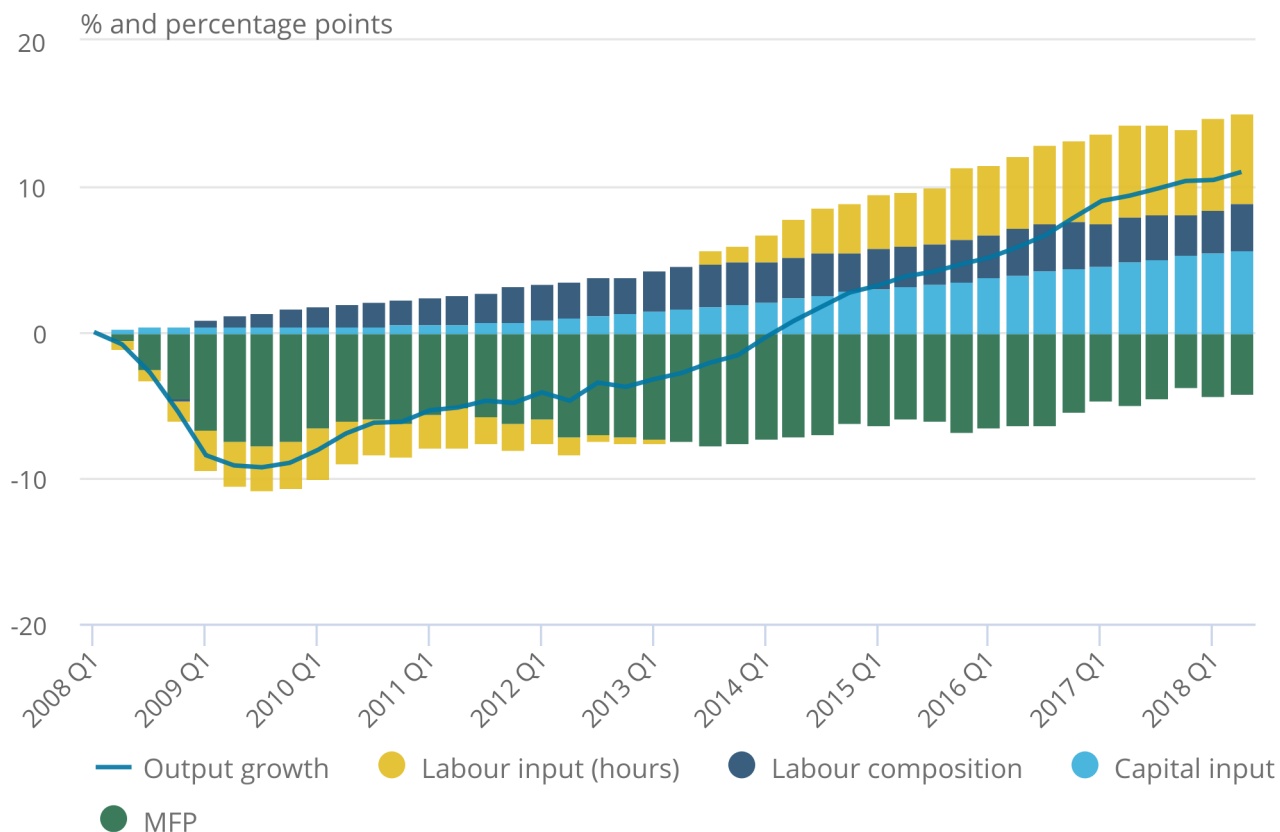
UK, market sector

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.

Hours worked and labour composition have plateaued over recent quarters. Arithmetically, this means that the growth of output reflects increased capital input plus a weak upward trend in MFP. Further information is available in the dataset published alongside this release.

The growth accounting framework can be rearranged 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 2 (Apr to June) 2018

UK, market sector

Figure 2: Decomposition of cumulative quarterly growth of output per hour worked, Quarter 1 (Jan to Mar) 2008 to Quarter 2 (Apr to June) 2018
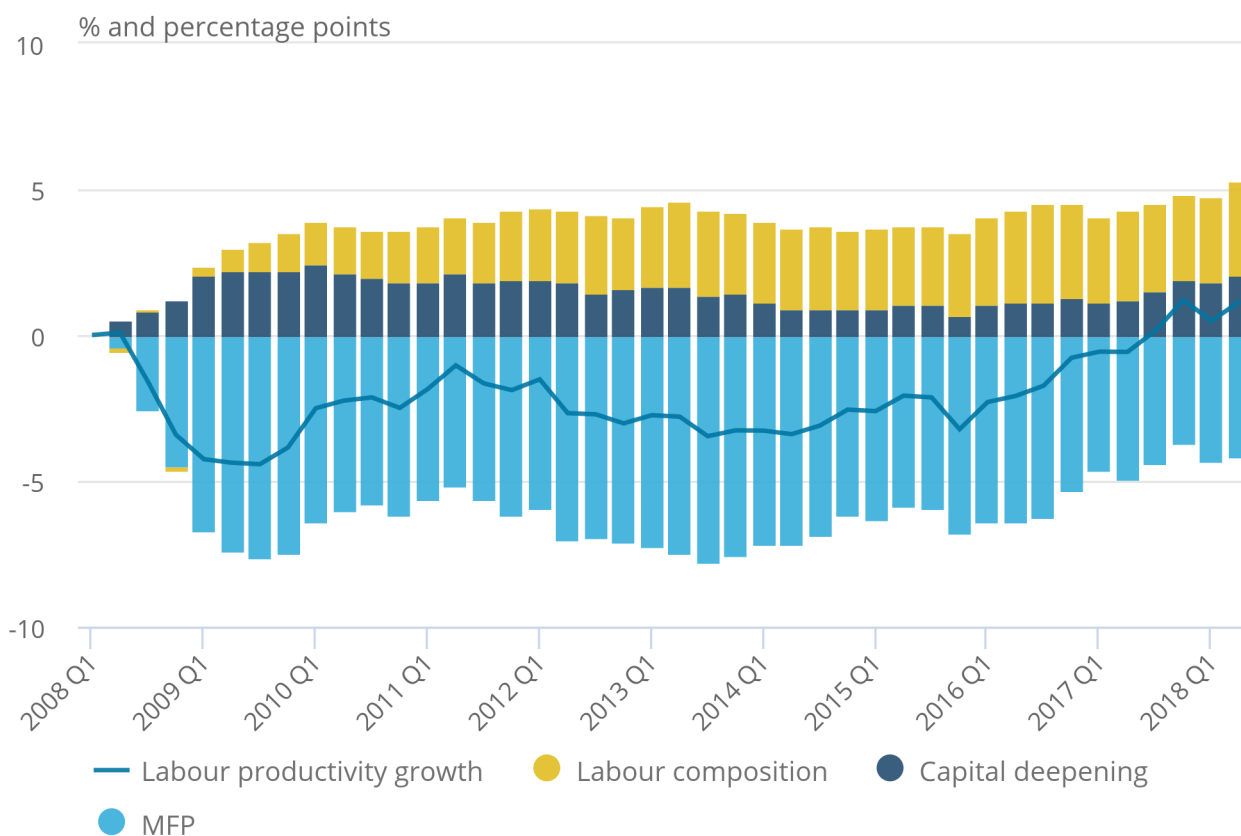
UK, market sector

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 financial crisis. More than 10 years on, labour productivity per hour worked is only just ahead of its level in 2008. MFP is still some 4 percentage points lower than in 2008, having grown only slowly and intermittently since 2009, compared with trend growth in MFP of around 1% per year prior to the financial crisis (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 2 (Apr to June) 2018

UK, market sector

Figure 3: Decomposition of cumulative quarterly growth of output per hour worked, Quarter 1 (Jan to Mar) 1994 to Quarter 2 (Apr to June) 2018
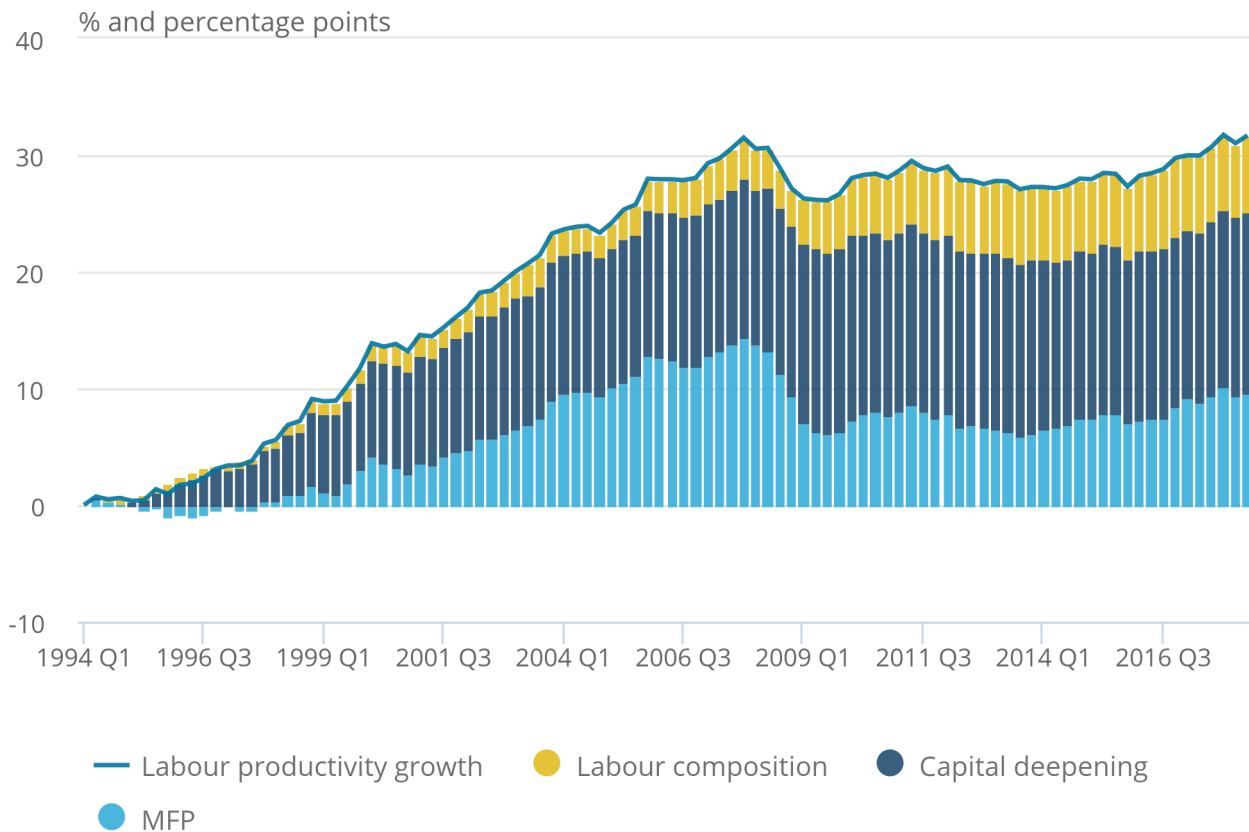
UK, market sector

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 exceed.

4 . Quality adjusted labour input increased in the second quarter, although hours worked decreased

Figure 4: Quarterly changes in hours worked and labour composition, Quarter 1 (Jan to Mar) 2008 to Quarter 2 (Apr to June) 2018

UK, market sector, current and previous estimates

Figure 4: Quarterly changes in hours worked and labour composition, Quarter 1 (Jan to Mar) 2008 to Quarter 2 (Apr to June) 2018

UK, market sector, current and previous estimates

● Labour composition - current   ● Labour composition - previous

— Hours worked - current   — Hours worked - previous
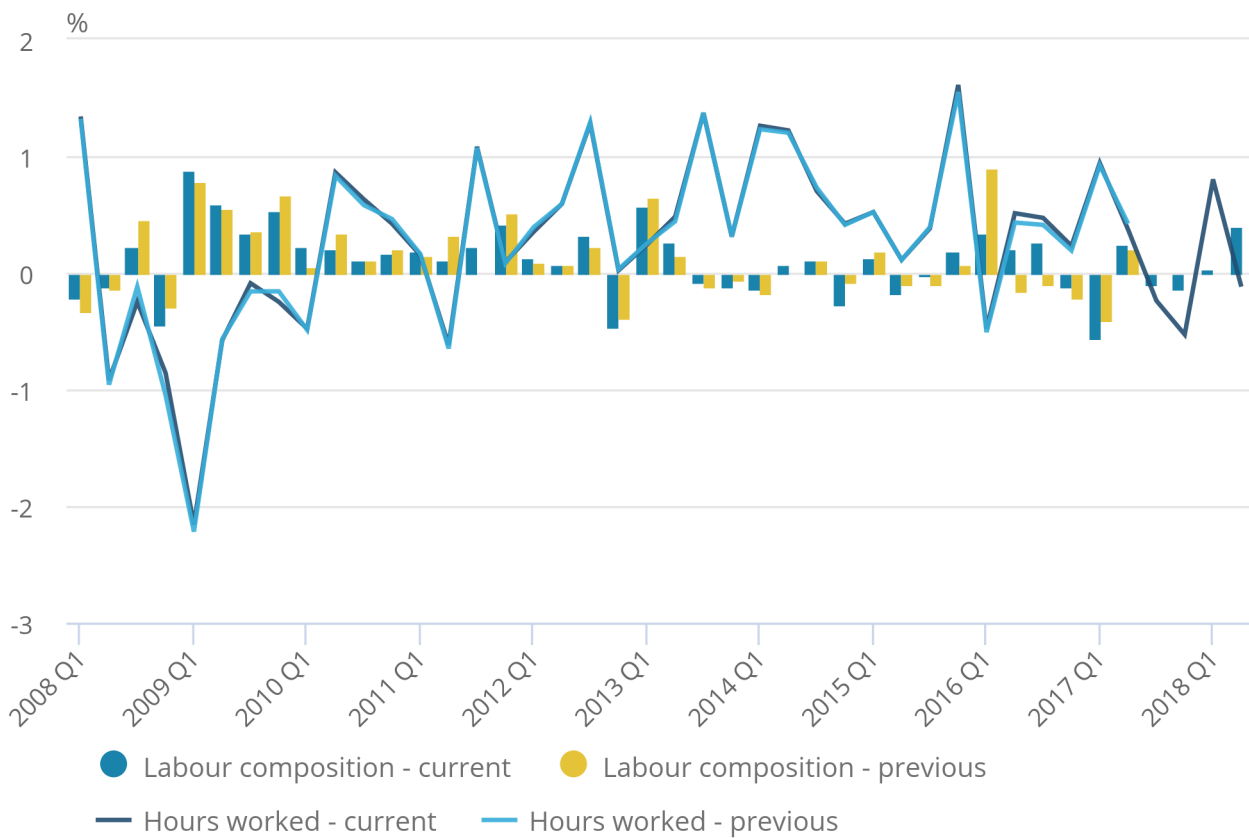
Source: Office for National Statistics

Notes:

1. Bars show changes in labour composition, lines show changes in hours worked.

The increase in labour composition in Quarter 2 (Apr to June) 2018 was the strongest since 2013 and was sufficient to offset a fall in hours worked, the third such fall in the last four quarters. Revisions to labour composition since the last quarterly multi-factor productivity (MFP) release in April 2018 reflect several developments, including revised industry distributions of hours worked (see Labour productivity latest developments' for more information) and revised labour income estimates in the Blue Book 2018. Further information including industry components is available in the dataset published alongside this release.

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 MFP are seasonally adjusted.

5 . In the second quarter capital services grew but at a decelerating pace

Figure 5: Quarterly changes in capital services, Quarter 1 (Jan to Mar) 2008 to Quarter 2 (Apr to June) 2018

UK, market sector, current and previous estimates

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UK, market sector, current and previous estimates
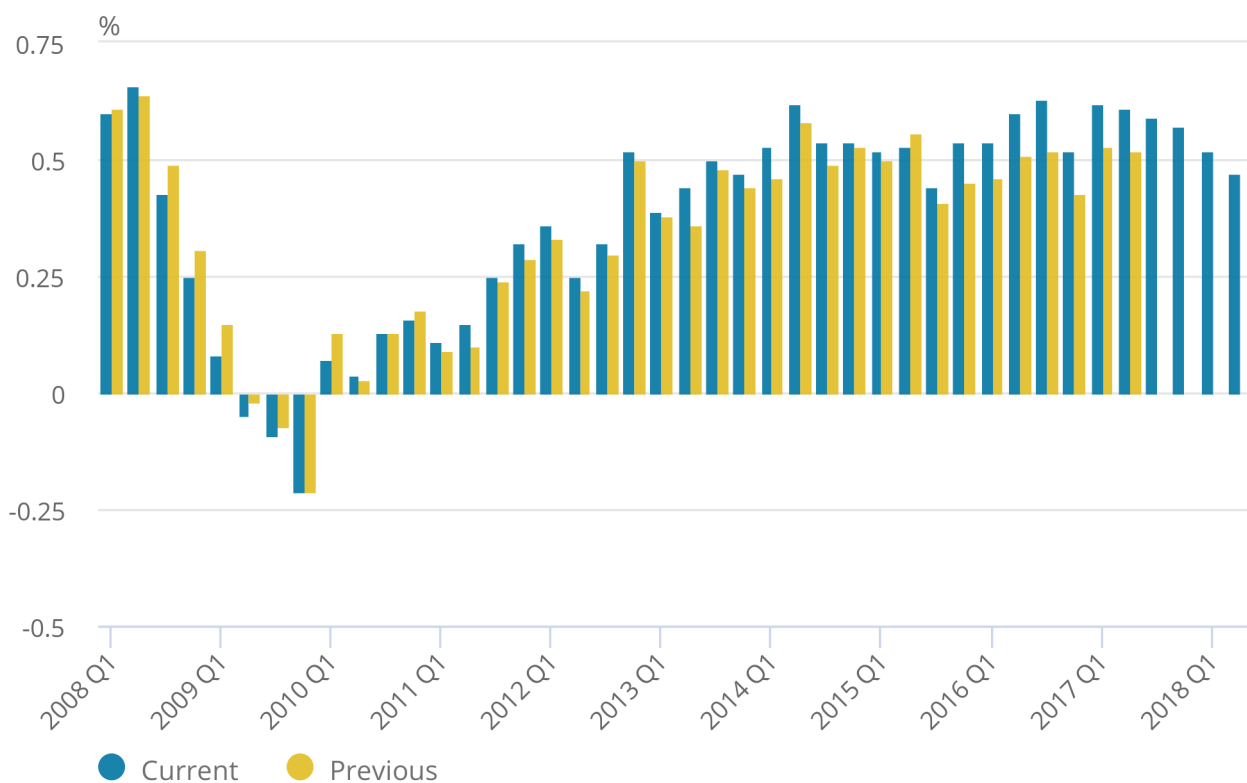
Source: Office for National Statistics

Notes:

1. CURR is this release. PREV is version published on 6 April 2018.

We have revised growth of capital services up since the last MFP release in April 2018. This reflects revised gross fixed capital formation (GFCF) estimates published in the [Blue Book 2018](#) and our latest [quarterly national accounts](#). GFCF estimates used in capital services are conceptually identical to the coverage of business investment (that is, excluding investment in dwellings, costs of ownership transfer and all investment by the general government and non-profit institutions serving households (NPISH) sectors).

Business investment fell by 0.7% in Quarter 2 (Apr to June) 2018, following a fall of 0.5% 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. This shows that the growth of capital services in Quarter 2 2018 was generally more pronounced in services and construction. Growth of capital services in the production industries was less positive.

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.
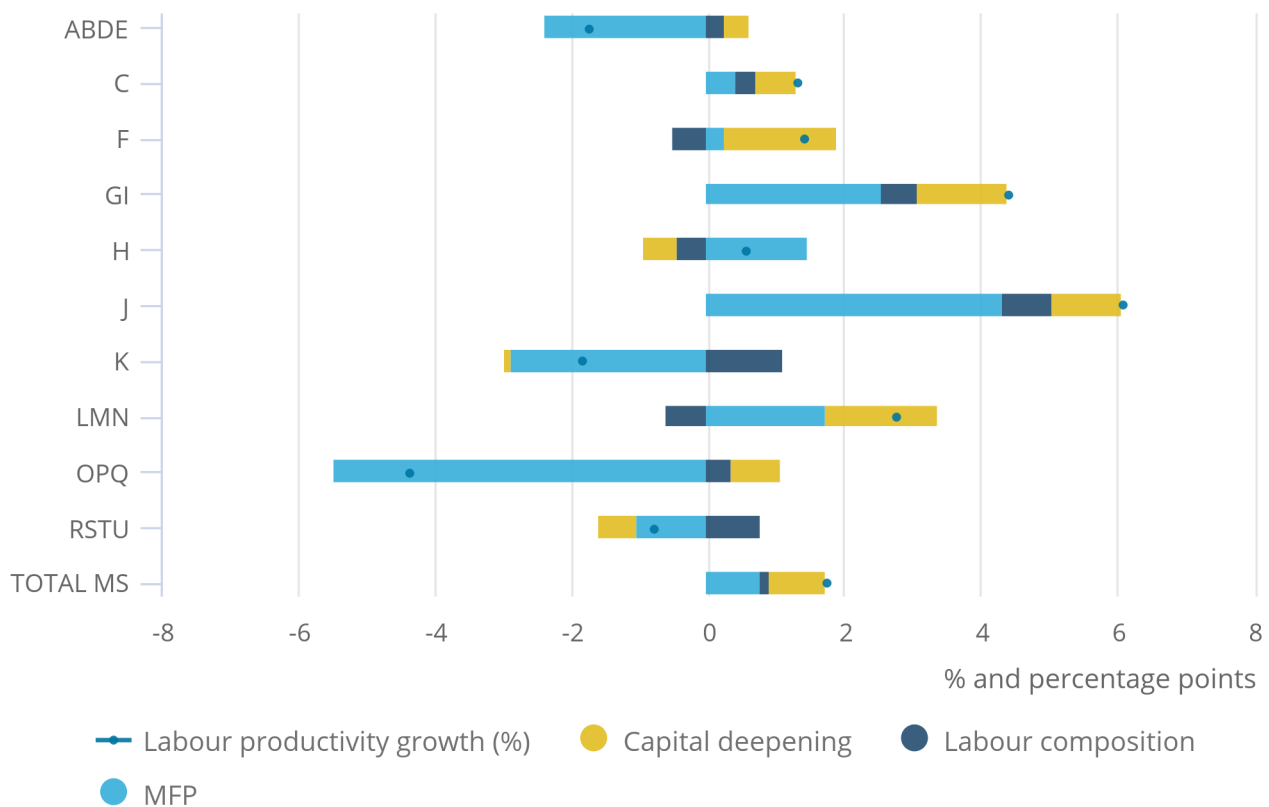
6 . Industry breakdown

Figure 6: Decomposition of year-on-year growth of output per hour worked to Quarter 2 (Apr to June)

UK, market sector and component industries

Figure 6: Decomposition of year-on-year growth of output per hour worked to Quarter 2 (Apr to June)

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 seven industries and negative in the other three. Capital deepening is also positive in seven industries. Movements in MFP are strongly correlated with movements in output per hour in terms of sign and magnitude.

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

7 . What's changed in this release?

This release provides a significant milestone in the suite of productivity statistics produced by Office for National Statistics (ONS). Multi-factor productivity (MFP) estimates have historically been produced annually, alongside articles on quality-adjusted labour input (QALI) and volume indices of capital services (VICS). This article supersedes these publications to deliver a significant improvement in timeliness – publication of MFP statistics will now be aligned with labour productivity and public service productivity quarterly releases, approximately 14 weeks after the end of the reference period, an improvement of 52 weeks. As far as we are aware, we are the only National Statistical Institute (NSI) in the world to publish these data with this frequency.

To support this publication additional datasets, providing more detail on the underlying QALI and 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. However, reflecting user feedback following the April 2018 MFP release, where we piloted this new publication model, we have also added more navigation to the MFP dataset. Further user comment on the usability of this article and supporting tables are welcome via email to productivity@ons.gov.uk.

Revisions to our MFP estimates since our last [MFP release in April 2018](#) chiefly reflect revisions to the industry distribution of hours worked arising from methodological changes, as described in [Labour productivity latest developments](#), and revisions to factor incomes in Blue Book 2018. Figure 7 provides a summary of revisions to average annual growth rates since April 2018. Average growth of capital input and market sector output has been revised up a little, while MFP has been revised down.

Figure 7: Contributions to annual average output growth, 1998 to 2016

Office for National Statistics

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Office for National Statistics

% and percentage points

● Previous estimate   ● Current estimate
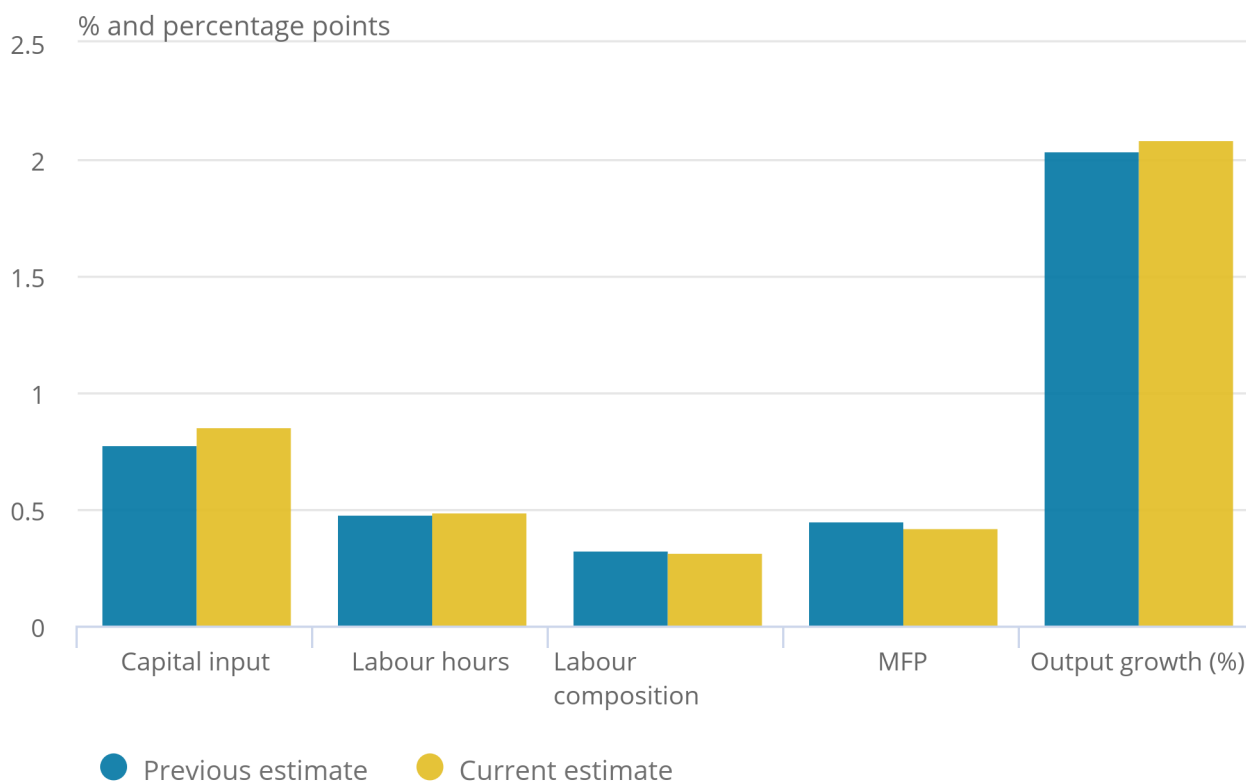
Source: UK, market sector, current and previous estimates

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. We hope to update users on progress on or before the next Productivity theme day on 9 January 2019.

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: April to June 2018 draws together the main findings from official statistics and analysis of UK productivity to present a summary of recent developments (published 5 October 2018).

- Labour productivity, UK: April to June 2018 contains the latest estimates of labour productivity for the whole economy and a range of industries, together with estimates of unit labour costs (published 5 October 2018).

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

- Quarterly UK public service productivity (Experimental Statistics): April to June 2018 contains the latest experimental estimates for quarterly UK total public service productivity, inputs and output (published 5 October 2018).

- Information and Communication Technology intensity and productivity contains new firm-level analysis to explore the relationship between the use of technologies and productivity (published 5 October 2018).

- Productivity development plan: 2018 to 2020 is a development plan that 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 that helps businesses to calculate their productivity and compare their performance with other businesses in Great Britain (published 6 July 2018).