

Article

Multi-factor productivity estimates: Experimental estimates April to June 2019

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

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1 . Main points

- Multi-factor productivity (MFP) in Quarter 2 (Apr to June) 2019 is estimated to have decreased by 0.5% compared with the same quarter a year ago; this contrasts with trend growth in MFP of around 1% per year prior to the financial downturn.
- Capital services per hour worked (capital deepening) has also been exceptionally weak by historic standards, reflecting sluggish growth in investment and buoyant growth in hours worked, and has delivered a negative contribution to labour productivity growth since 2012.
- Growth in market sector hours worked has been driven by workers with degrees.
- Over the last decade, since the 2008 financial downturn, non-financial services have made a positive contribution to MFP, while all other sectors have made negative contributions.

2 . Things you need to know about this release

This is the next publication in our series of experimental quarterly multi-factor productivity (MFP) estimates for the UK market sector, we have also previously published a [simple guide to MFP](#). These estimates present estimates for the UK market sector only, and therefore, unlike other published data, doesn't capture the non-market sector (for example, government services). This data is produced usually one week after the publication of the quarterly national accounts (QNA) and around 14 weeks after the reference quarter.

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 quantifiable distinction between the volume and quality of capital.

Currently these experimental quarterly estimates cover only the aggregate UK market sector and 10 component industries to allow us to strengthen these estimates ready for [National Statistics](#) badging. We are investigating the feasibility of publishing a more granular quarterly breakdown by industry in future releases.

Data in this release is consistent with Quarterly National Accounts and Blue Book 2019. All data previously published as part of our discontinued quality-adjusted labour input (QALI) and volume indices of capital services (VICS) articles are published alongside this article.

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. For more information, see our [simple guide to MFP](#).

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 differ slightly from those in our labour productivity release: we are working towards aligning these in future releases.

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. This article also incorporates Blue Book 2019 changes to National Accounts, which has caused revisions to our previous MFP estimates.

More detailed information on the Blue Book 2019 changes and their impacts can be found in the separate articles released by the [UK National Accounts](#). [Section 8](#) in this article outlines the impact of these changes on multi-factor productivity.

3 . Multi-factor productivity decreased in Quarter 2 2019 and still lower than in 2008

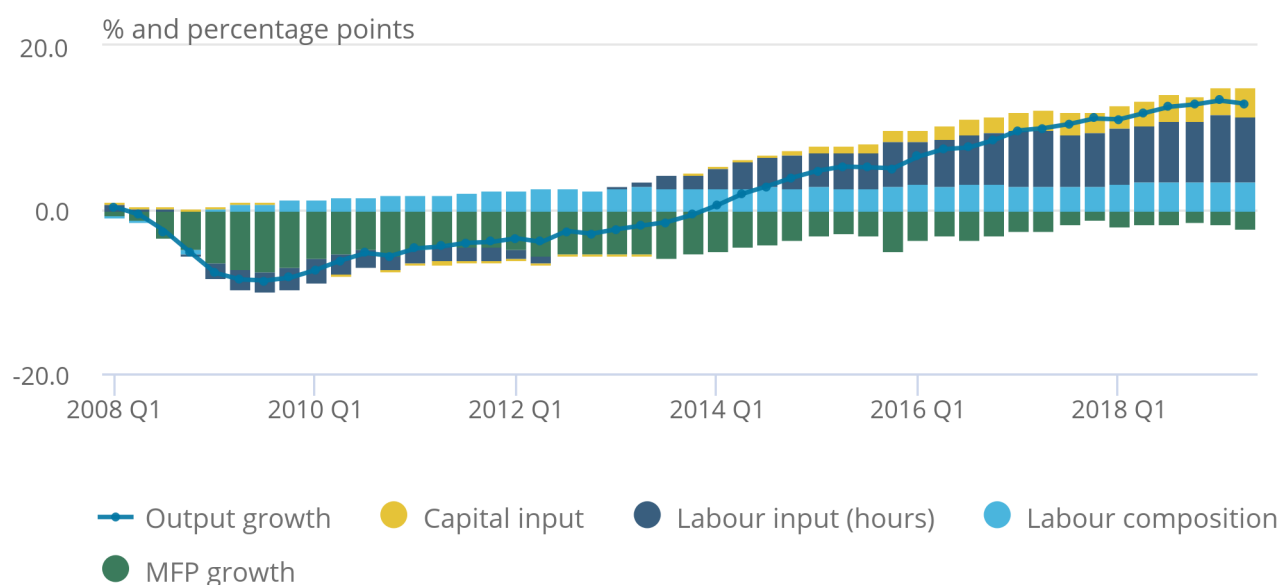
Figure 1 decomposes cumulative quarterly market sector output growth since Quarter 1 (Jan to Mar) 2008 into contributions from capital and labour input growth (the latter separated into contributions from hours and labour composition) and the residual multi-factor productivity (MFP) contribution.

Figure 1: Multi-factor productivity made a negative contribution to output growth; labour composition growth has flatlined

Decomposition of cumulative quarterly output growth, Quarter 1 (Jan to Mar) 2008 to Quarter 2 (Apr to June) 2019, UK, market sector

Figure 1: Multi-factor productivity made a negative contribution to output growth; labour composition growth has flatlined

Decomposition of cumulative quarterly output growth, Quarter 1 (Jan to Mar) 2008 to Quarter 2 (Apr to June) 2019, 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.

Quarter 2 (Apr to June) 2019 saw a fall in market sector gross value added (GVA) which was driven by fall in multi-factor productivity growth. This is the first fall in market sector GVA since Quarter 1 2018. The previous upward trend in market sector GVA growth 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. Further information is available in the [dataset](#) published alongside this release.

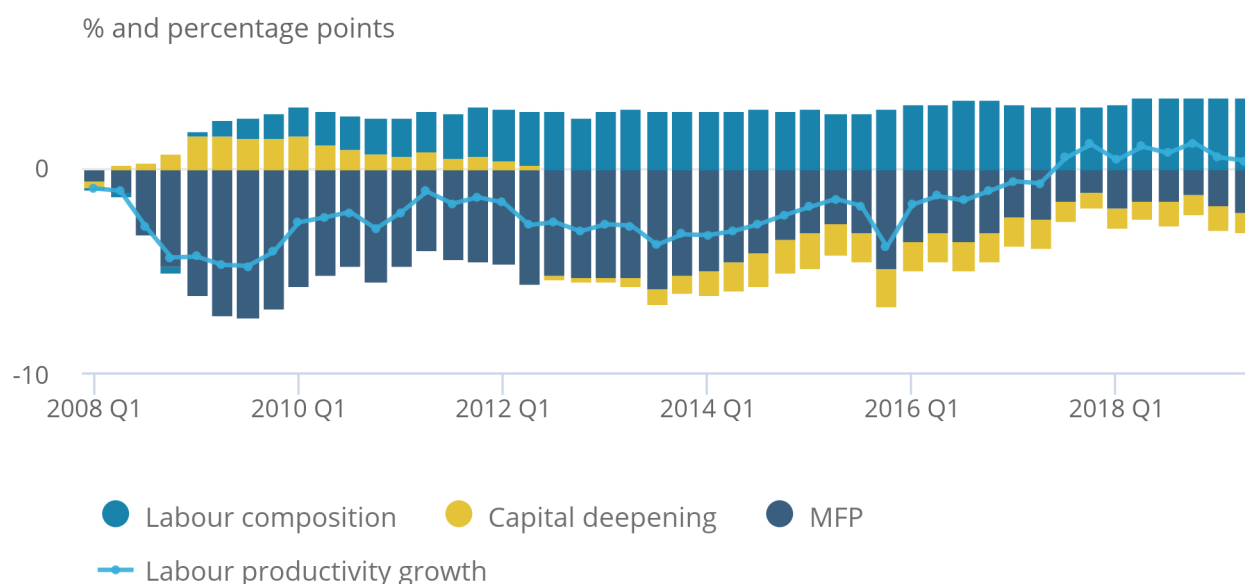
The growth accounting framework can be re-arranged to provide a decomposition of movements in labour productivity measured by output per hour, as shown in Figure 2. In this presentation, the capital contribution reflects changes in capital services per hour worked (known as capital deepening). The contributions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

Figure 2: Market sector output per hour has barely increased in the last 11 years

Decomposition of cumulative quarterly growth of output per hour worked, Quarter 1 (Jan to Mar) 2008 to Quarter 2 (Apr to June) 2019

Figure 2: Market sector output per hour has barely increased in the last 11 years

Decomposition of cumulative quarterly growth of output per hour worked, Quarter 1 (Jan to Mar) 2008 to Quarter 2 (Apr to June) 2019



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. Multi-factor productivity (MFP) is calculated by residual.

Figure 2 highlights the prolonged weakness of market sector labour productivity since the 2008 financial downturn. More than 10 years on, labour productivity per hour worked is only just ahead of its level at the end of 2007. In Quarter 2 multi-factor productivity (MFP) growth fell by 0.5 percentage points compared to same quarter a year ago. This contrasts with trend growth in MFP of around 1% per year prior to the financial crisis.

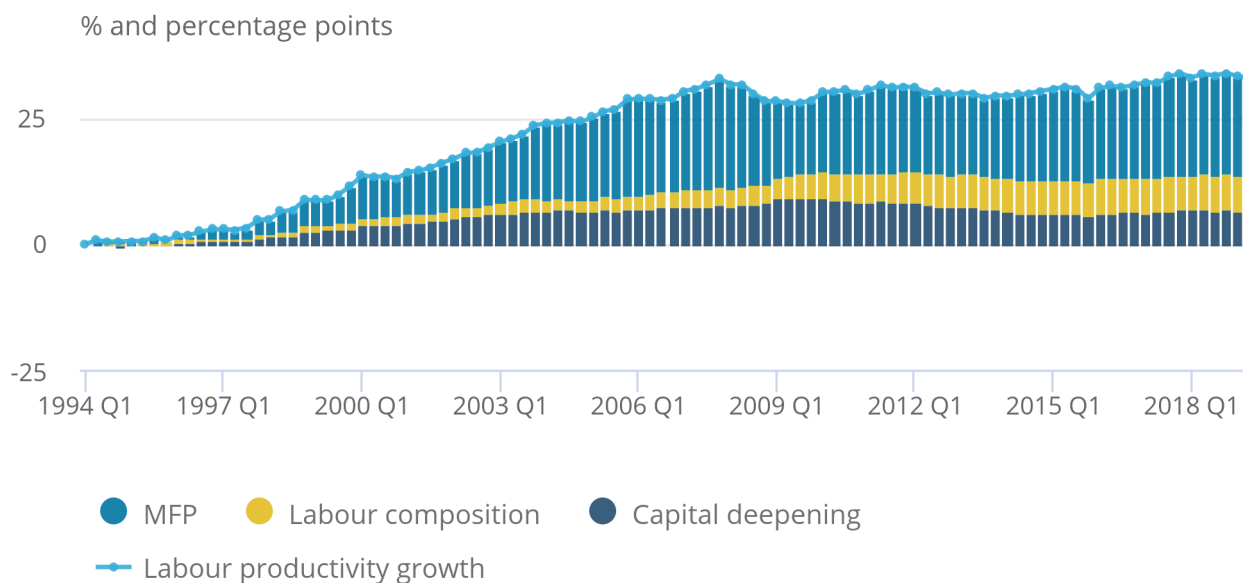
Capital deepening has also been exceptionally weak by historic standards. Capital deepening (capital services per hour worked) has had a negative contribution to labour productivity growth since 2012 – known as capital shallowing – reflecting sluggish growth in investment. Since the 2008 economic downturn, there has been a buoyant growth in hours worked and steady improvement in labour composition. The contributions made by capital deepening have been revised down from our previous estimates, following improvements to capital stocks and gross fixed capital formation estimates. MFP is calculated as a residual, so downward revisions to capital deepening have caused the MFP estimates to be revised up. MFP is now estimated to be 2 percentage points below the pre-downturn level compared with [our previous estimate](#) of 4.5 percentage points. Section 8 covers revisions to MFP estimates in more detail.

Figure 3: Strengthening labour composition has propped up productivity growth

Decomposition of cumulative quarterly growth of output per hour worked, Quarter 1 (Jan to Mar) 1994 to Quarter 2 (Apr to June) 2019, UK, market sector

Figure 3: Strengthening labour composition has propped up productivity growth

Decomposition of cumulative quarterly growth of output per hour worked, Quarter 1 (Jan to Mar) 1994 to Quarter 2 (Apr to June) 2019, 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. Multi-factor productivity (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 . More educated workers drive improvements in labour quality

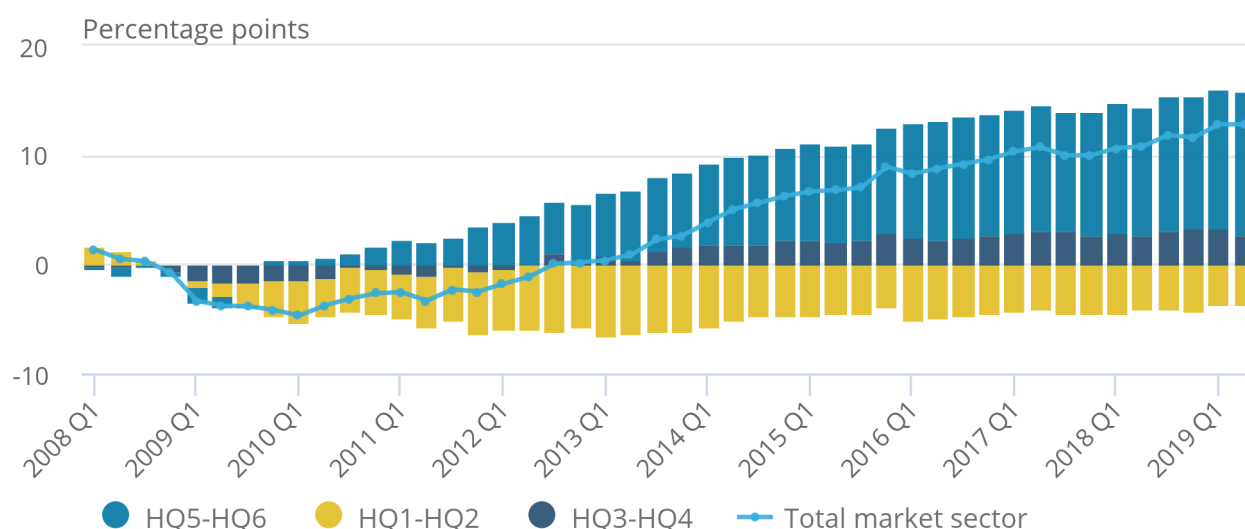
Labour composition (or quality) was unchanged in Quarter 2 (Apr to June) 2019 compared with the previous quarter. The share of hours worked by workers with degrees or postgraduate degrees has been increasing since the downturn. In Quarter 2 2019 workers with degrees accounted for 31% of the total hours worked in the market sector. For more information on the UK labour composition post downturn can be found in [our analysis of compositional changes in hours worked in the UK](#).

Figure 4: Since the financial downturn the growth in market sector hours worked has been driven by workers holding degrees or higher qualifications

Cumulative contributions to changes in hours worked by highest level of education, Quarter 1 (Jan to Mar) 2008 to Quarter 2 (Apr to June) 2019, UK, market sector

Figure 4: Since the financial downturn the growth in market sector hours worked has been driven by workers holding degrees or higher qualifications

Cumulative contributions to changes in hours worked by highest level of education, Quarter 1 (Jan to Mar) 2008 to Quarter 2 (Apr to June) 2019, 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.

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. Further information on hours worked and labour composition, including industry components, is available in the QALI00, QALI01 and QALI02 [datasets](#) published alongside this release.

We no longer publish standalone 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 standalone datasets are not seasonally adjusted.

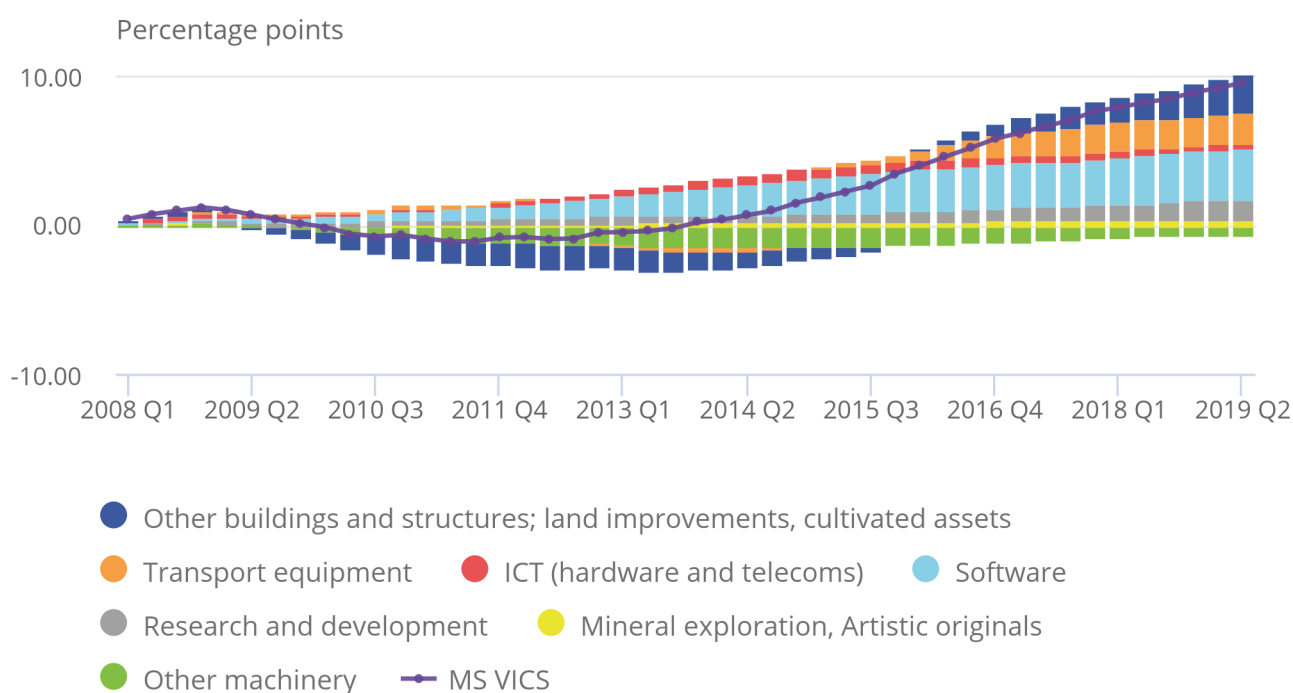
5 . Growth in capital services has been slow since the downturn

Figure 5: Capital services growth has been dominated by software

Cumulative contributions to changes in capital services, Quarter 1 (Jan to Mar) 2008 to Quarter 2 (Apr to June) 2019, UK, market sector, by broad asset category

Figure 5: Capital services growth has been dominated by software

Cumulative contributions to changes in capital services, Quarter 1 (Jan to Mar) 2008 to Quarter 2 (Apr to June) 2019, UK, market sector, by broad asset category



Source: Office for National Statistics

Notes:

1. Other buildings and structures, Land improvements, Cultivated assets; Transport equipment, Other machinery and ICT are classified as tangible assets.
2. Software, Research and development, Mineral exploration and Artistic originals are classified as intangible assets.

Capital services measure the flow into production activities of the accumulated stocks of productive capital embodied in different types of assets, adjusted for deterioration of each vintage of the asset and weighted by a set of user cost weights. This release incorporates [the Blue Book 2019 \(BB19\) changes to asset lives and gross-fixed capital formation](#). Asset lives, which dictate the rate of deterioration of assets' productive potential, have been reviewed in line with international best practice and the latest research. For many assets, this has led to reductions in asset lives, especially for tangible assets. This has reduced the value of the capital stocks, and impacted capital services estimates. The impact of these changes on capital services and multi-factor productivity is covered in [Section 8](#).

The coverage of capital in the multi-factor productivity (MFP) system is similar to that of [Business investment](#), which fell by 0.4% in Quarter 2 (Apr to June) 2019. On a year-on-year basis, business investment was 1.4% lower than in Quarter 2 2018. In contrast, capital services are estimated to have increased by 1.3% in the year to Quarter 2. This suggests that lower levels of new investment were still sufficient enough to more than offset declines in the stock of productive capital due to wear and tear, and retirements. The growth of capital deepening (capital services per hour worked) has been slow since the 2008 financial downturn. The average growth rate for capital deepening for the 2009 to 2018 period has been negative 0.3% when the average growth rate for the pre-downturn period 1998 to 2008 was 1.8%.

We no longer publish standalone articles on [volume indices of capital services \(VICS\)](#) but we are publishing all the estimates previously included in VICS articles alongside this article (in the VICS01 [dataset](#)). 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 standalone VICS dataset are not seasonally adjusted.

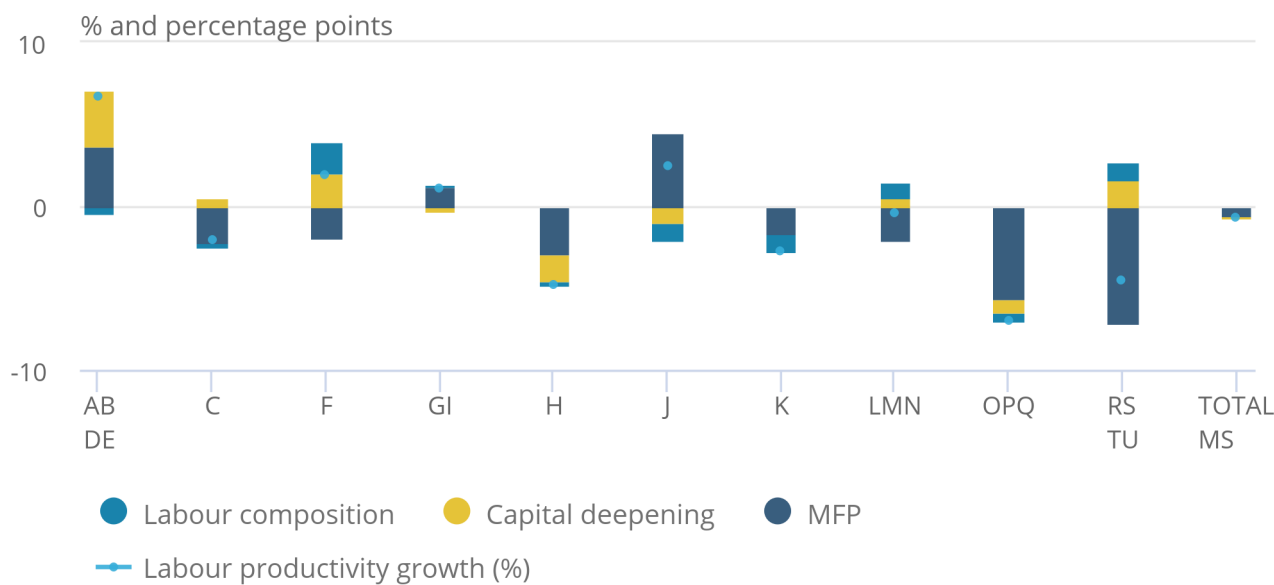
6 . Industry breakdown

Figure 6: Multi-factor productivity grew in three out of ten industries in the year to Quarter 2 2019

Decomposition of year-on-year growth of output per hour worked to Quarter 2 (Apr to June) 2019, UK, market sector and component industries

Figure 6: Multi-factor productivity grew in three out of ten industries in the year to Quarter 2 2019

Decomposition of year-on-year growth of output per hour worked to Quarter 2 (Apr to June) 2019, 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 four industries, negative in six industries. Capital deepening is positive in five industries, negative in four industries, negligible in K (finance and insurance) and slightly negative overall. Movements in MFP are positive in three industries but negative in the other seven industries.

Further information including industry components is available in the MFP01 [dataset](#) published alongside this release.

7 . Non-financial services have made a positive contribution to changes in multi-factor productivity since 2007

The MFP01 [dataset](#) published alongside this release includes 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 a breakdown of the cumulative movement in MFP since 2007 into five broad industry groups. According to this analysis, only non-financial services has made a positive contribution to MFP over this period.

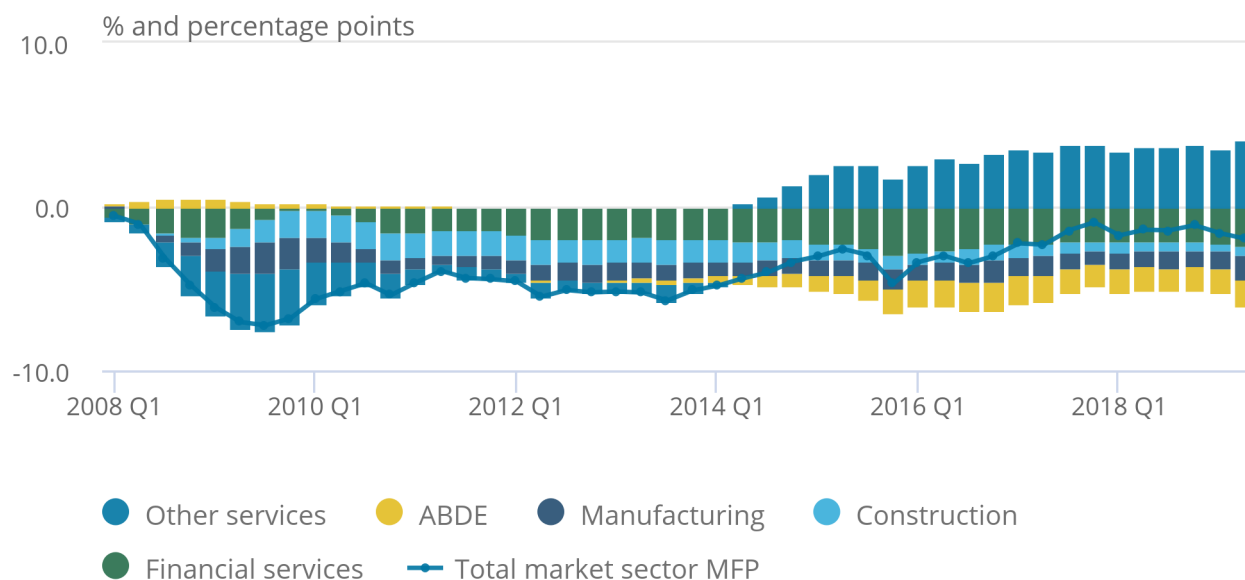
The Diewert (2015) methodology can also be used to decompose movements in MFP into “within” industry and “between” industry elements. We welcome views from users on whether this would be helpful.

Figure 7: Multi-factor productivity lower in all industries since downturn except non-financial services

Industry contributions to cumulative multi-factor productivity growth, Quarter 1 (Jan to Mar) 2008 to Quarter 2 (Apr to June) 2019, UK, market sector

Figure 7: Multi-factor productivity lower in all industries since downturn except non-financial services

Industry contributions to cumulative multi-factor productivity growth, Quarter 1 (Jan to Mar) 2008 to Quarter 2 (Apr to June) 2019, 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.
2. Total MS is the whole market sector.

8 . Revisions

One of the most impactful changes in Blue Book 2019 (BB19) in terms of multi-factor productivity (MFP) is reduced asset lives for many of the assets. The reduction in asset lives has reduced the productive capital stock for these assets. The changes to asset lives have also impacted the weights assigned to different asset groups in volume index of capital services (VICS).

Contributions to annual market sector output growth by capital input has been revised down by 0.2 percentage points and the VICS growth rate for the period 2009 to 2018 has been revised down by 0.65%. The effect of the BB19 changes to VICS varies across industries as the asset mix used in production varies. The largest VICS growth rate revision for the period 2009 to 2018 is in industry B (mining and quarrying) where the growth rate has been revised down by 2.4%. More detailed information on BB19 changes to asset lives can be found in [the capital stock article](#). More information on revisions to capital services can be found in [VICS01](#) data set published alongside this article.

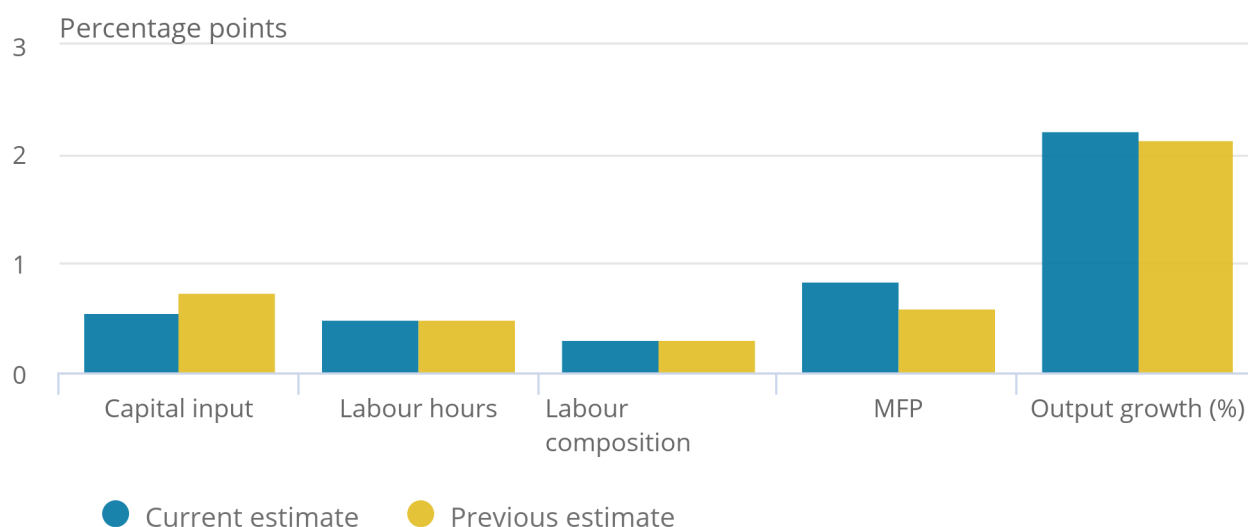
Multi-factor productivity (MFP) growth rate between 1998 and 2018 has been revised up by 0.3 percentage points since our last [MFP release in July 2019](#). Contributions to output growth by labour composition and hours remain broadly unchanged. The market sector gross value added (GVA) growth rate is revised up by 0.1 percentage points for the period 1998 to 2018. More information on the BB19 changes to GVA can be found in [the National Accounts article](#).

Figure 8: Capital input and MFP have been affected the most by Blue Book 2019 changes

Contributions to annual average output growth, 1998 to 2018, UK, market sector, current and previous estimates

Figure 8: Capital input and MFP have been affected the most by Blue Book 2019 changes

Contributions to annual average output growth, 1998 to 2018, UK, market sector, current and previous estimates



Source: Office for National Statistics

Notes: Revisions at component industry level are contained in the MFP01 [dataset](#) published alongside this release.

9 . Next steps

In addition to ongoing work to expand the level of industry detail, the development priorities of the Office for National Statistics Growth Accounting Team, as set out in our [Productivity development plan](#), published in July 2018, are further developments to capital stocks and capital services, and development of wider measures of multi-factor productivity (MFP).

10 . Related links

[Labour productivity, UK: April to June 2019](#) Article | Released 8 October 2019

The latest estimates of labour productivity for the whole economy.

[Quarterly UK public service productivity \(Experimental Statistics\): April to June 2019](#) Article | Released 8 October 2019

Contains the latest experimental estimates for quarterly UK total public service productivity, inputs and output.

[Industry by region estimates of labour productivity: 2017](#) Article | Released 6 February 2019

Annual productivity estimates for 16 industries in Standard Industrial Classification 2007 section groups for each of the NUTS1 regions from 1997 to 2017. It compares annual productivity growth by region, as output per hour, relative to the UK and explains how manufacturing and services have grown across the regions.

[Regional and sub-regional productivity in the UK](#) Article | Released 6 February 2019

Estimates for measures of labour productivity using a balanced gross value added (GVA) approach for NUTS1, NUTS2 and NUTS3 sub-regions of the UK, selected city regions and English local enterprise partnerships (LEPs) up to 2017. Estimates are in both real and nominal terms.

[Improving estimates of labour productivity and international comparisons](#) Article | Released 9 January 2019

Discusses recent Organisation for Economic Co-operation and Development 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.

[Analysis of compositional changes in hours worked in the UK](#) Article | Released 7 August 2019

Analysis of the changes in the UK labour composition during and after the economic downturn, and international comparison over the last five years.

[Public service productivity: total, UK, 2016](#) Article | Released 9 January 2019

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.

[Public service productivity: healthcare, UK, 2016](#) Article | Released 9 January 2019

Presents updated estimates of output, inputs and productivity for public service healthcare in the UK between 1995 and 2015, and new estimates for 2016.

[How productive is your business?](#) Article | Released 6 July 2018

An interactive tool that helps businesses to calculate their productivity and compare their performance with other businesses in Great Britain.