Office for National Statistics

Article

Multi-factor productivity estimates: Experimental estimates January to March 2019

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

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Notice

5 July 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.

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1 . Main points

- Compared with the same quarter in 2018, MFP in Quarter 1 (Jan to Mar) 2019 is estimated to have decreased by 0.2%; this contrasts with trend growth in MFP of around 1% per year prior to the financial downturn.
- If MFP had continued to grow at its pre-downturn trend, we estimate that the average market sector worker would have earned over £5,000 more in 2018 than their actual earnings.
- 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.
- Capital deepening is estimated to have had a negative impact on labour productivity growth of 0.2 percentage points in the year to Quarter 1 2019, compared with trend growth of around a percentage point a year prior to the financial downturn.
- 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.
- Across the UK market sector as a whole, the share of labour income has been trending gently upwards and was higher in Quarter 1 2019 than at any time since 2005.
- This release contains provisional MFP results for sub-sections of manufacturing and, for the first time, of distribution and professional services; we plan to publish further industry detail in future releases.
- 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.

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 quantifiable distinction between the volume and quality of capital.

This is the fifth 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 fourth 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.

Currently 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 are investigating the feasibility of publishing a more granular quarterly breakdown by industry in future releases. This release also contains experimental annual MFP estimates for the period 1970 to 2018 for the aggregate market sector and 37 component industries, including for the first time three sub-sections of distribution and five sub-sections of professional services. Users should note that due to the use of a new more granular model of labour composition, the estimates for these sub-sections are not wholly consistent with the quarterly and annual estimates for the corresponding aggregate series.

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. 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 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 April 2019, principally to take account of revised estimates of hourly pay at detailed component level in 2017 and 2018 from the Annual Survey of Hours and Earnings.

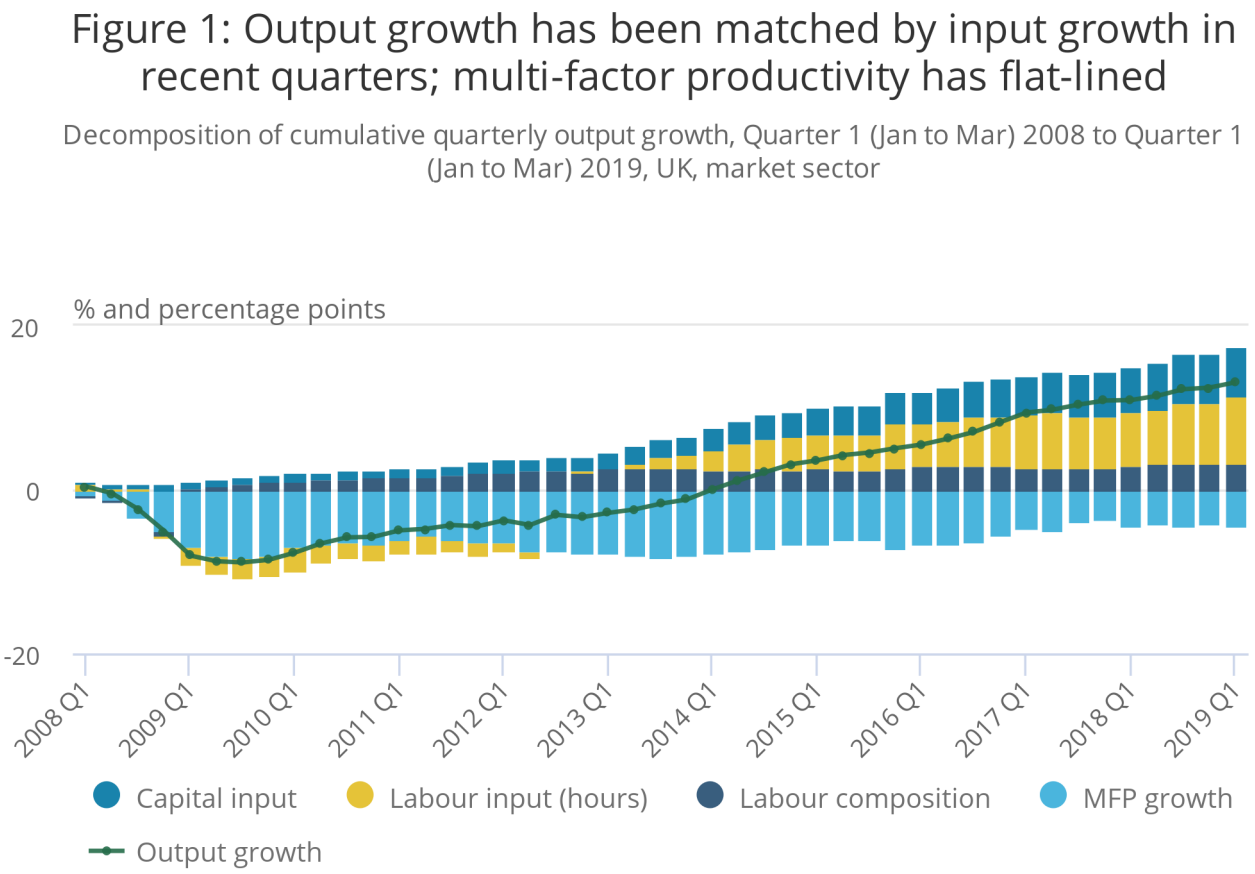
Estimates of capital services have been compiled using new processes and source data, as described in Volume index of UK capital services (experimental): estimates to Quarter 2 (Apr to June) 2017 (published in February 2018). These changes allow estimation of capital services on a quarterly frequency, 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 decreased in Quarter 1 (Jan to Mar) 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: Output growth has been matched by input growth in recent quarters; multi-factor productivity has flat-lined

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



Source: Office for National Statistics

Notes:

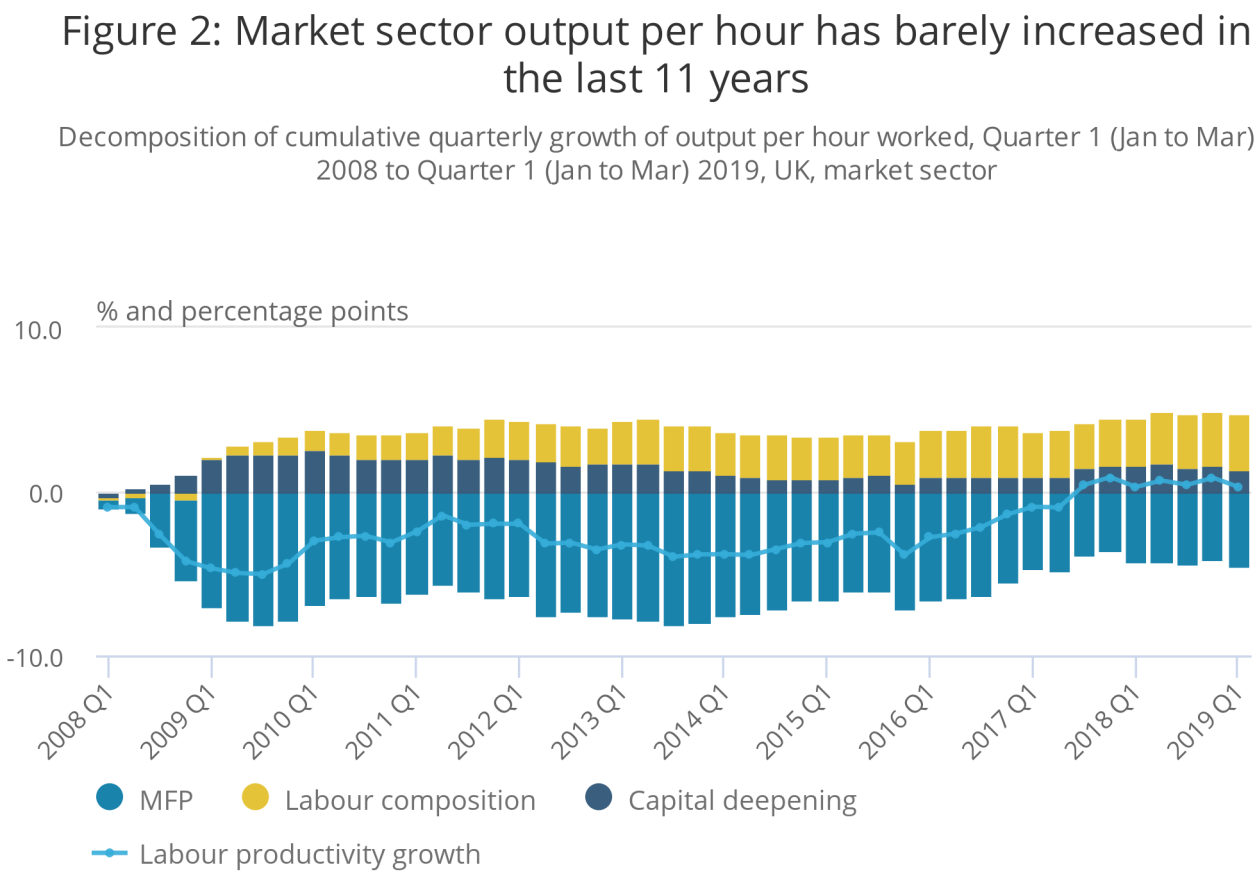
1. Output growth is the cumulative quarter-on-quarter log change in market sector gross value added (GVA).
2. Columns show contributions of components, calculated by weighting log changes in each component by its factor income share.
3. MFP is calculated by residual.

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 Multi-factor productivity (experimental): estimates 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 1 (Jan to Mar) 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.

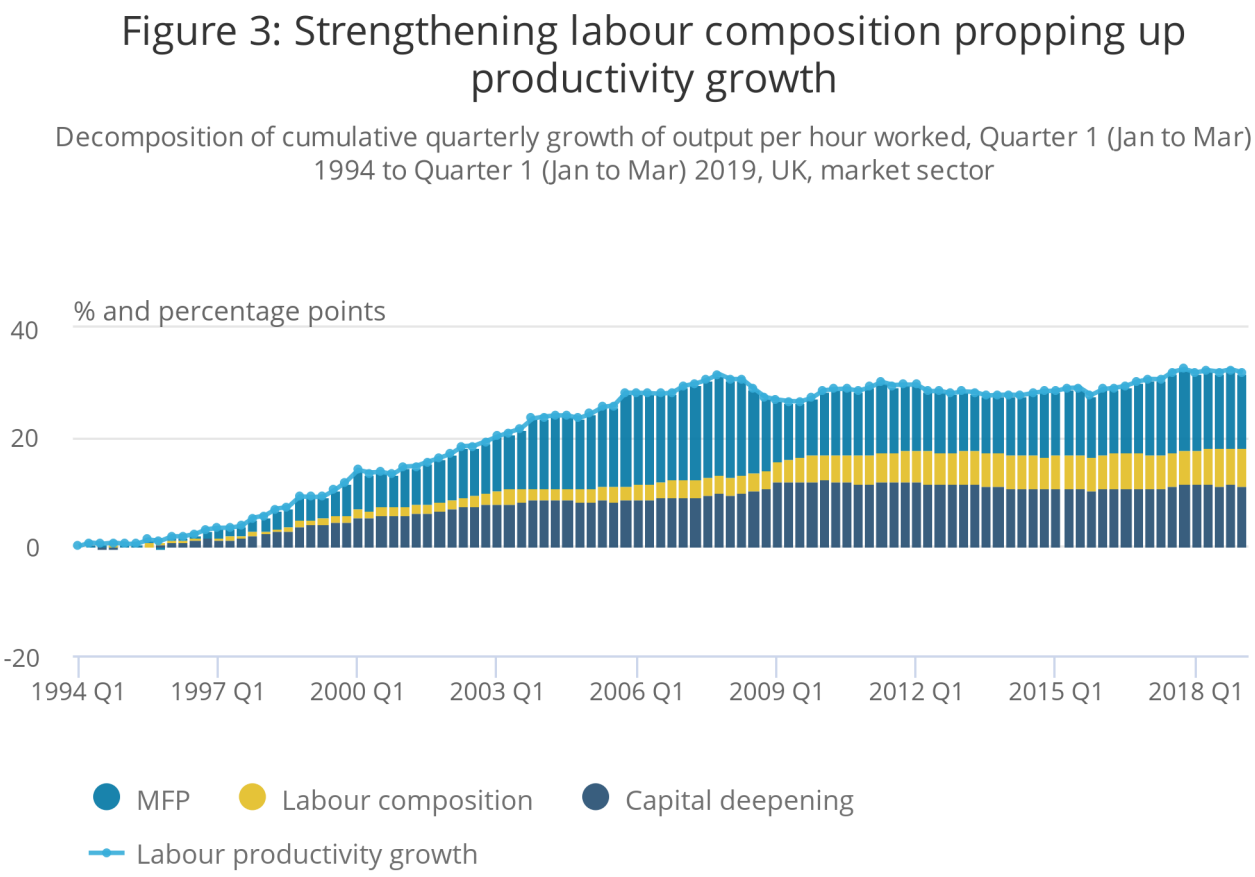
Figure 2 highlights the prolonged weakness of market sector labour productivity since the 2008 financial downturn. More than 10 years on, labour productivity per hour worked is only just ahead of its level at the end of 2007 and MFP is still 4.5 percentage points lower, having grown only slowly and intermittently since 2009. This contrasts 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 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 MFP01 dataset published alongside this release.

Figure 3: Strengthening labour composition propping up productivity growth

Decomposition of cumulative quarterly growth of output per hour worked, Quarter 1 (Jan to Mar) 1994 to Quarter 1 (Jan to Mar) 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.

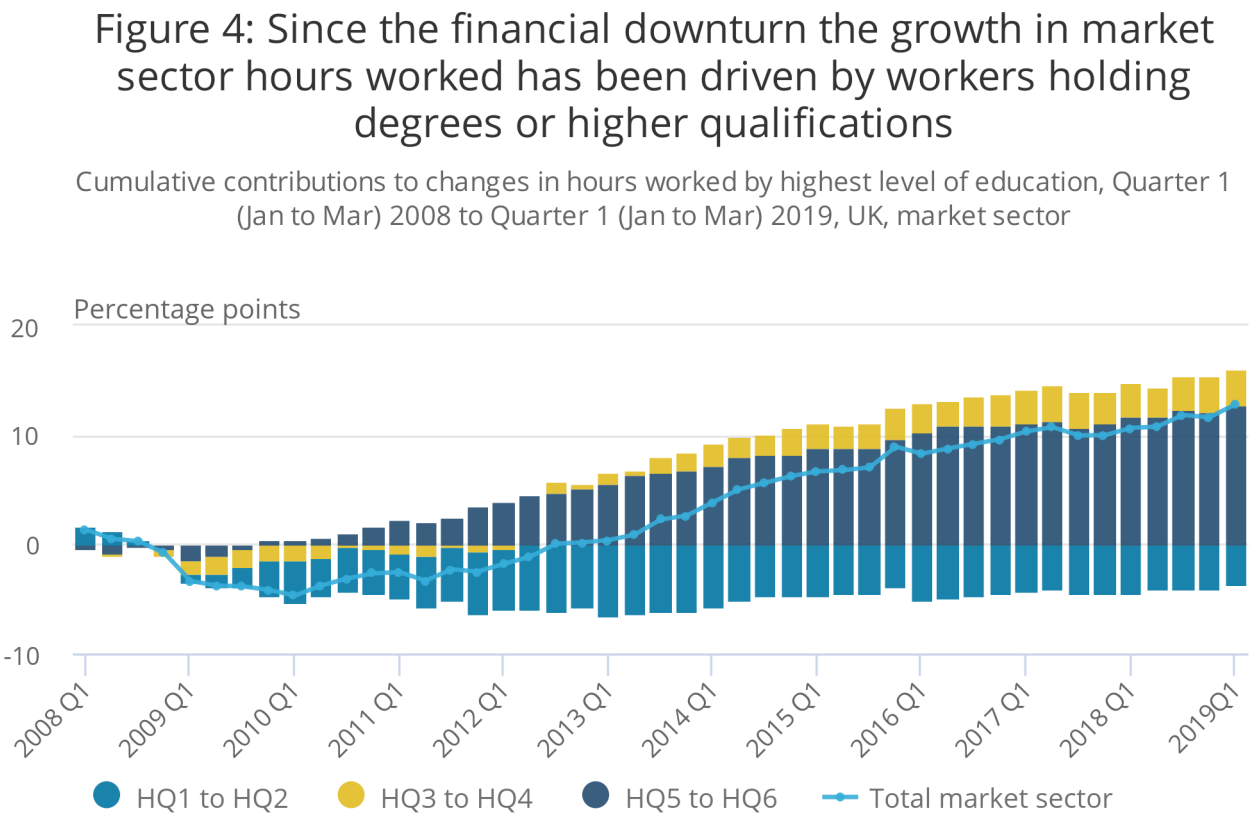
Figure 3 highlights the structural break at the time of the 2008 recession, where capital deepening ceased growing and MFP demonstrated a level-shift downwards, which incremental growth from labour composition and MFP has so far failed to exceed.

4 . More educated workers drive improvements in labour quality

Labour composition (or quality) was unchanged in Quarter 1 (Jan to Mar) 2019 compared with the previous quarter, but was still 0.6% higher than in the same quarter of 2018. This reflects a continuing trend for the share of hours worked by workers with higher educational qualifications (and hence, on average, higher wages) to increase.

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 1 (Jan to Mar) 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.

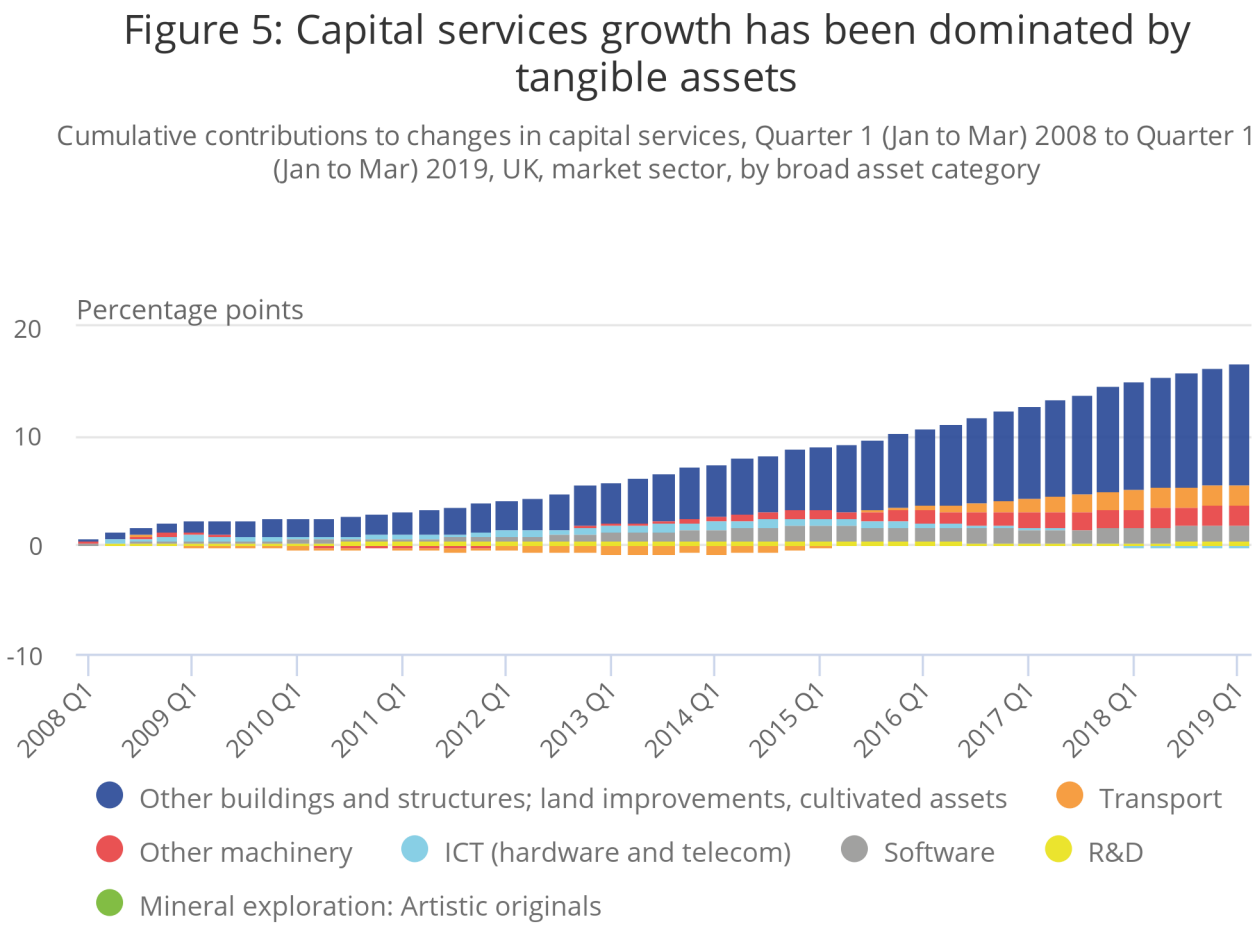
Figure 4 shows quarterly changes in hours worked broken down by highest education qualification. In general, there is a strong positive correlation between level of education and hourly earnings, so a shift in hours worked towards workers with higher qualifications will typically materialise as an increase 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 . Capital services growth picked up in Quarter 1 (Jan to Mar) 2019

Figure 5: Capital services growth has been dominated by tangible assets

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



Source: Office for National Statistics

Notes:

1. Other buildings and structures, Land improvements, Cultivated assets; Transport, Other machinery and ICT are classified as tangible assets.

2. Software, R&D, 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. In this release there are no revisions to flows of new assets (that is, gross fixed capital formation (GFCF) estimates), where we continue to use a breakdown by asset and industry that anticipates improvements scheduled to be introduced into the national accounts in Blue Book 2019.

The coverage of capital in the multi-factor productivity (MFP) system is similar to that of Business investment, which increased by 0.4% in Quarter 1 (Jan to Mar) 2019 after four consecutive quarterly reductions. On a year-on-year basis, business investment was 1.5% lower than in Quarter 1 2018. In contrast, capital services are estimated to have increased by 1.6% in the year to Quarter 1. This suggests that lower levels of new investment were still sufficient to more than offset declines in the stock of productive capital due to wear and tear, and retirements.

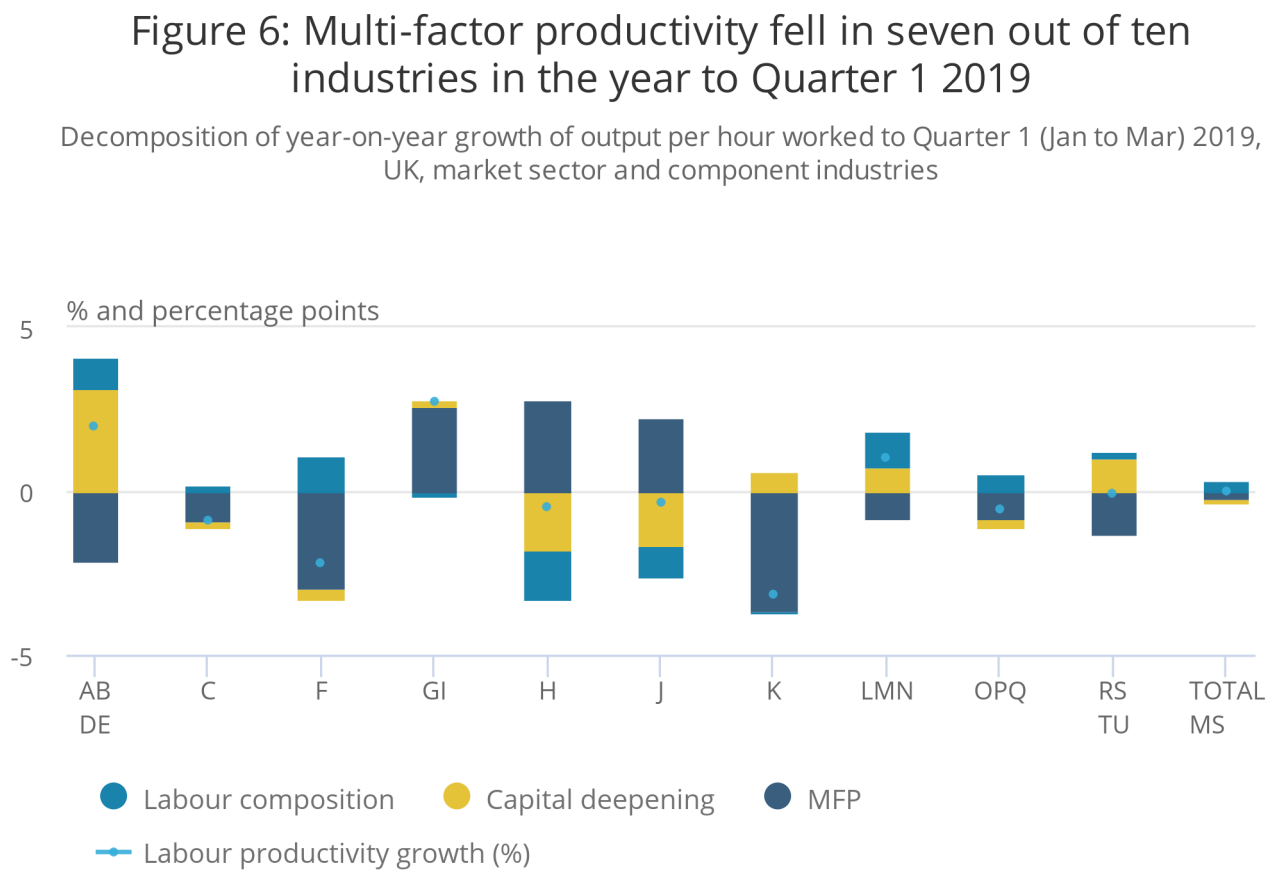
Blue Book 2019 will introduce a number of improvements to the estimation of capital stocks which will impact our estimates of capital services. The main change will be to asset lives, which will generally be shortened. Further information is available in the National Accounts article published on 27 June 2019.

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 fell in seven out of ten industries in the year to Quarter 1 2019

Decomposition of year-on-year growth of output per hour worked to Quarter 1 (Jan to Mar) 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 five industries, negative in two (transportation and storage, information and communication) and negligible in the remaining three industries. Capital deepening is positive in five industries, negative in five industries 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

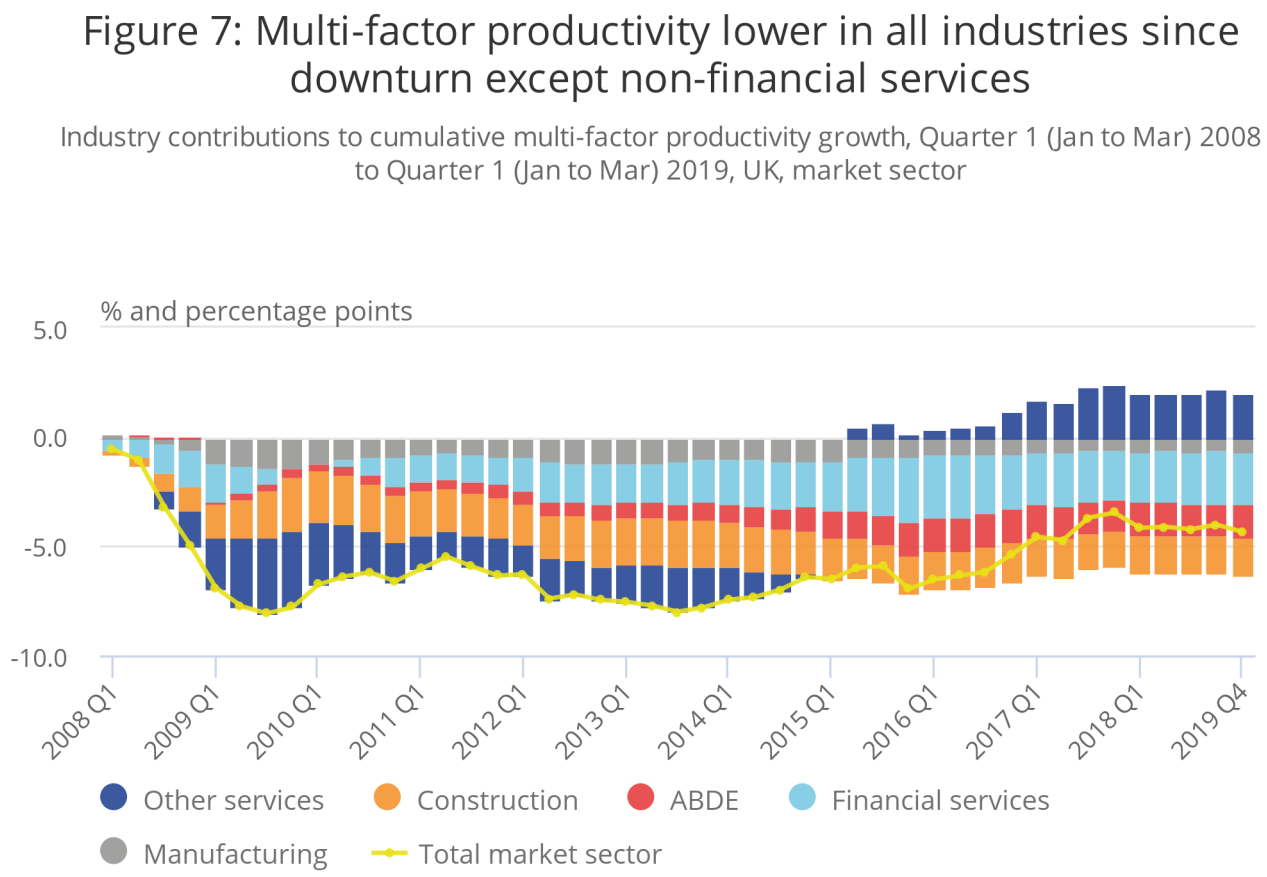
The MFP01 dataset published alongside this release includes breakdowns of aggregate market sector multi-factor productivity (MFP) into contributions due to individual industries, following the methodology set out by Diewert (2015) in Decompositions of productivity growth into sectoral effects. This is an extension and generalisation of the Tang and Wang (2004) methodology used in our labour productivity release.

Figure 7 shows some illustrative results from the Diewert (2015) methodology, breaking down 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 1 (Jan to Mar) 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 . What's changed in this release?

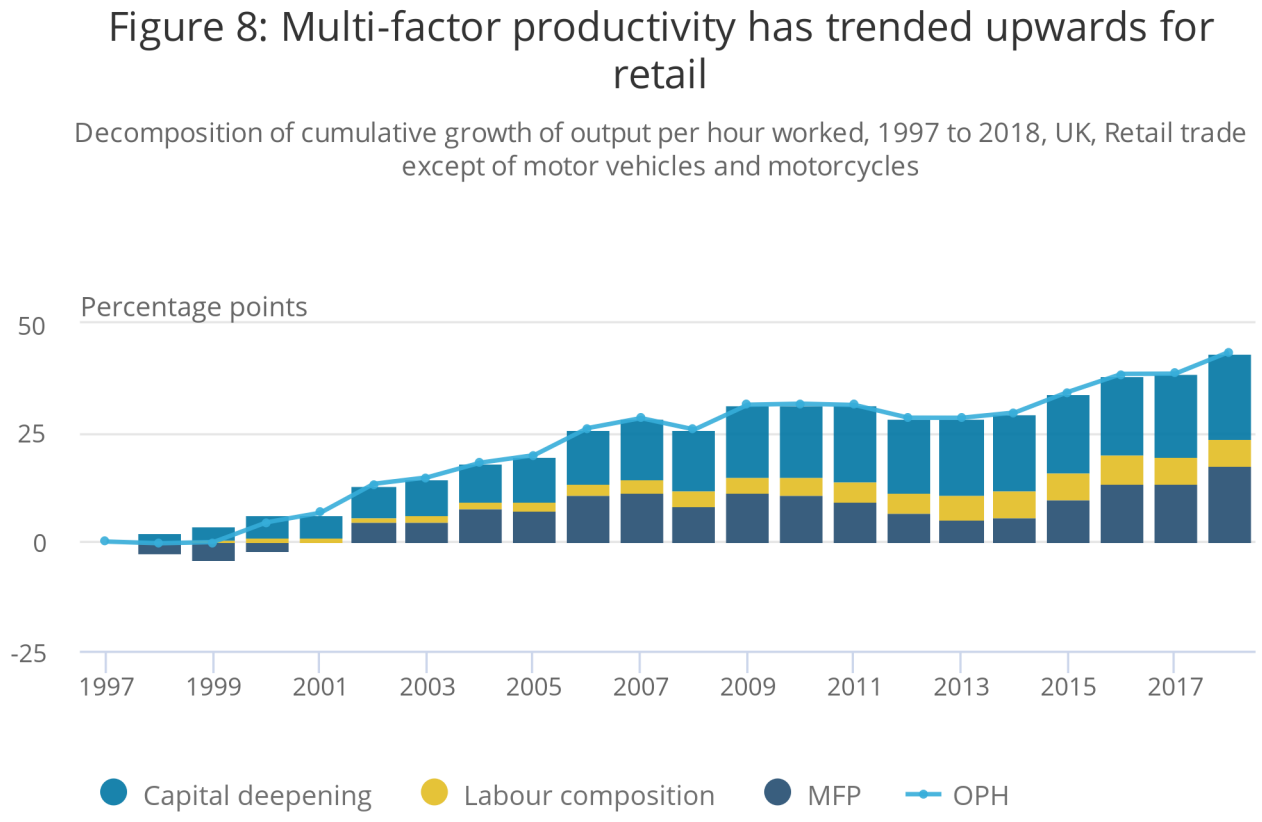
This release introduces the additional provisional results from a more granular growth accounting framework. This is identical to the existing framework in terms of gross value added (GVA), capital services, hours worked and factor income weights (that is, aggregated estimates published in previous additions are simple aggregations of the bottom-level industry components). But the new framework utilises a new model of labour composition that is not strictly additive, that is, labour composition aggregated across the bottom-level industries is not consistent with labour composition derived in the existing, more aggregated framework.

The more granular framework identifies 19 two-digit (and some clustered two-digit) sub-sections of industry C (manufacturing), three two-digit sub-sections of industry G (wholesale and retail trade; repair of motor vehicles and motorcycles) and five two-digit (and some clustered two-digit) sub-sections of industry M (Professional, scientific and technical activities). In each case the more granular estimates are fairly consistent between the two frameworks. More work is planned to explore the remaining inconsistencies, but in the meantime we are sharing annual multi-factor productivity (MFP) results for 13 two-letter manufacturing sub-sectors such as CA (food products, beverages and tobacco) and CH (basic metals and metal products), three sub-sections of industry G and five sub-sections of industry M.

Figure 8 shows the decomposition of cumulative growth of output per hour for industry 47 (Retail trade, except of motor vehicles and motorcycles) which is the largest subsection of industry G in terms of hours worked and value added.

Figure 8: Multi-factor productivity has trended upwards for retail

Decomposition of cumulative growth of output per hour worked, 1997 to 2018, UK, Retail trade except of motor vehicles and motorcycles



Source: Office for National Statistics

Notes:

1. Labour productivity growth is the cumulative annual 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.

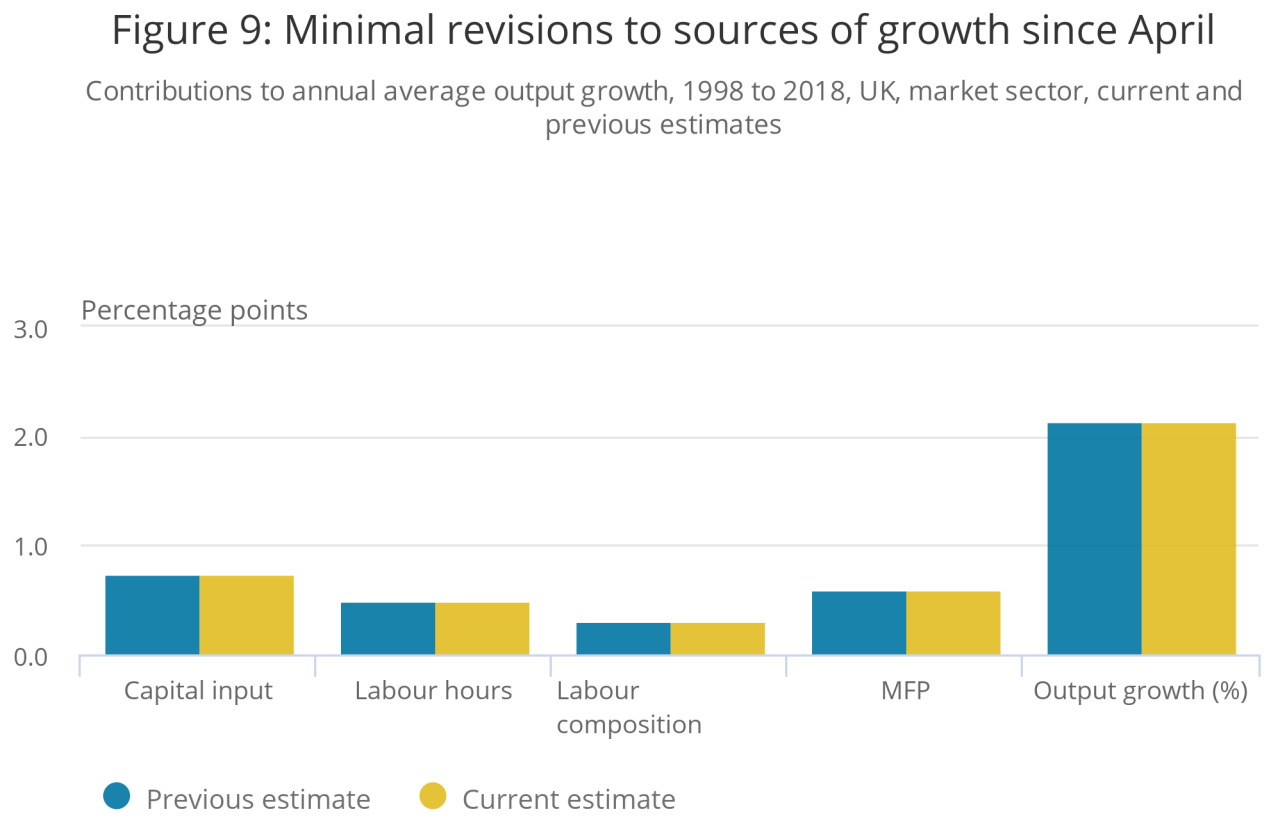
Further information on the sub-sections of industries C, G and M is available in the Multi-factor productivity estimates for sub-sections for industries C, G and M: Experimental estimates to 2018 published alongside this release.

Revisions

For the market sector as a whole, revisions to our multi-factor productivity (MFP) estimates since our last MFP release in April 2019 are minutely small, as shown in Figure 9. Average annual contributions for capital inputs and labour composition have been revised very slightly downwards, with corresponding tiny upwards revisions to MFP.

Figure 9: Minimal revisions to sources of growth since April

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



Source: Office for National Statistics

Revisions at component industry level, contained in the MFP01 dataset published alongside this release, additionally reflect revised estimates of hours worked (and, to a lesser extent, of labour composition).

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 . Links to related statistics

Productivity economic commentary: January to March 2019
Article | Released 5 July 2019
Draws together the main findings from official statistics and analysis of UK productivity to present a summary of recent developments.

Labour productivity, UK: January to March 2019
Article | Released 5 July 2019
The latest estimates of labour productivity for the whole economy.

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.

A simple guide to multi-factor productivity
Article | Released 5 October 2018
Explains the concept and measurement of multi-factor productivity through simple stylised examples.

Quarterly UK public service productivity (Experimental Statistics): January to March 2019
Article | Released 5 July 2019
Contains the latest experimental estimates for quarterly UK total public service productivity, inputs and output.

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.

Public service productivity: healthcare, England: financial year ending 2017
Article | Released 9 January 2019
Presents estimates of output, inputs and productivity for public service healthcare in England on a financial year basis up to financial year ending 2017.

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.

[How productive is your business?]
Article | Released 6 July 2018
An interactive tool that aids businesses to calculate their productivity and compare their performance with other businesses in Great Britain.

[Unit labour costs, UK: January to March 2019]
Article | Released 6 July 2019
Unit labour costs and sectional unit labour costs estimates for the whole economy and a range of industries.