

Statistical bulletin

# International comparisons of UK productivity (ICP), final estimates: 2020

A comparison of productivity across the G7 nations, including analysis of levels and growth rates of labour productivity (output per worker and output per hour worked) and multifactor productivity (MFP).



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# 1 . Main points

- In 2019, the UK's output per hour worked was lower than the US and France, and higher than Canada and Japan.
- The G7 countries' average (excluding the UK) output per worker was 13% above the UK in 2019.
- The UK's output per hour growth between 1997 and 2007 was the second fastest of the G7 countries, but between 2009 and 2019, it was the second slowest.
- Compared with other G7 countries, the contribution of capital deepening to labour productivity growth in the UK has been weak.
- Since 2009, the role of multifactor productivity (MFP) and labour composition in supporting labour productivity growth has been similar in the UK, US and Canada.
- During the coronavirus (COVID-19) pandemic, all G7 countries saw volatile but overall positive output per hour worked growth.

## 2 . Productivity levels

### Output per hour worked

Output per hour worked is calculated by dividing Gross Domestic Product (GDP) by the number of hours worked. GDP is calculated following consistent international guidelines across all G7 nations; however, this is not the case for hours worked. For more information, see [International comparisons of productivity \(ICP\) methodology updates: labour input measurements February 2021](#).

Figure 1 illustrates this variation by showing the numerous point estimates using various methods of calculating hours worked, where necessary data are available. For example, we can therefore say that Germany appears to be more productive than the UK in 2019, but this could range from 24% more productive to 3% less productive. The median of all the estimates suggests Germany is around 10% more productive per hour worked than the UK.

### Figure 1: The UK's output per hour worked is less than France and the US, but greater than Canada and Japan

Output per hour worked point estimate comparisons using differing methods to calculate hours worked, 2019

#### Notes:

1. The number of data points between countries will differ as data for the direct hours worked methodology are unavailable for Japan, Canada and the US, thus reducing the total number of comparisons.
2. Output per hour worked comparisons can be made using equivalent methodologies (UK direct versus country direct or UK simplified component versus country component) or differing methodologies (UK direct versus country component or UK simplified component versus country direct). A median has been presented as a central estimate - see [Section 9](#).

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We estimate that:

- Japan is between 20% and 27% less productive than the UK, with a central estimate of around 23% less productive
- Canada is between 4% and 11% less productive than the UK, with a central estimate of 8% less productive
- Italy is between 2% more productive and 8% less productive than the UK, with a central estimate of 3% less productive
- Germany is between 3% less productive and 24% more productive than the UK, with a central estimate of 10% more productive
- France is between 9% and 28% more productive than the UK, with a central estimate of 18% more productive
- the US is between 18% and 28% more productive than the UK, with a central estimate of 23% more productive

## Output per worker

Worker estimates are more easily compared across countries, as there is greater uniformity in methods to calculate the number of workers, so the relative difference between output per worker estimates are more robust (Figure 2). However, output per worker figures do not account for differences in working patterns, which could help explain some of the variation between countries in these estimates. These working-pattern differences include the levels of part-time, casual and “gig economy” work completed in the country. There are also differences in labour policies, including holiday, sick and maternity leave, or legislation on working hours.

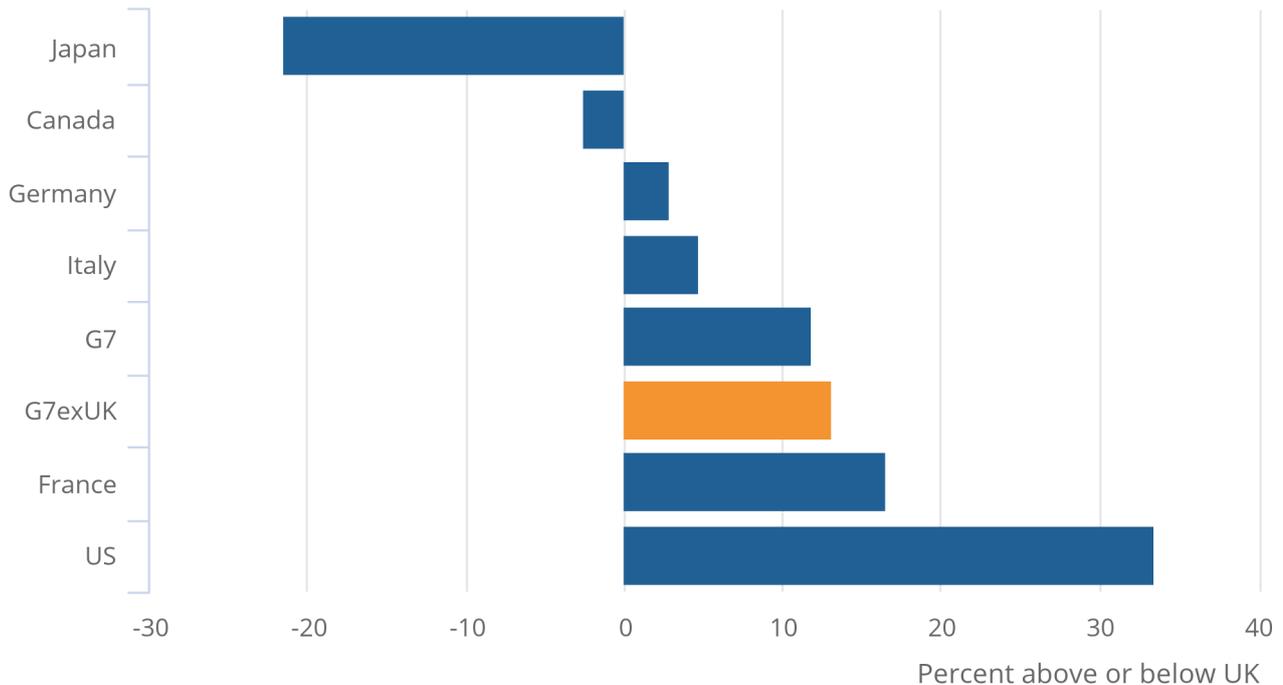
Four G7 nations produced more output per worker in 2019 than the UK. The best performer on this measure was the US, which was 35% greater than the UK. Only Japan and Canada had lower output per worker than the UK, producing 22% and 3% less, respectively.

**Figure 2: The UK's output per worker is lower than four of the G7 nations**

Output per worker, 2019

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Output per worker, 2019



Source: Organisation for Economic Co-operation and Development (OECD) data, Office for National Statistics calculations

Notes:

1. Data on number of workers are collected from the OECD Productivity database, which is consistent with domestic concept estimates from the OECD National Accounts database and thus more consistent with the gross domestic product (GDP) boundary. It was previously collected from the OECD Labour database, which is on a national basis and not adjusted to the GDP boundary. This source change has resulted in changes to our estimates.

### 3 . Labour productivity growth

## Output per hour worked

Regardless of which methodology is used to calculate hours worked, the corresponding growth rates are very similar – for more information see [Section 7](#). We therefore use each country's official hours worked estimate to calculate output per hour growth rates – [see Section 9](#) for more information.

Most G7 countries saw similar growth in output per hour worked from 1997 to 2007, with Italy a noticeably weaker outlier and the US being a noticeably stronger outlier. During this period, the UK was among the fastest growth, outpaced by just the US, and was thus catching up with all the other G7 countries in productivity levels terms. Since the 2008 economic downturn, growth rates have been slower in all G7 countries, with the UK and US having the largest slowdowns. The UK's productivity has fallen away from most of the other G7 countries during this period.

Table 1: Compound average annual growth rate of output per hour worked, before and after 2008 economic downturn

	<b>Average annual growth (%) 1997 to 2007</b>	<b>Average annual growth (%) 2009 to 2019</b>	<b>Difference</b>
<b>US</b>	2.3	0.8	-1.5
<b>UK</b>	1.9	0.7	-1.2
<b>France</b>	1.6	0.9	-0.7
<b>Canada</b>	1.5	1.0	-0.5
<b>Japan</b>	1.6	1.2	-0.4
<b>Germany</b>	1.4	1.1	-0.3
<b>Italy</b>	0.4	0.4	0.0
<b>G7 average</b>	1.9	0.9	-1.0

Source: OECD data, Office for National Statistics calculations

### Notes

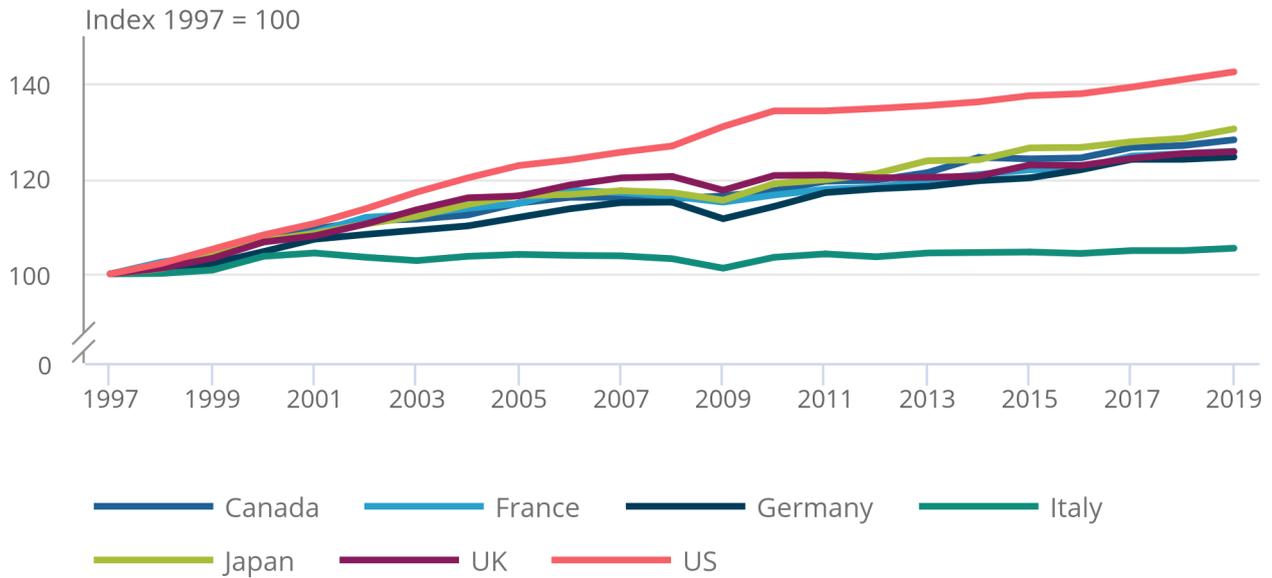
1. The figures for the UK in this table differ slightly to ONS National Statistics estimates of output per hour worked, which use gross value added (GVA) instead of gross domestic product (GDP) in the numerator. GDP is used here for international comparability.

**Figure 3: The UK's output per hour growth since 1997 has been comparable with Canada, France, Japan and Germany**

Output per hour worked, 1997 to 2019, index 1997 = 100

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Output per hour worked, 1997 to 2019, index 1997 = 100



Source: Organisation for Economic Co-operation and Development (OECD) data, Office for National Statistics calculations

## Output per worker

Every country has seen slower growth in output per worker since 2009 when compared with the pre-financial crisis period. In the UK, output per worker grew by 0.8% on average per year from 2009 to 2019, which was the same as the G7 average of 0.8%. The US saw the largest growth in this measure, increasing by 1.1% on average per year. Italy had the slowest growth over this time, and saw output per worker increase by less than 0.1% on average per year.

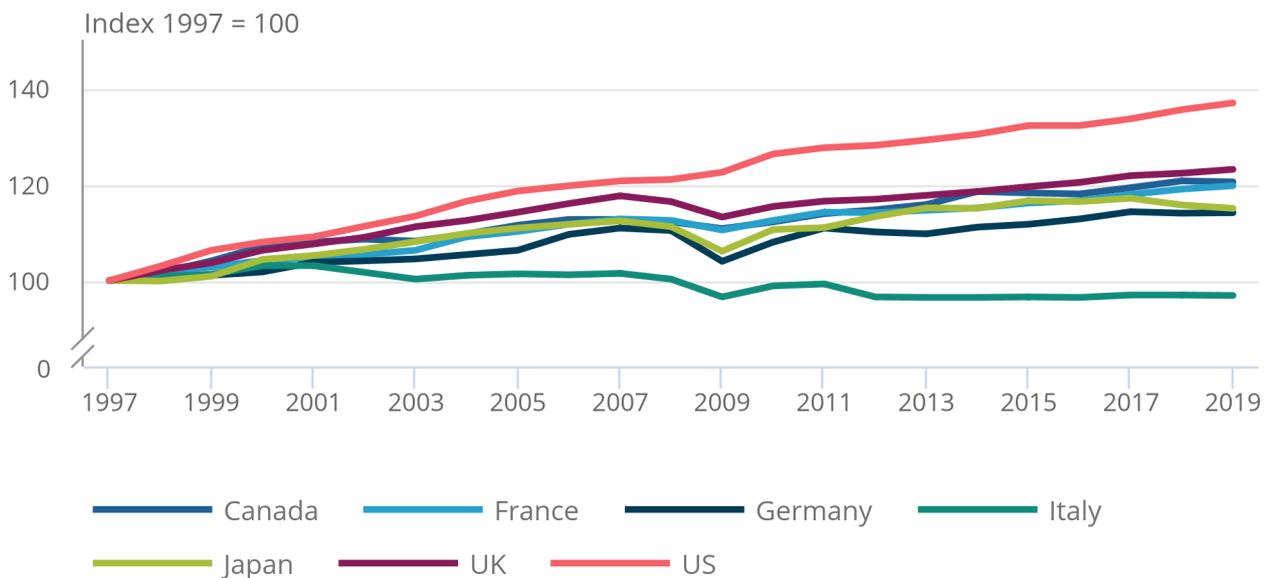
All countries saw a fall in output per worker during the 2008 economic downturn, other than the US, which saw an increase of 1.5%, driven by a sharper decline in employment. From the peak in 2007 to the trough in 2009, the UK saw a fall of 3.7%, which was close to the average fall of 3.2% for all G7 countries.

**Figure 4: The UK's output per worker growth since 1997 has consistently outperformed all G7 nations, except for the US**

Output per worker, 1997 to 2019, index 1997 = 100

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Output per worker, 1997 to 2019, index 1997 = 100



Source: Organisation for Economic Co-operation and Development (OECD) data, Office for National Statistics calculations

## 4 . Multifactor productivity

Output growth can be broken down into growth in the factors of production. These include capital services (the amount of productive capital available to businesses), quality adjusted labour input (the number of hours worked weighted by workers' wages) and multifactor productivity (MFP) (how well inputs are used in the production process). This can be re-arranged to give contributions to labour productivity growth, as shown in Figure 5.

Figure 5 provides contributions of capital deepening (capital services available per hour worked) and MFP to output per hour worked growth. Here, MFP also encompasses changes in the composition of the workforce, making it a broader concept than that published in the Office for National Statistics' (ONS) quarterly multifactor productivity estimates. This is because the Organisation for Economic Co-operation and Development's (OECD) data used for this chart does not distinguish changes in labour composition, and MFP is calculated by residual. Figure 6 explores the role of labour composition for a smaller set of countries for which data are available.

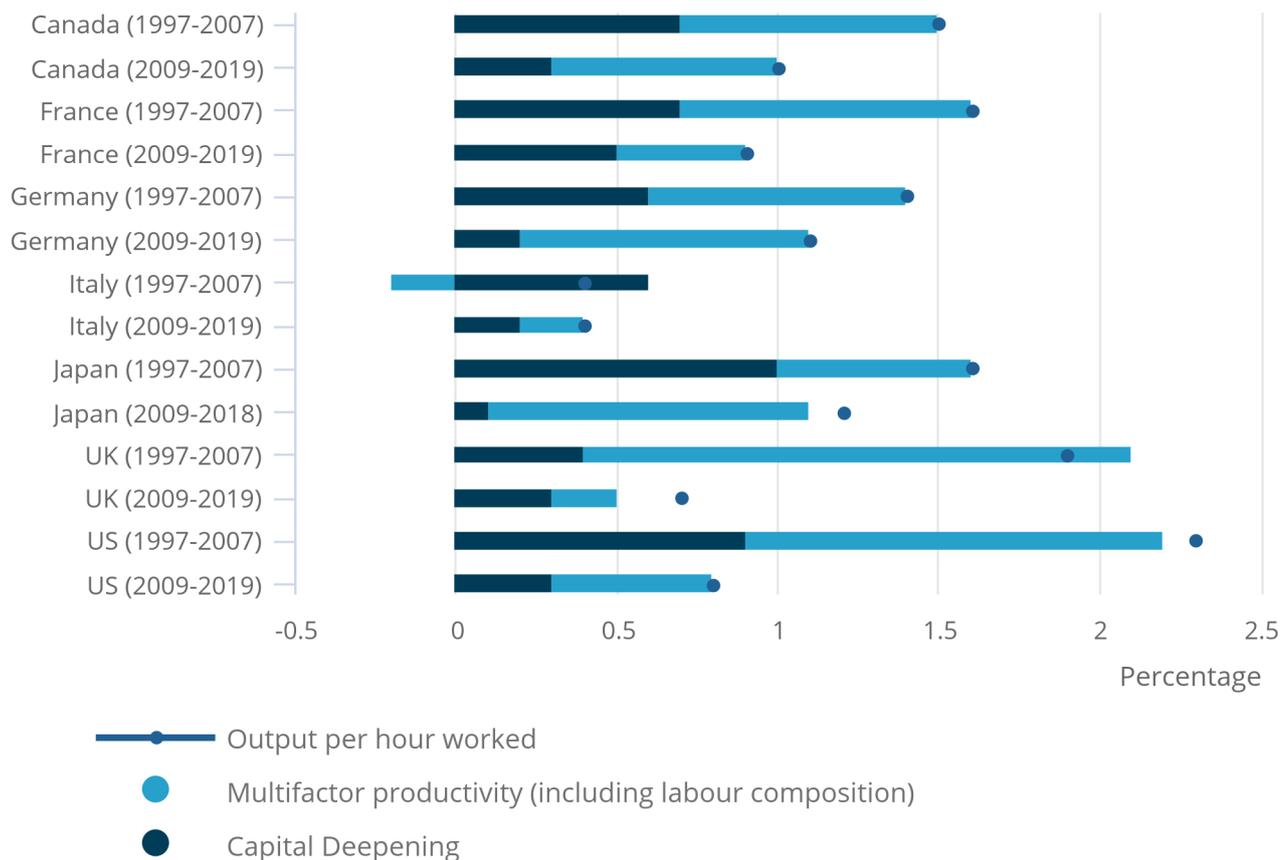
Prior to the 2008 economic downturn, capital deepening supported labour productivity growth in all G7 countries. The contribution from MFP (implicitly including labour composition) was positive in all G7 countries, except Italy, and strongest in the UK and US. Contributions to labour productivity from capital deepening fell after the 2008 economic downturn across all G7 nations. MFP growth, including labour composition, held up or increased for Italy, Germany, Canada and Japan, but fell for France, the US and the UK.

**Figure 5: Weak output per hour growth in the UK, by international standards, is driven by the decline in MFP and capital deepening contributions**

Contributions of capital deepening and MFP growth to output per hour worked growth, G7 countries, whole economy, before and after 2008 economic downturn

Figure 5: Weak output per hour growth in the UK, by international standards, is driven by the decline in MFP and capital deepening contributions

Contributions of capital deepening and MFP growth to output per hour worked growth, G7 countries, whole economy, before and after 2008 economic downturn



Source: OECD data, Office for National Statistics calculations

Notes:

1. The estimates of labour productivity are made independently of the estimates of capital deepening and MFP. Thus, differences in data vintages can cause the sum of the contributions not to add to labour productivity growth. For the UK, we believe the labour productivity estimates are Blue Book 2021 consistent, while the MFP contributions are Blue Book 2020 consistent. We expect most of the difference to be accounted for by revised MFP contributions in future releases from the OECD.
2. Data relate to the whole economy, whereas ONS multifactor productivity estimates are for the market sector.
3. Data for Japan only go up to 2018.

Figure 6 explores the role of labour composition for a smaller set of countries for which data are available. Labour composition is a measure of the skills of the workforce, proxied by education, age and sex. Improvements in labour composition reflect a larger share of hours worked by more educated or experienced workers, which should support output and labour productivity growth. The coverage for Figure 6 is the market sector, rather than the whole economy as in Figure 5.

The contribution of labour composition to labour productivity has been positive and fairly consistent before and since the economic downturn in the US, Canada and UK. The contribution of multifactor productivity (MFP) (adjusted for labour composition) fell in the US and UK after the 2008 economic downturn, although remained positive and was similar in all three countries in the past decade.

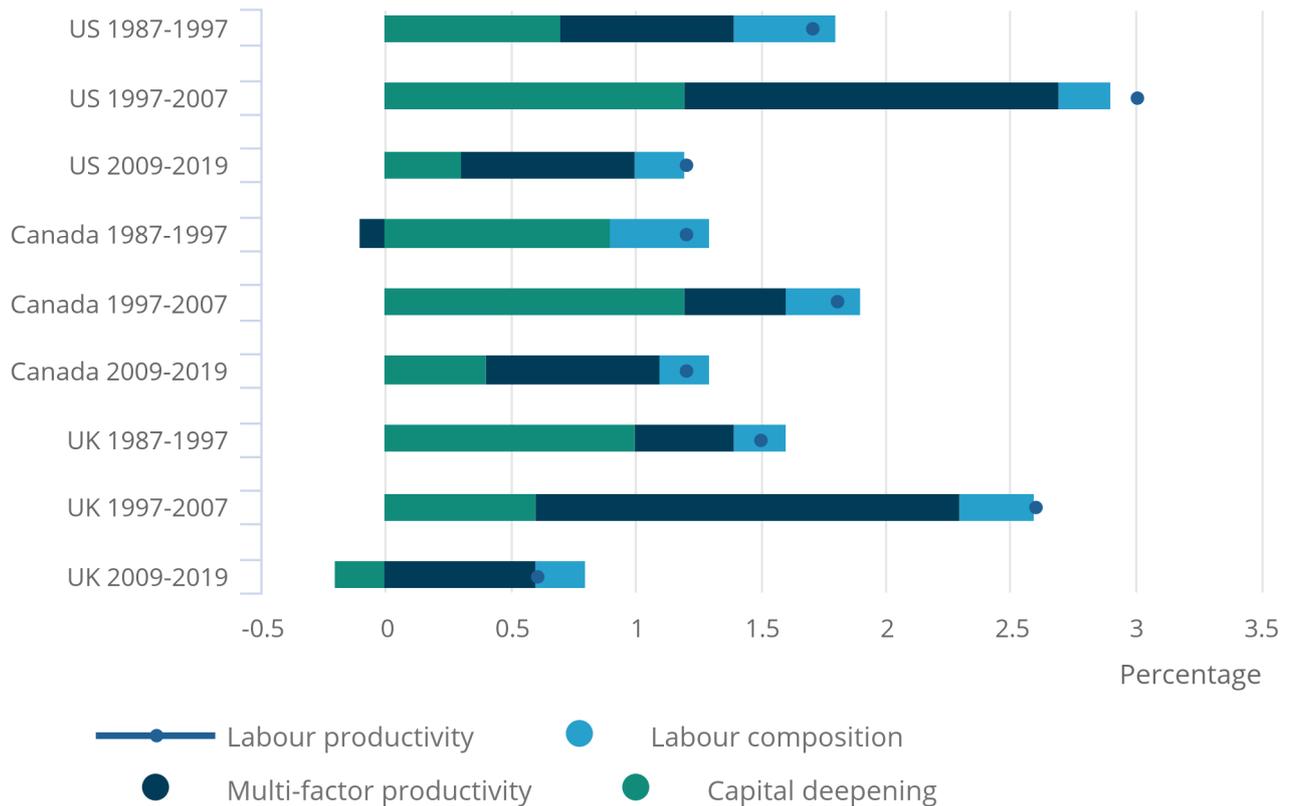
The most noteworthy feature of the UK's relatively weak performance in the past decades seems to be weak capital deepening growth in the market sector, which dragged on labour productivity growth in the UK but remained positive for Canada and the US.

**Figure 6: The contribution of capital deepening to labour productivity growth in the UK has been weak by international standards**

Contributions of capital deepening, labour composition and MFP to market sector output per hour worked growth, UK, US and Canada, 1987 to 2019

Figure 6: The contribution of capital deepening to labour productivity growth in the UK has been weak by international standards

Contributions of capital deepening, labour composition and MFP to market sector output per hour worked growth, UK, US and Canada, 1987 to 2019



Source: Office for National Statistics, Bureau of Labour Statistics and Statistics Canada

Notes:

- Contributions may not add to Labour Productivity due to rounding.

## 5 . Productivity during the coronavirus pandemic

The coronavirus (COVID-19) pandemic led to higher volatility in output per hour worked estimates in all G7 countries. The differences in productivity growth across these countries likely reflects a range of factors, including different responses to policies, different structured economics, measurement differences, and other factors.

In the UK, hours fell faster than the fall in output. This led to an increase in output per hour worked, as the industries most affected were generally those with lower levels of productivity. This resulted in average output per hour increasing.

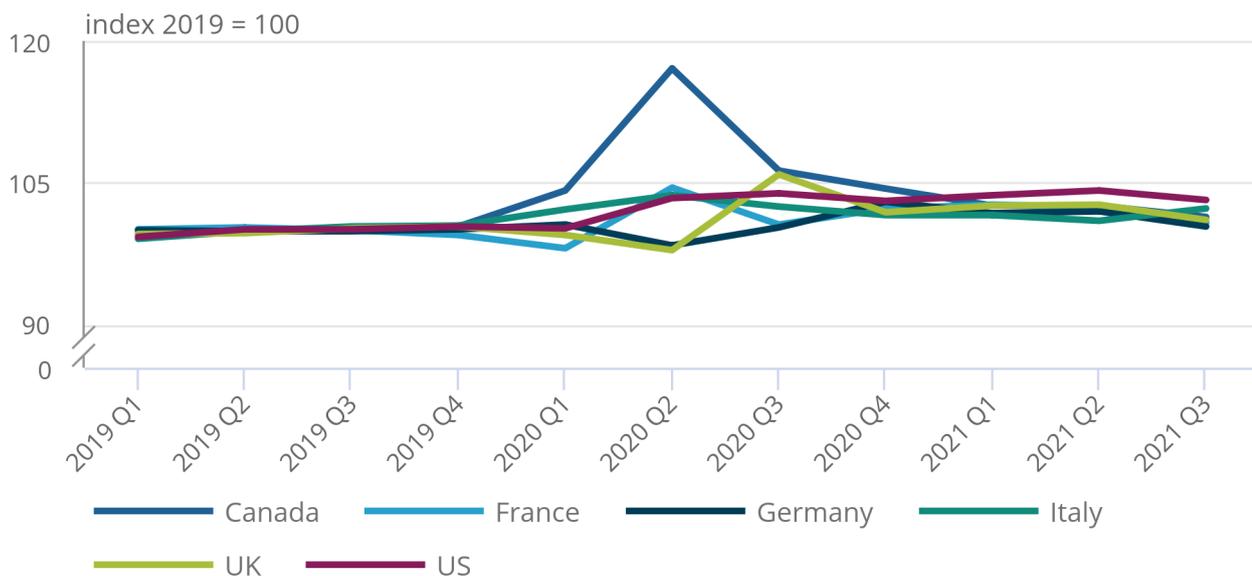
This pattern is also reflected in other G7 countries to a greater or lesser extent. Canada and the US, which did not operate a furlough scheme as in the UK, saw larger declines in employment and hours worked than other G7 countries, and thus larger increases in labour productivity.

**Figure 7: In 2020, the UK has experienced similar changes in output per hour worked to all European G7 nations**

Output per hour worked, 2020, index 2019 = 100

Figure 7: In 2020, the UK has experienced similar changes in output per hour worked to all European G7 nations

Output per hour worked, 2020, index 2019 = 100



Source: OECD data, Office for National Statistics calculations

Notes:

1. Quarterly output per hour worked data were unavailable for Japan. Recent analysis highlights the [challenges of making international comparisons of gross domestic product \(GDP\) at this time](#).

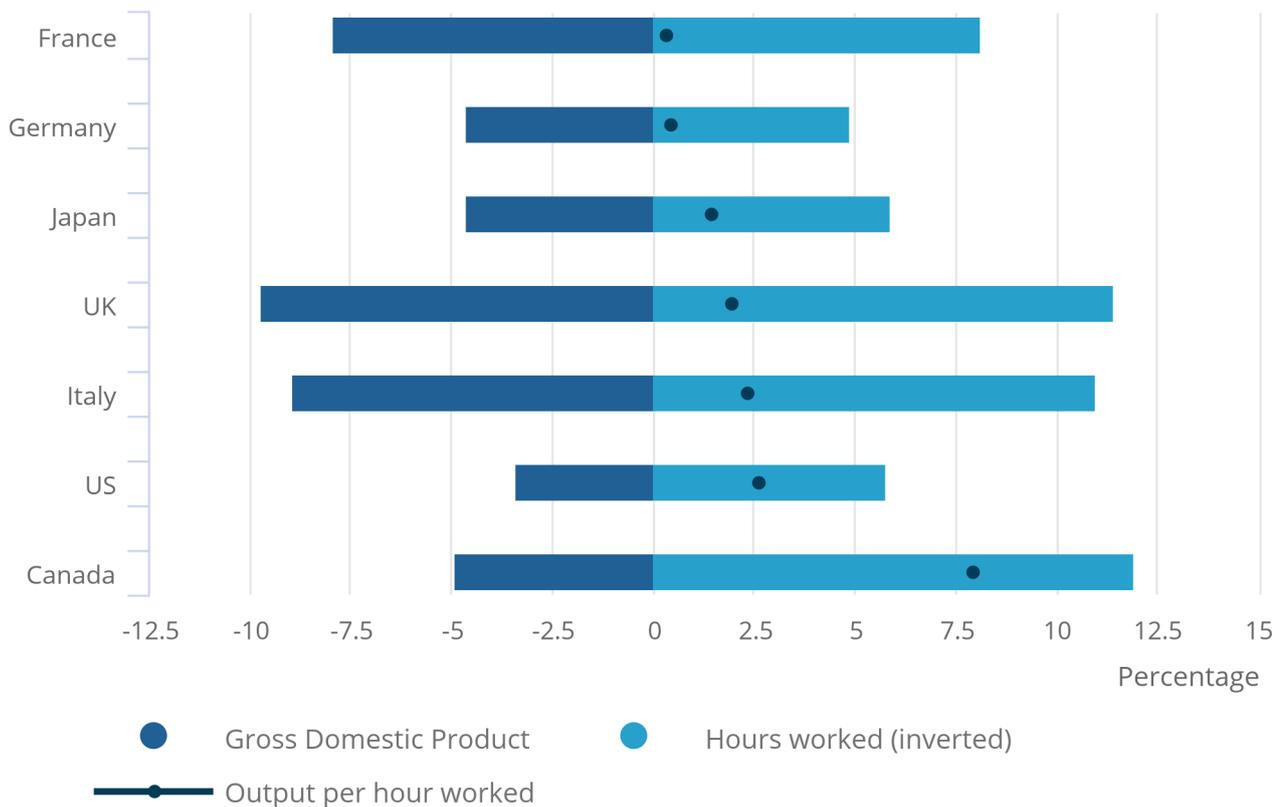
That is, as labour changes were concentrated in lower productivity sectors, and as lower productivity staff took furlough, the average productivity of those remaining active increased, even if none of these staff became more productive. This may be true in other countries. Larger falls in volume gross domestic product (GDP) in the UK than other countries may in part reflect differences in measurement of public sector output, as explored in our [International comparisons of GDP during the coronavirus \(COVID-19\) pandemic article](#).

**Figure 8: In 2020, the UK had large falls in both GDP and hours worked compared with other G7 nations**

Gross domestic product growth, hours worked growth, output per hour worked growth, 2020 relative to 2019

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Gross domestic product growth, hours worked growth, output per hour worked growth, 2020 relative to 2019



Source: OECD data, Office for National Statistics calculations

## 6 . Developments

This bulletin is the first release in this series since April 2018. Publication was previously suspended because of concerns with the comparability of the hours worked methodology across countries. You can see our [Improving estimates of labour productivity and international comparisons article](#) for details. We are continuing to address this issue and published a [progress update in February 2021](#).

For this release, we have worked with the Economic Statistics Centre of Excellence (ESCoE) and data visualisation experts to conduct [user research](#) into the best approach to present uncertainty in the hours worked data, as used in Figure 1. Some of this research, using an online public survey, is published today. We welcome any feedback about the new release, its new dataset and visualisation. Feedback can be sent by email to [productivity@ons.gov.uk](mailto:productivity@ons.gov.uk).

## Economic statistics governance after EU exit

Following the UK's exit from the EU, new governance arrangements are being put in place that will support the adoption and implementation of high-quality standards for UK economic statistics.

The new National Statistician's Committee for Advice on Standards for Economic Statistics (NSCASE) will ensure its processes for influencing and adopting international statistical standards are world leading. The advice it provides to the National Statistician will span the full range of domains in economic statistics. This includes the National Accounts, fiscal statistics, prices, trade and the balance of payments, and labour market statistics.

There is further information about NSCASE on the [UK Statistics Authority's website](#).

## 7 . Data

### [International comparisons of productivity](#)

Dataset | Released 20 January 2020

This dataset is published as part of the Office for National Statistics' (ONS) "International comparisons of UK productivity" article. These data include gross domestic product (GDP), hours worked (both direct and component methodologies), workers, output per hour (both direct and component methodologies), and output per worker level estimates for all G7 nations. It also includes growth rates for GDP, hours worked, workers, output per hour, output per worker, capital deepening, labour composition and multifactor productivity for all G7 nations.

## 8 . Glossary

### Labour productivity

Labour productivity measures how many units of output are produced for each unit of labour input and is calculated by dividing output by labour input.

### Labour inputs

The preferred measure of labour input is hours worked ("productivity hours"), but workers and jobs ("productivity jobs") are also used.

### Output

Output refers to gross value added (GVA), which is an estimate of the volume of goods and services produced by an industry, and in aggregate for the UK.

### Direct method

A method of estimating hours worked, which annualises "reported weekly hours actually worked" data collected from a data source, usually a continuous labour force survey, for all weeks of the calendar year.

### Component method

A method of estimating hours worked. The method starts with normal, usual, paid or contractual hours and then moves to the concept of hours actually worked through a series of explicit adjustments called components, which account for holiday, sickness, maternity leave, and so on.

## Simplified component method (SC)

A method for estimating hours worked, developed by the Organisation for Economic Co-operation and Development (OECD), which uses EU-Labour Force Survey (LFS) data for each country. It is designed to illustrate the variation in sources and methods across countries, and it is a second best to national efforts that make use of all available sources.

## Labour Force Survey (LFS)

The UK's Labour Force Survey (LFS) is a continuous quarterly household survey, which captures data about the labour market including employment and hours worked. Many countries have their own labour force surveys.

## Multifactor productivity (MFP)

For any given change in output, multifactor productivity (MFP) measures the amount that cannot be accounted for by changes in inputs of quality adjusted labour and capital.

## Capital deepening

Capital deepening is the amount of capital available to workers for each hour they work. It is calculated by taking the amount of capital services and dividing by the number of hours worked.

## Labour composition

Labour composition measures the characteristics of the labour used in the production process. The labour measure used in multifactor productivity (MFP) is quality adjusted labour input (QALI), which splits the hours worked data using four categories: industry, age, sex and education.

## Pre-coronavirus pandemic

The term pre-coronavirus pandemic refers to a 2019 average.

# 9 . Measuring the data

The data used in this release were collected primarily from the Organisation for Economic Co-operation and Development's (OECD's) Productivity database. For specific data sources, see our [dataset associated with this release](#).

## Gross domestic product

The numerator of the productivity equation is measured using gross domestic product (GDP) in the majority of this bulletin. GDP is measured by the national statistical institutes of each country and reported to the OECD. GDP is measured according to international guidance: European countries (including the UK) follow the European System of Accounts (ESA) 2010, and non-European countries largely follow the System of National Accounts (SNA) 2008, which is very similar.

For comparison of the level of productivity, we use current price GDP, converted to a common currency using purchasing power parities (PPPs). For comparison of growth rates of productivity, we use constant price (volume measure) GDP, measured in national currencies.

## Workers

Estimates of the number of workers are sourced from the OECD Productivity database. These data are based on the domestic concept and adjusted to meet the National Accounts production boundary. They therefore include employees, the self-employed, and all other workers contributing to GDP.

## Hours worked

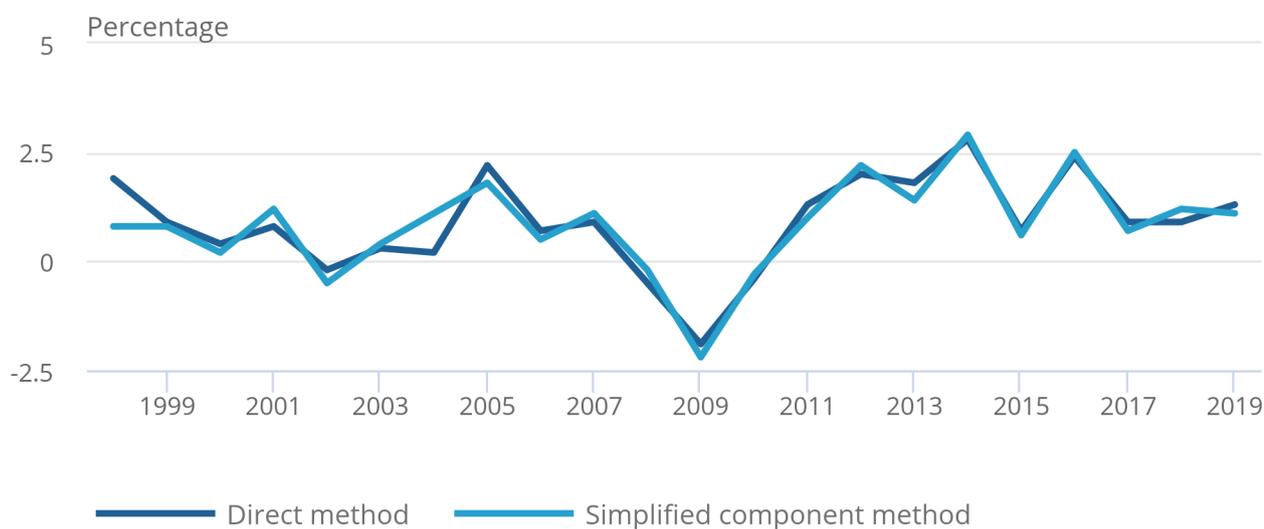
In [Section 2](#), we present multiple comparisons of levels of output per hours worked, where hours worked statistics were calculated using a direct method, simplified component method (UK only) or component method. For more information about direct, simplified component and component methods, see our [International comparisons of productivity \(ICP\) methodology updates: labour input measurements February 2021 article](#). The difference in methodology results in a substantial difference in the level of hours worked. However, the growth rate in hours worked is largely consistent, as seen in the UK data in Figure 9. We therefore use each country's National Accounts method (the UK's is "direct" and all others are "component") for all subsequent growth analysis.

### Figure 9: The growth rate is similar for measuring hours worked using either the direct or simplified component method

Hours worked year-on-year growth (Direct), hours worked year-on-year growth (Simplified component), UK, 1998 to 2019

#### Figure 9: The growth rate is similar for measuring hours worked using either the direct or simplified component method

Hours worked year-on-year growth (Direct), hours worked year-on-year growth (Simplified component), UK, 1998 to 2019



Source: OECD data, Office for National Statistics calculations

## Multifactor productivity

Figures 5 and 6 cannot be directly compared because of measurement and data source differences. Data for Figure 5 is compiled by the Organisation for Economic Co-operation and Development (OECD), whereas the data for Figure 6 come directly from the national statistics institutes for the respective countries. These estimates are calculated using different methodologies and assumptions. For example, the OECD measure covers the whole economy, whereas data in Figure 6 measure the market sector, which excludes non-profit entities such as the government and charities.

Although the OECD produce data for labour productivity, capital deepening and multifactor productivity (MFP), it does not produce estimates for changes to labour composition. As such, labour composition is implicitly captured within the MFP data. The UK, US and Canada all decompose labour productivity into capital deepening, labour composition and MFP, as shown in Figure 6.

## 10 . Strengths and limitations

### Strengths

Most of the data in this publication are sourced from the Organisation for Economic Co-operation and Development (OECD), which in turn sources most of its data from national statistical institutes. The measurement of gross domestic product (GDP) is governed by international standards, which are very similar across all G7 countries. This ensures a high degree of consistency of GDP across countries, ensuring a fair comparison in the productivities of different countries.

This release better reflects the variation in output per hour worked estimates than previous publications, by comparing different methods with one another and showing the range of possible differences between UK productivity and that of other countries. We researched presentation options in collaboration with the Economic Statistics Centre of Excellence (ESCoE) by running an online [experiment](#), and we found that this presentation supported understanding of the data.

### Limitations

The UK constructs its hours worked estimates differently to other G7 nations, using a direct method rather than a component method. The OECD found evidence that using a direct method may bias the estimate of hours worked up, and thus lead productivity to be understated. This makes comparisons in the level of output per hour worked between the UK and other countries difficult. The OECD produces a simplified component method for the UK, which is a far simpler approach to the component method but may improve comparability of the estimates.

To compare the level of productivity across countries, the output measure (gross domestic product) for each country must be converted to a common currency. We use [purchasing power parities \(PPPs\)](#) to convert from national currencies to pound sterling. PPPs are preferred to market exchange rates as they are typically more stable and better represent economic output, allowing for easier comparisons of productivity over time. However, PPPs are measured with error and, as such, may not fully account for differences in currency between countries and over time.

## 11 . Related links

### [Improving estimates of labour productivity and international comparisons](#)

Article | Released 9 January 2019

Analysis of how the methodologies, data sources and adjustments used internationally to estimate the number of persons, jobs and hours worked affect our international comparisons of UK productivity statistics.

### [International comparisons of productivity \(ICP\) methodology updates: labour input measurements February 2021](#)

Article | Released 15 February 2021

An update on the work in progress to develop a UK-tailored component method for estimating labour inputs for productivity estimates.

### [Productivity overview, UK: July to September 2021](#)

Article | Released 11 January 2022

A summary of economic productivity measures, including output per hour, output per job and output per worker for the whole economy and a range of industries. This article also includes information about productivity in the public sector and international comparisons of productivity across the G7 nations.

### [Productivity development plan: 2021 to 2023](#)

Article | Released 6 October 2021

This development plan builds on recent improvements to Office for National Statistics (ONS) productivity statistics and looks at introducing new outputs, further improving our productivity statistics, and consolidating our improvements to date.

