OECD Compendium of Productivity Indicators 2023

OECD

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BETTER POLICIES FOR BETTER LIVES

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Reader's guide

"Productivity isn't everything, but in the long run it is almost everything" *(Paul Krugman, 1994).*

Productivity is commonly defined as a ratio between the volume of output and the volume of inputs. In other words, it measures how efficiently production inputs, such as labour and capital, are being used in an economy to produce a given level of output. Productivity is a key source of economic growth and competitiveness and, as such, internationally comparable indicators of productivity are central for assessing economic performance.

The *OECD Compendium of Productivity Indicators* examines recent and long-term trends in productivity, providing insights on:

- Productivity and the COVID-19 pandemic
- Cross-country comparisons of labour productivity levels
- Contributions of labour and capital inputs, and multifactor productivity, to economic growth
- Industry contributions to aggregate labour productivity growth
- Productivity in small and medium-sized enterprises (SMEs) and large firms
- Evolution and composition of investment
- Changes in labour income and productivity growth

The OECD Productivity Statistics Database

Most of the indicators presented in this publication are drawn from the OECD Productivity Statistics Database, which provides a consistent set of annual estimates of labour, capital and multifactor productivity growth, unit labour costs and other related indicators to analyse the drivers of economic growth in OECD member countries and G20 economies. The database includes the following indicators:

- GDP per capita and labour productivity levels
- Labour productivity growth
- Measures of labour input, such as total hours worked and total employment
- Measures of capital input, as an aggregate and by type of asset
- Multifactor productivity growth

Country, time, and industry coverage of the *Compendium*

The *OECD Compendium of Productivity Indicators* includes data for OECD countries in all Chapters, and additionally, whenever possible, for non-OECD G20 economies.

It covers the period 1970-2021 in most Chapters, with breakdowns between 2000-2007 and 2010-2019 to visualise the slowdown in GDP and productivity growth, and data points for the years 2020 and 2021 to illustrate the impact of the COVID-19 crisis. Chapter 7 on Labour income and productivity includes data since 1990 whenever possible.

Throughout this publication, all breakdowns by industry follow the International Standard Industry Classification of all Economic Activities (ISIC). Indicators by industry are presented according to its latest version, ISIC Rev.4, or the European equivalent, NACE Rev.2 (Nomenclature statistique des Activités Économiques dans la Communauté Européenne).

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Krugman, P. (1994), *The Age of Diminished Expectations*, Revised and Updated Edition, MIT Press, Cambridge, Massachusetts.

1 Productivity and the COVID-19 pandemic

Productivity developments in the aftermath of Covid

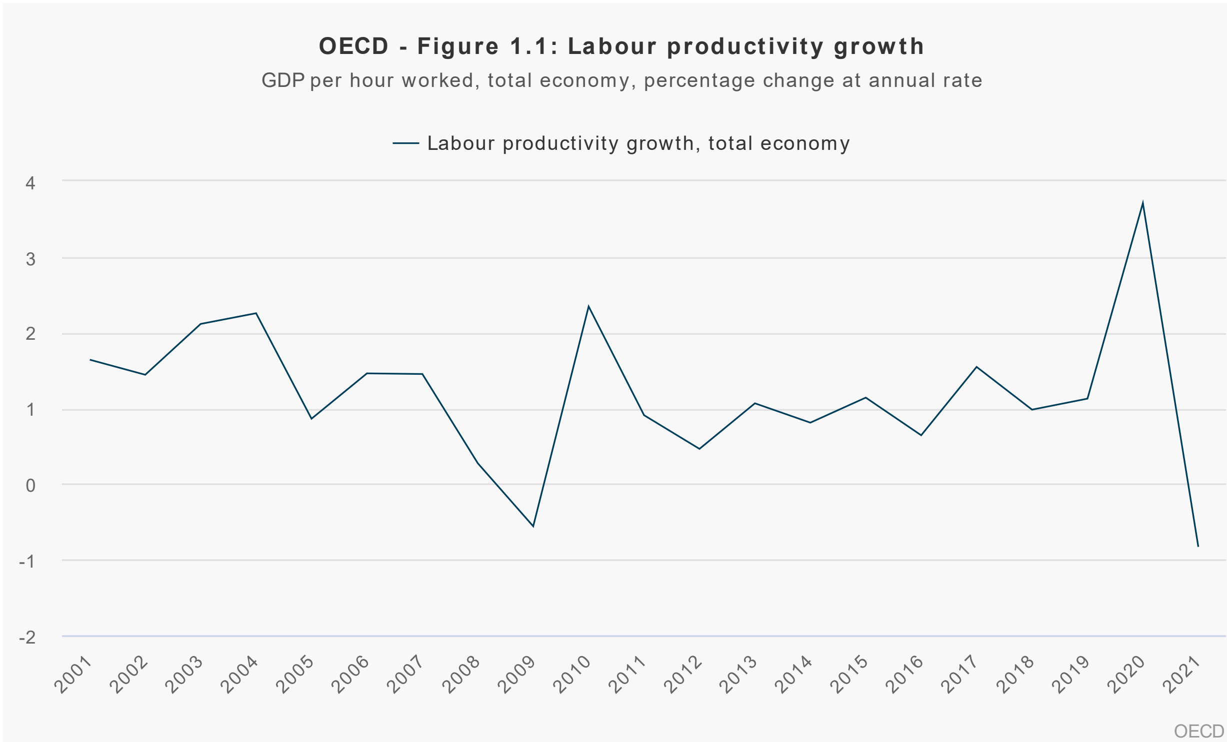
Physical distancing, lockdowns and restrictive measures put in place worldwide to contain the COVID-19 pandemic triggered the most severe and abrupt global recession since the end of the Second World War. However, the depth of the economic downturn was heterogeneous across OECD countries. This reflects the uneven impact of the pandemic throughout the economy, resulting from differences in economic structure, variations in the nature and timing of restrictions, and differences in fiscal and monetary policy across countries.

Russia's war of aggression against Ukraine and the energy crisis have derailed the post-pandemic economic recovery and, as of early 2023, a significant growth slowdown is expected for the world economy in 2023. Growth has lost momentum, inflation has hovered at elevated levels, confidence has weakened, and uncertainty is high (OECD, 2022a). As productivity growth in many countries had been declining before the pandemic, the downturn could potentially drive long-term productivity growth into zero or negative territory, lowering living standards (di Mauro and Syverson, 2020).

The economic literature on the impact of the COVID-19 crisis on productivity is inconclusive as several factors are at play (OECD/APO, 2022). On the one hand, recessions are likely to hit primarily less productive firms and result in a reallocation of resources towards more productive firms. On the other hand, permanent losses of capital and jobs can hamper long-term productivity developments. The specificities of the COVID-19 crisis make the assessment even more challenging. It affected both demand and supply, curtailing large areas of activity intermittently over months. The scale of impact was global and combined with strong uncertainties for an extended period, thus holding back corporate investment. Nevertheless, the policy reaction to limit the spread of the virus and cushion the downturn was unprecedented. The acceleration of digitalisation and take up of teleworking also helped to mitigate the depth of the recession.

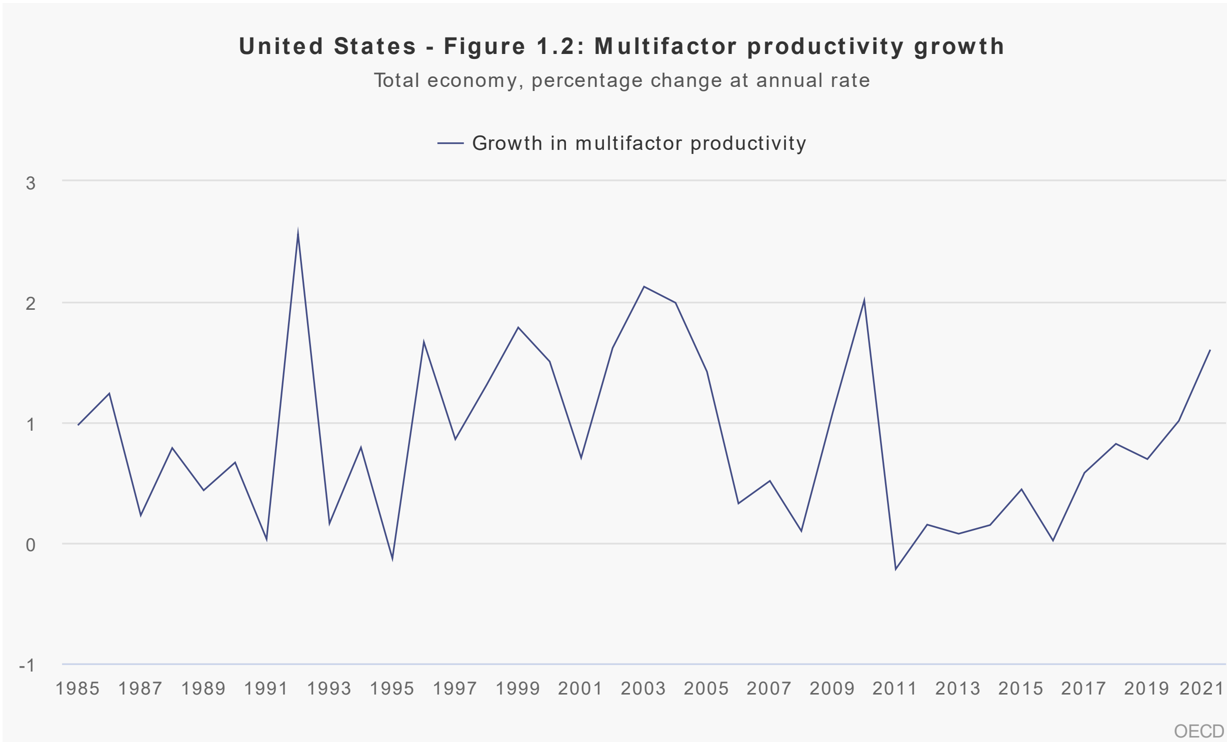
In the OECD as whole, labour productivity, measured as GDP per hour worked, soared in 2020, growing at a record high rate of almost 4%, much higher than the 1% annual average growth over the period 2010-2019. This reflected a much larger decrease in hours worked than in GDP, particularly during the first half of 2020. Nevertheless, OECD labour productivity growth slowed in the second half of 2020, and then stagnated in 2021.

These aggregate developments mask significant heterogeneity across countries, with for example large swings observed between 2019 and 2021 in Canada, Chile, Colombia, Costa Rica and Türkiye, and overall stability in Denmark, Finland and Germany.



Compare: https://www1.compareyourcountry.org/compendium-productivity-indicators-2023/en/2/5139/default/all/OECD+EA19?embed=noHeaderNoNav

Multifactor productivity (MFP) growth fell in many countries in 2020, as capital inputs did not decline as fast as hours worked, and bounced back in most economies in 2021. These movements led to a stagnation of MFP growth in most countries between 2019 and 2021, adding further concerns to the MFP slowdown observed in many economies prior to the COVID-19 crisis.



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Beyond its aggregate impact, the recession affected economic sectors in different ways, both in terms of output and hours worked, reflecting the uneven impact of the restrictions put in place to contain the propagation of the virus. While under normal economic circumstances, within-industry labour productivity growth is the major driver of aggregate labour productivity growth, the lockdowns put in place during the pandemic led to an unprecedented reallocation of hours worked across sectors, with hours worked declined much more in contact-intensive and transport sectors than others. Overall, hours worked declined less in high-productivity than in low-productivity sectors, which boosted aggregate labour productivity growth in 2020. The available evidence for countries in 2021 shows that most of these effects were temporary and got reversed in 2021 (see Chapter 4 on Industry contributions to aggregate labour productivity growth).

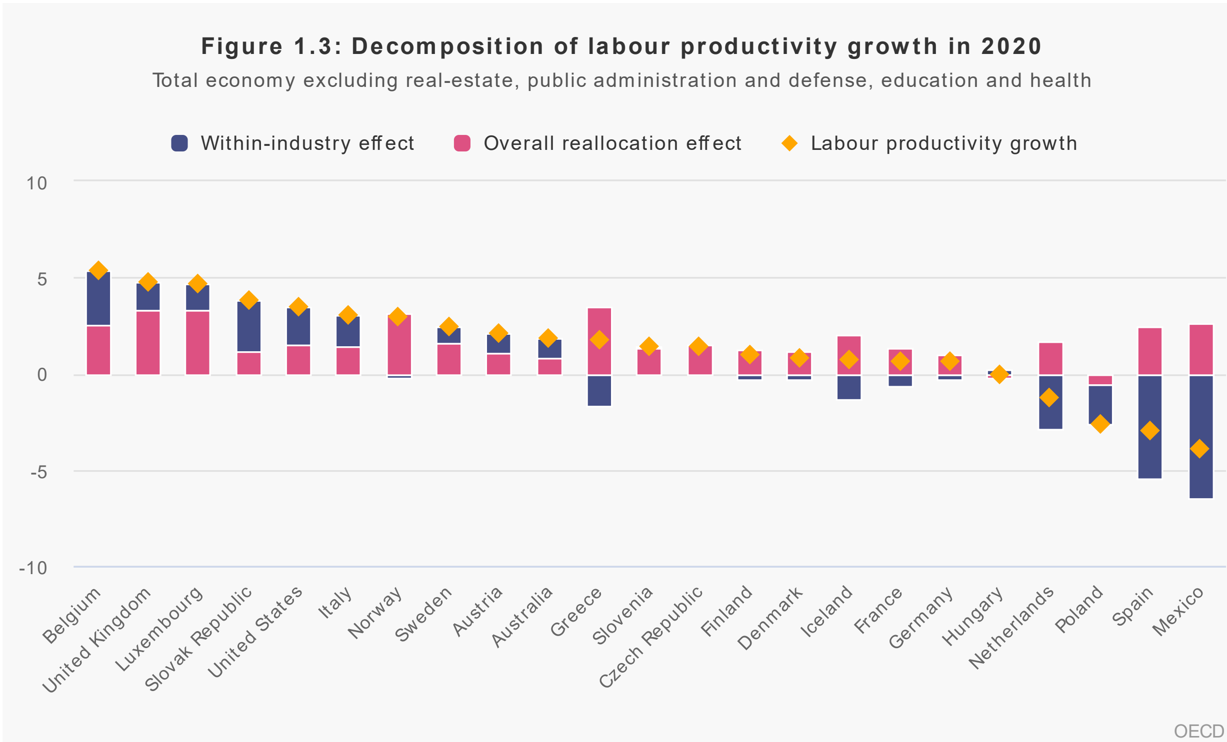
Figure 1.3: Decomposition of labour productivity growth in 2020
Total economy excluding real-estate, public administration and defense, education and health
Within-industry effect
Overall reallocation effect
Labour productivity growth
10
5
0
-5
-10
Belgium
United Kingdom
Luxembourg
Slovak Republic
United States
Italy
Norway
Sweden
Austria
Australia
Greece
Slovenia
Czech Republic
Finland
Denmark
Iceland
France
Germany
Hungary
Netherlands
Poland
Spain
Mexico
OECD

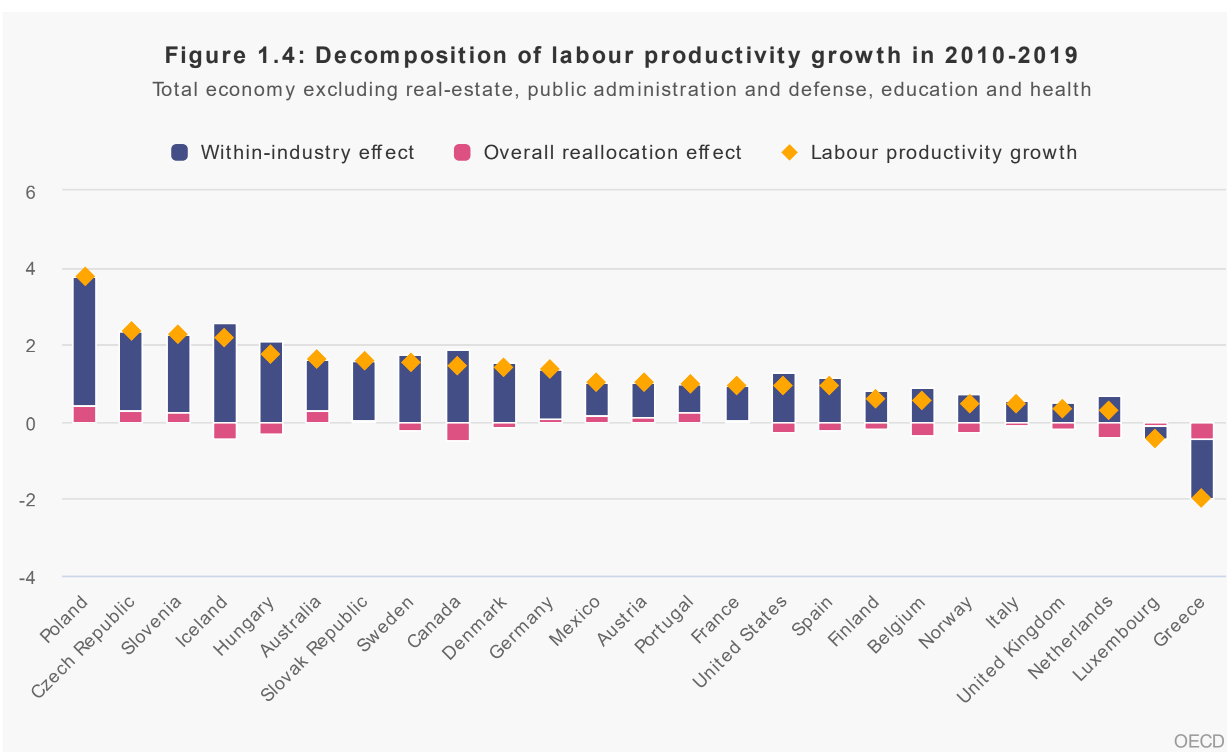
Figure 1.4: Decomposition of labour productivity growth in 2010-2019
Total economy excluding real-estate, public administration and defense, education and health
Within-industry effect
Overall reallocation effect
Labour productivity growth
6
4
2
0
-2
-4
Poland
Czech Republic
Slovenia
Iceland
Hungary
Australia
Slovak Republic
Sweden
Canada
Denmark
Germany
Mexico
Austria
Portugal
France
United States
Spain
Finland
Belgium
Norway
Italy
United Kingdom
Netherlands
Luxembourg
Greece
OECD

In the longer term, the main risk to productivity depends on the impact of the crisis on the productive capacity of the economy. While recessions can accelerate the process of resource reallocation from low-productivity to high-productivity firms, the policy response to the COVID-19 pandemic that prioritised preservation (over reallocation) of resources via job retention schemes may have softened the traditional cleansing (Andrews, et al., 2021). In addition, financial measures put in place by governments to support firms and temporary regulations on insolvency contributed to avoid a wave of bankruptcies in 2020, but have increased private debt and firm vulnerability to shocks (OECD, 2022b), especially in the current environment of rising interest rates. Besides, despite government actions to mitigate the crisis, the pandemic may also influence human capital accumulation. Notwithstanding tight labour markets and shortage of workers across the OECD (OECD, 2022c), the "scarring" effects of the COVID-19 pandemic on workers, in particular women, youth, low-skilled and low-income workers are likely to affect labour force developments over the medium to long term (ILO, 2021a, OECD, 2022c).

On a more positive note, the COVID-19 crisis has accelerated the adoption of digital technologies by firms. Indeed, evidence from business surveys conducted worldwide in the course of 2020 indicated that most firms have intensified their use of digital technologies during the pandemic (OECD, 2023 forthcoming). Nevertheless, smaller firms consistently report that costs, and lack of skills and awareness of digital tools, remain important concerns for investing in digital technologies (OECD, 2021b). The diffusion of digital technologies across firms is key to avoid a further widening of the productivity gap within economies and to ensure a sustained rebound of aggregate productivity after the crisis (Andrews et al. 2016). In addition, the take up of teleworking also helped to mitigate the depth of the recession. Survey evidence points to a positive short-term impact on self-assessed productivity by managers or by employees in OECD economies (Barrero et al., 2021; Criscuolo et al., 2021). However, the evidence on the long-term effects of teleworking on productivity remains scarce.

Monitoring the dynamics and composition of investment, with a focus on assets such as research and development (R&D) and information and communication technologies (ICT), will be key to assess the potential for a rebound in productivity after the crisis. The volume of gross fixed capital formation (GFCF) declined by almost 4% on average across OECD countries in 2020, with large cross-country differences, and rebounded by almost 5% in 2021, recording the highest growth of GFCF in the OECD since 2005. Investment in transport equipment, and to a lower extent other machinery and equipment, was the main contributor to these large swings in aggregate investment in 2020 and 2021, which is both related to the restrictions put in place to contain the pandemic and to the fluctuations in economic activity. Early evidence shows that investment in R&D and ICT has been more resilient and has even increased in 2020 in a few countries. In this respect, the COVID-19 crisis has reinforced the need for more timely data to monitor short-term developments, including of investment and productivity.

Statistical measurement challenges and cross-country comparability issues during the crisis

Measuring non-market output

The COVID-19 pandemic had a significant impact on the provision of education and health services which, in most countries, are largely non-market services. Contrary to market output, non-market output is provided most often for free or at subsidised prices. In the absence of a market, its value is imputed in the national accounts and calculated as the sum of the underlying costs of production. These costs include intermediate consumption, compensation of employees, consumption of fixed capital, and taxes less subsidies on production.

Compensation of employees represents by far the largest share of non-market value added in current prices (around 80% on average across OECD countries). In countries where governments maintained the compensation of their employees in the first phase of the crisis even though they may have worked longer or shorter hours than usual, the value added of non-market activities at current prices (i.e. in nominal terms) remained largely unaffected in the national accounts.

When it comes to the measurement of the volume of non-market output (i.e. in real terms), national statistical agencies tend to use different methods in the absence of observable market prices to deflate output at current prices (Schreyer, 2012; Mitchell et al., 2022). In a nutshell, they choose between four different methods: (1) deflate nominal output using output price indices in comparable market sectors (indirect output method), (2) deflate nominal output using input price indices (indirect input method), (3) measure the volume of inputs using direct input indicators such as the number of employees or the volume of hours worked (direct input method), and (4) measure the volume of output using direct output indicators such as the number of medical treatments (direct output method).

While most OECD countries use direct output indicators to measure the volume of education, all four methods are used to measure the volume of health services. In both cases, different adjustments may also have been implemented to account for COVID-19-related reductions in education output resulting from remote learning, and for the change in the composition and costs of medical treatments during the pandemic.

Countries most affected by the COVID-19 pandemic, as measured by their excess mortality rate, tended to have a larger decline in measured education and healthcare output during the first wave of the pandemic (second quarter of 2020). This decline was more significant in countries using direct output indicators and applying *ad-hoc* adjustments to measure non-market output during the pandemic (e.g. the United Kingdom), and mitigated in countries measuring the volume of non-market output by deflation or based on direct input indicators, especially if they relied on the number of employees rather than the volume of hours worked to measure inputs (e.g. Spain) (Mitchell et al., 2022).

Nevertheless, the issues related to the measurement of non-market output are probably more severe when relying on the first estimates of quarterly national accounts. Indeed, additional and better data feed into the successive vintages of annual national accounts and contribute to an improved measurement.

Moreover, even though non-market activities make up around 20% of GDP on average across OECD countries, differences in non-market output account for only a small part of cross-country variation in annual GDP growth in 2020 (OECD, 2021a). In other words, differences in measuring non-market output across countries played a much more limited role than other factors (e.g. economic specialisation, restrictions put in place to limit the propagation of the virus, magnitude of the monetary and fiscal impulse) in explaining cross-country differences in overall GDP growth during the COVID-19 crisis.

Measuring labour input

The COVID-19 pandemic occurred at a time when employment rates, i.e. ratios of employment to working age population, were at historic highs across OECD countries (OECD, 2019). According to the OECD Labour Market Statistics, the OECD employment rate declined by 2.7 percentage points, from 68.8% in 2019 to 66.1% in 2020. Nonetheless, the latest estimates for the second quarter of 2022 point to an employment rate in the OECD close to 69.4% - its record high since the start of the series in 2005.

While the total number of persons employed declined by more than 1% in most OECD countries in 2020, the situation varied substantially across countries, with Canada and the United States recording a drop in total employment of 4.2% and 4.3% respectively between 2019 and 2020, and the euro area recording a decline of 1.3%. These cross-country differences are partly related to differences in macroeconomic conditions and labour-market institutions, but they mostly reflect differences in the treatment of workers on temporary lay-off in official labour statistics (Arnaud, 2020).

According to the International Labour Organisation (ILO) guidelines, temporarily laid-off or furloughed workers are persons “employed” who, in their present job, are “not at work” due to economic reasons for a short duration but maintain a job attachment during their absence (ILO, 2013 and 2020). These guidelines treat furloughed workers as being employed when:

- the expected total duration of the absence is up to three months (or more if the return to employment in the same economic unit is guaranteed), or
- workers continue to receive a remuneration from their employer, including partial pay, even if they also receive support from other sources, including government schemes.

In turn, furloughed workers not satisfying the above criteria are classified as either unemployed, if they are actively looking for a job and available for work, or as outside of the labour force (i.e. neither employed nor unemployed).

In practice, departures from these guidelines in national practices do exist. In the United States for example, persons on temporary lay-off are classified as “unemployed” even if they expect to be recalled to their job within six months. “People who were effectively laid off due to pandemic-related closures [are] counted among the unemployed on temporary lay-off” without further testing for their return to their previous job (BLS, 2020). In Canada, persons on temporary lay-off are also classified as “unemployed” even if they have a date of return or an indication that they will be recalled by their employer. On the contrary, in Europe, only those furloughed workers that do not have an assurance to return to work within three months and receive less than half of their salary are treated as unemployed, if they are available to start working in the next two weeks.

In normal times, these differences only have a marginal impact on the international comparability of employment and unemployment measures, as furloughed workers typically account for a relatively insignificant share of the population. However, the confinement measures put in place to contain the spread of the virus significantly increased their number. Prior to the pandemic, furloughed workers represented 0.5% of the labour force in the United States and less than 0.2% in the European Union, but in the second quarter of 2020, these shares jumped to 9.3% and 9.6% respectively (Arnaud, 2020).

It is therefore important to use total hours worked as a measure of labour input, as opposed to job- and head-counts labour input measures, in particular when analysing the short-term impact of the COVID-19 outbreak on productivity. International differences in the treatment of temporarily laid-off workers are likely to be less relevant when labour input is measured as the total number of hours worked, as furloughed workers work by definition zero hours while being in temporary lay-off. National accounts data for 2020 reveal a decline in total hours worked of 6.8% and 8.1% in the European Union and the euro area, respectively, against a drop of 1.4% and 1.5% in total employment.

The effective quantity of labour input depends not only on the total number of hours actually worked but also on the skills and characteristics of the workforce. Indeed, workers with different education levels and experience are not perfect substitutes and can show different productivity performance. Accurate estimates of labour input for productivity analysis requires accounting for both the number of hours worked and the composition of the workforce, that is a measure of composition-adjusted or quality-adjusted labour input. During a recession, the compositional effect of labour input generally points to an increase in the average skill level of those in employment (i.e. an increase in labour quality), as firms are likely to shed labour and/or reduce hours worked among lower-skilled workers, and to hoard higher-skilled individuals.

Measuring investment and capital utilisation

The fluctuations in investment that were recorded in 2020 and 2021 have a direct impact on the measurement of capital stocks and capital services during the pandemic and beyond. Nevertheless, current measures of capital services do not capture the reduced rates of capital utilisation during the crisis. Differences in containment measures and in teleworking capacities across countries resulted in different patterns of capital usage across economic activities. For instance, many offices and commercial buildings were closed, in full or in part, during lockdowns, with much of the capital equipment being unused. This has certainly caused a fall in capital utilisation rates, which has been more or less pronounced across assets and industries. In productivity analysis, it is typically assumed that capital services are a time-invariant proportion of the productive capital stock, an assumption that is difficult to maintain during the COVID-19 crisis, when strict and widespread lockdowns were implemented. While estimating capital utilisation rates is far from trivial (OECD, 2001), future research could be oriented to adjust measured capital services for the reduced rates of capital utilisation to provide a more accurate estimate of capital services and MFP growth during the pandemic.

Data sources

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2 Cross-country comparisons of labour productivity levels

Context

Productivity is commonly defined as a ratio between the volume of output and the volume of inputs. In other words, it measures how efficiently production inputs, such as labour and capital, are being used in an economy to produce a given level of output. Productivity is a key source of economic growth and living standards and, as such, internationally comparable indicators of productivity are central for assessing economic performance.

There are different productivity measures. The choice largely reflects the policy question to be addressed, with data availability often constituting an additional constraint.

Labour productivity, measured as Gross Domestic Product (GDP) or Gross Value Added (GVA) per hour worked or per worker, is one of the most widely available measures of productivity, which is therefore widely used for international comparisons. Labour productivity measures based on hours worked better capture the volume of labour input than measures based on the number of persons employed due to cross-country differences in working time (e.g. related to part-time employment) and employment legislations (e.g. statutory working time).

Size of output

Gross Domestic Product (GDP) is a widely used measure of output in the compilation of productivity indicators. It measures the value added generated by an economy, i.e. the value of goods and services produced during a given period, minus the value of intermediate consumption used in the production process. Countries measure GDP in their own currencies. In order to compare these estimates across countries, they have to be converted into a common currency. The conversion is often made using nominal exchange rates but these can provide a misleading comparison of the true volume of goods and services produced across countries. A better approach is to use Purchasing Power Parities (PPPs), which are currency converters that control for differences in price levels between countries and allow for international comparisons of the volume of GDP and of the size of economies (OECD, 2017; World Bank, 2020).

Key findings

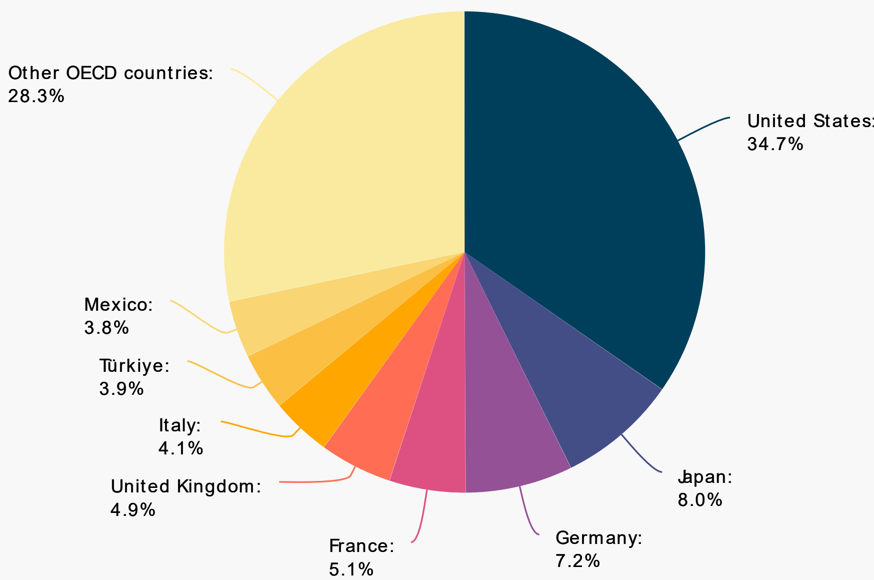
- **The use of PPPs to convert countries' GDP into a common currency, as opposed to the use of nominal exchange rates, allows analysts to account for cross-country differences in price levels**. Indeed, when using PPPs rather than exchange rates as currency converters to US Dollars (USD), the gap between a country's GDP and the US GDP shrinks for the large majority of OECD countries. For example, in 2021, the GDP expressed in USD more than doubles when using PPPs rather than nominal exchange rates for Hungary, Mexico and Poland, and it is multiplied by three for Colombia and Türkiye.

- When using PPPs to convert countries' GDP into a common currency, **the United States accounts for the largest share (over one third) of GDP in 2021 in the OECD area**, followed by Japan, Germany, France, the United Kingdom, Italy, Türkiye, and Mexico. The ranking and the shares differ when using nominal exchange rates.

Indicators

Figure 2.1: Relative size of OECD economies

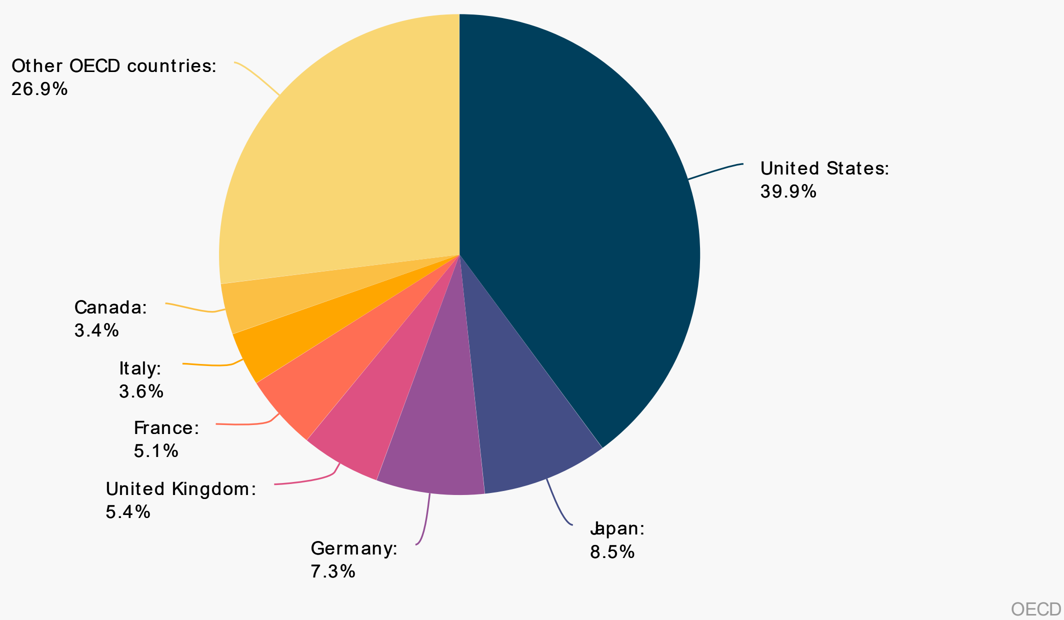
Gross domestic product, US dollars, current PPPs, percentage of OECD total in 2021



OECD

Figure 2.2: Relative size of OECD economies

Gross domestic product, US dollars, current exchange rates, percentage of OECD total in 2021



How to read the indicators

The compilation of GDP is based on harmonised accounting concepts and definitions that ensure its comparability across countries. In practice, however, the measurement of GDP can be affected by three main issues:

- *The measurement of the non-observed economy*. An exhaustive coverage of production activities can be difficult to achieve in some countries and national estimates may differ in their coverage of non-observed activities. The size of the non-observed economy is generally larger in emerging-market and developing economies reflecting, in part, the higher degree of informal activities and employment.
- *International production arrangements*. In the last decades, globalisation has led to a fragmentation of production processes across countries. In some cases, national accounts record output in the country where intellectual property (IP) assets are located rather than in the country where output is physically produced (e.g. in the case of contract manufacturing). This can lead to a disconnection between GDP and production factors, as well as to changes in GDP due to the relocation of IP assets from one country to another. Moreover, some of the income generated by IP assets may be ultimately transferred abroad. This can happen, for example, when IP assets are located in the balance sheets of affiliates of multinational enterprises who ultimately transfer the related benefits to their parent company (UNECE, 2015). A large gap between GDP and Gross National Income (GNI), which accounts for property income flows across countries, is likely to signal transfers of income related to IP assets.
- *The measurement of the digital economy.* The digital transformation also poses many challenges to the measurement of the production of goods and services and hence GDP. The emergence of new digital services, the increasing scale of peer-to-peer interactions through digital intermediary platforms, the development of “free” services blurring distinction between consumers and producers, are only a few examples of the challenges currently faced by national accountants

(Ahmad and Schreyer, 2016; Ahmad et al., 2017). Moreover, shorter cycles of entering and exiting of ICT products exacerbate long standing challenges on the distinction between price movements and quality increases (Aeberhardt et al., 2020).

When it comes to the measurement of GDP in volume or real terms (i.e. excluding the impact of inflation), it is important to note that most countries covered in the report derive annual estimates of real GDP using annually chain-linked volume indices[1] (i.e. updating every year the prices used to measure volume indices). However, Mexico and South Africa currently produce fixed-base volume indices (i.e. measuring volume indices at the prices of a fixed given period) with the base year updated less frequently. The 2008 System of National Accounts (2008 SNA) recommends the production of estimates based on annually chain-linked volume indices.

For further methodological information, consult the *OECD Productivity Statistics – Methodological notes* at https://www.oecd.org/sdd/productivity-stats/OECD-Productivity-Statistics-Methodological-note.pdf.

Employment and hours worked

In productivity analysis, the volume of labour input is most appropriately measured by the total number of **hours actually worked**, i.e. hours effectively used in production, whether paid or not. Hours actually worked reflect regular hours worked by full-time and part-time workers, paid and unpaid overtime, hours worked in additional jobs, excluding time not worked because of public holidays, annual paid leave, sick leave, maternity leave, strikes, bad weather, and economic conditions, among other reasons. As such, the relevant concept for measuring labour input is hours actually worked, as opposed to hours paid, contractual hours, or usual hours worked. However, the number of persons employed (i.e. **total employment**) is often used as a proxy for labour input, in particular, when data on total hours worked (either actually worked or paid) cannot be estimated.

Key findings

- The United States accounts for the largest share (about one fourth) of total hours worked and total employment in the OECD area. However, **the ranking of countries in terms of their share in total labour input varies with the measure of labour input used, i.e. hours worked or employment.** Variations in working time patterns (e.g. part-time or full time employment) and employment legislations (e.g. statutory hours) across countries and over time affect the comparability of total employment figures, justifying, when possible, the use of total hours worked as a measure of labour input in productivity analysis.
- **Estimates of average hours worked per worker differ substantially across countries. While some countries record close to 2000 hours worked per worker in a given year, other countries record less than 1500**. While differences in average hours worked per worker across countries partly reflect structural differences in the organisation of labour markets, there is empirical evidence that measurement can also play a role in explaining these differences (Ward, Zinni and Marianna, 2018). A comparison of official national accounts estimates of hours worked per worker in countries using a direct approach with OECD estimates points to a reduction of average hours worked per worker of around 8% compared with official national accounts estimates. In addition, there are notable changes in the international ranking of average hours worked per worker when they are estimated using the simplified component method (see How to read the indicators for further details).

[1] The United States and Canada use chain-linked Fisher indices while other OECD countries use the chain-linked Laspeyres ones.

Indicators

Figure 2.3: Relative size of the workforce in OECD economies

Total hours worked in the OECD area, percentage of OECD total in 2021

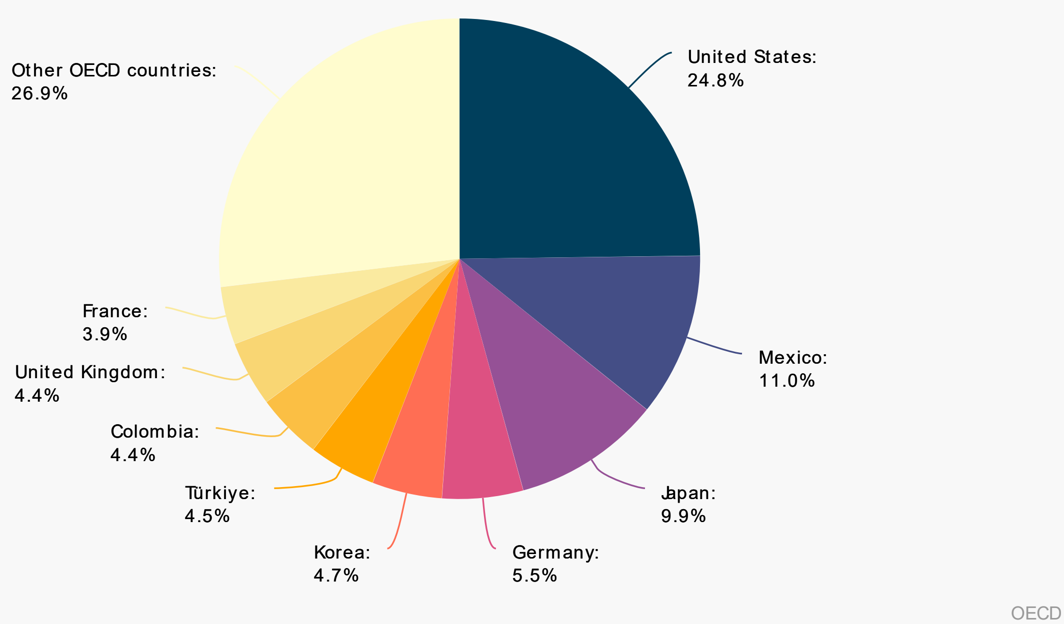


Figure 2.4: Relative size of the workforce in OECD economies

Total persons employed in the OECD area, percentage of OECD total in 2021

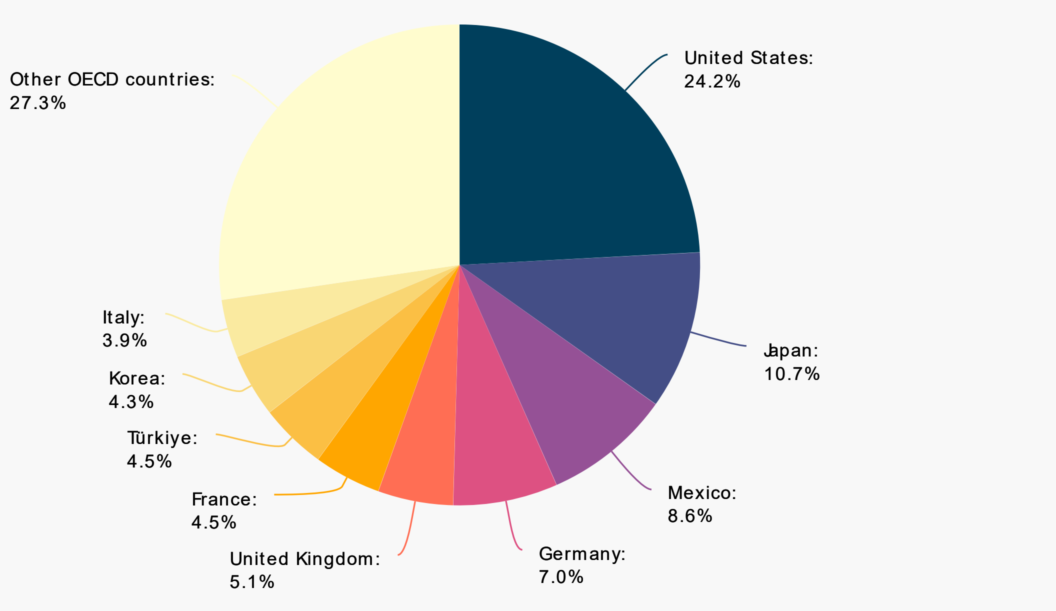
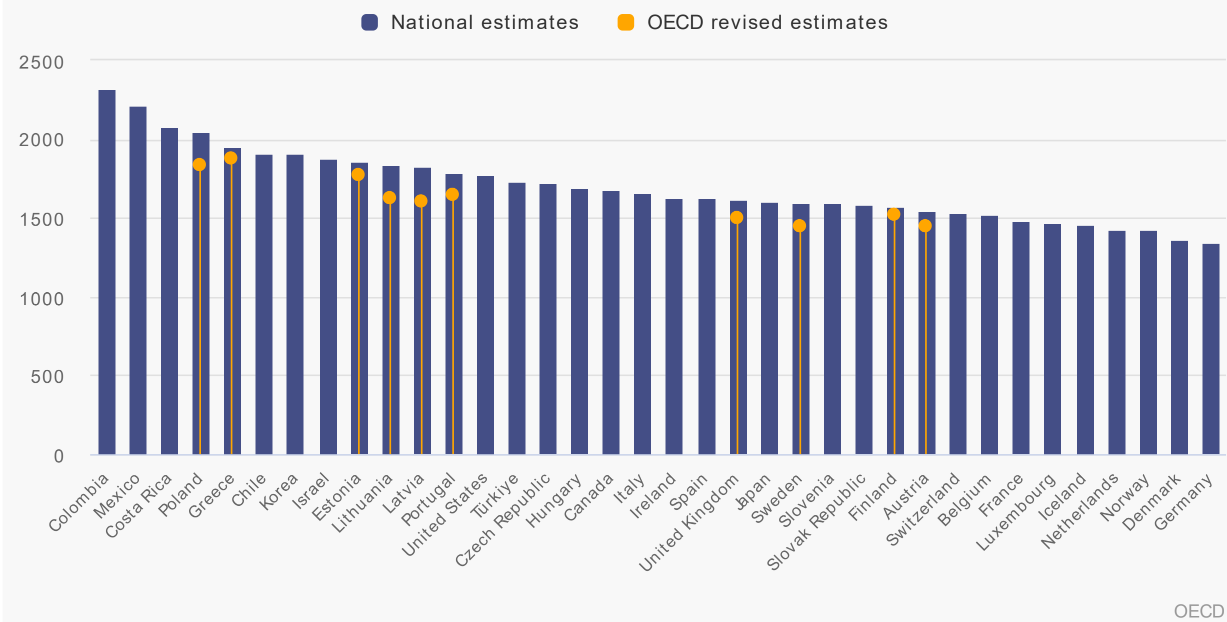


Figure 2.5: Comparison of average hours worked across countries

Average annual hours worked per worker, selected OECD countries, 2021



How to read the indicators

In most countries, the main source to construct measures of hours actually worked is the labour force survey. However, many countries rely, only or in addition, on establishment surveys and administrative sources. The use of different sources may affect the comparability of labour productivity levels but comparisons of labour productivity growth are less likely to be affected (Ward, Zinni and Marianna, 2018).

Computing estimates of hours worked also implies adjusting the activities covered by the labour input measures (employment and hours worked) to those covered by the output measure. This requires adapting the geographical and economic boundaries of employment and hours worked to the national accounts production boundary, in order to exclude resident persons working in non-resident production units and include non-resident persons working in resident production units.

In practice, countries adopt one of two methods to estimate actual hours worked for productivity analysis:

- the **direct method**, which takes actual hours worked self-reported by respondents in surveys, generally labour force surveys (LFS);
- the **component method**, which starts from contractual, paid or usual hours per week from establishment surveys, administrative sources or the LFS, with subsequent adjustments for absences and overtime, and other adjustments to align hours worked with the concepts of hours actually worked and the concept of domestic output.

While the direct approach appeals due to its simplicity, it depends heavily on respondent recall, cannot account for response bias, and assumes a perfect alignment of measures of workers and output. The component approach is more complex, but it systematically attempts to address these issues. There is evidence that response bias and insufficient adjustments to align with the concept of domestic output led to systematic upward biases in estimates of average hours worked per worker based on the direct approach, as compared to the component approach (Ward, Zinni and Marianna, 2018).

Admittedly, the OECD simplified component method necessarily relies on available data sources. In particular, it assumes that workers in all countries take, on average, all the leave to which they are entitled. However, actual take-up leave rates are likely to reflect differences in working cultures across countries. For this and other reasons, like the access of national statistics offices to a variety of national data sources, the OECD simplified component method estimates should be considered only as a stopgap for those countries currently using a direct approach with minimal or no adjustments, while these countries work towards improving their methodologies (Ward, Zinni, and Marianna, 2018).

Finally, the effective quantity of labour input depends not only on the total number of hours actually worked but also on the education, working experience, business functions and other workers' characteristics. The measure of labour input used in this publication, i.e. total hours worked, does not account for the **composition or "quality" of the workforce** and likely underestimates the effective contribution of labour to production.

For further methodological information, consult the *OECD Productivity Statistics – Methodological notes* at https://www.oecd.org/sdd/productivity-stats/OECD-Productivity-Statistics-Methodological-note.pdf.

Labour productivity

Labour productivity is the most frequently computed productivity indicator. It represents the volume of output produced per unit of labour input. The ratio between output and labour input depends to a large degree on the presence of other inputs, such as physical capital (e.g. buildings, machinery and transport vehicles) and intangible assets used in production (e.g. intellectual property assets), technical efficiency and organisational change. Labour productivity is a key dimension of economic performance and an essential driver of changes in living standards.

Intangible assets play an increasingly important role in economic growth and productivity. This comes with measurement challenges related to the potential recording of output where intellectual property assets are located rather than where output is physically produced. In addition to challenges to the measurement of output and GDP, intellectual property assets may give rise to large transfers of income between the countries where they are registered, usually for fiscal reasons (low-tax jurisdictions), and those where the ultimate owners of these assets are resident, thus leading to a large gap between GDP and GNI (see the section on the Size of output). In such cases, measures of labour productivity based on GNI are more meaningful than measures based on GDP.

Key findings

- **There are large disparities in labour productivity levels across countries, including within the OECD area.** When measured as GDP per hour worked in PPP terms, average labour productivity in the OECD area was slightly above USD 60 per hour in 2021, with a standard deviation across countries of about USD 24. When measured as GDP per hour worked, labour productivity was about twice the OECD average in Ireland and Luxembourg and about one third of the OECD average in Mexico and Colombia.
- Most countries with a labour productivity level below the OECD average in 2000 have seen a substantial catch-up since then, pointing to a convergence of labour productivity levels across OECD countries. However, the gap with the OECD average deepened for Greece, Israel, Japan, Mexico and New Zealand in the last 20 years.

- In most countries labour productivity measures based on GDP and GNI are similar, as the underlying income flows are relatively small or offset each other. In Ireland and Luxembourg, however, significant differences arise between **labour productivity measures based on GDP and GNI**, reflecting the significant role played by multinationals in output and income transfers. In such cases, labour productivity measures based on GNI are more meaningful.

Indicators

Figure 2.6: Labour productivity in 2021

GDP per hour worked, current prices and current PPPs

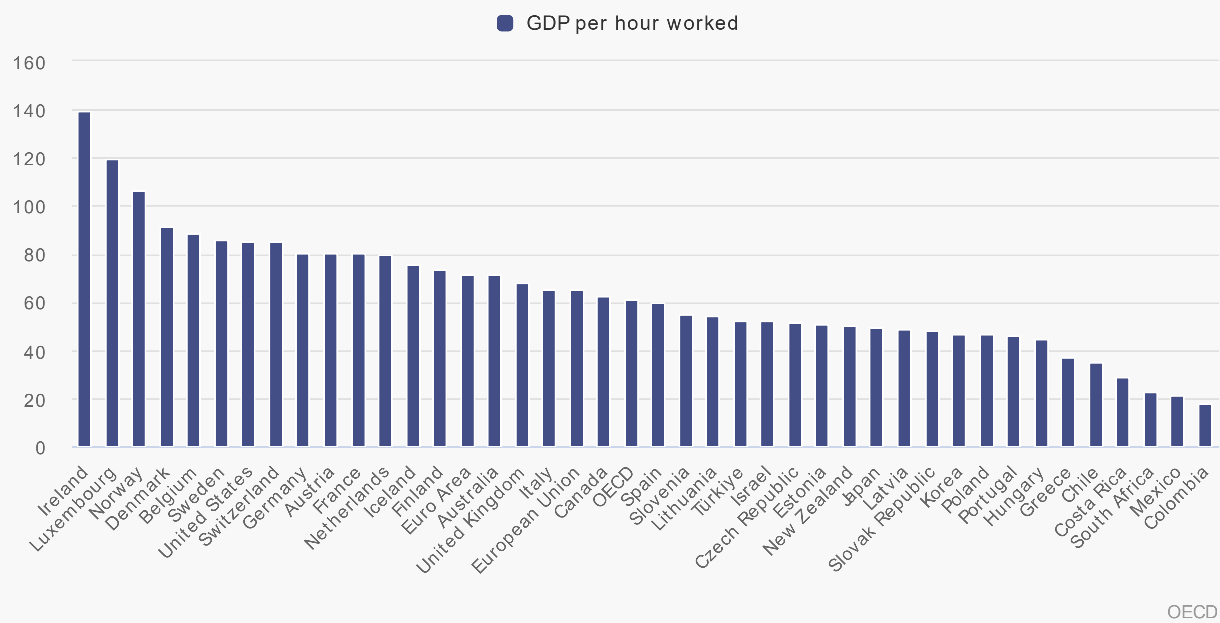


Figure 2.7: GDP per hour worked

Percentage point difference from the OECD (OECD= 0), current prices and current PPPs

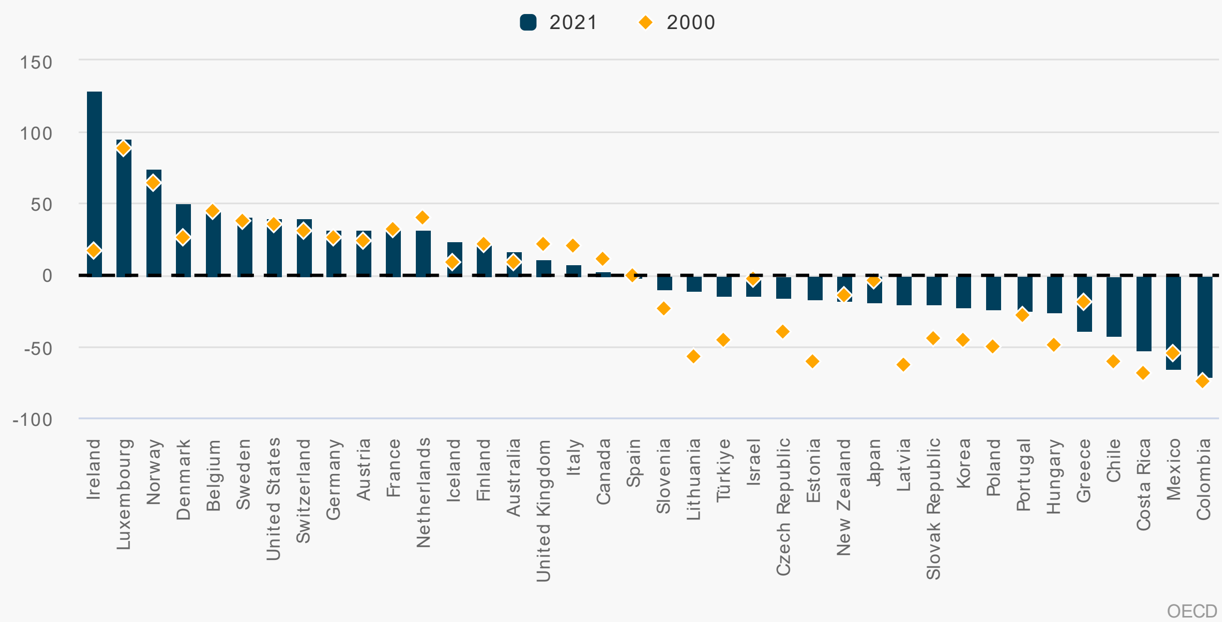
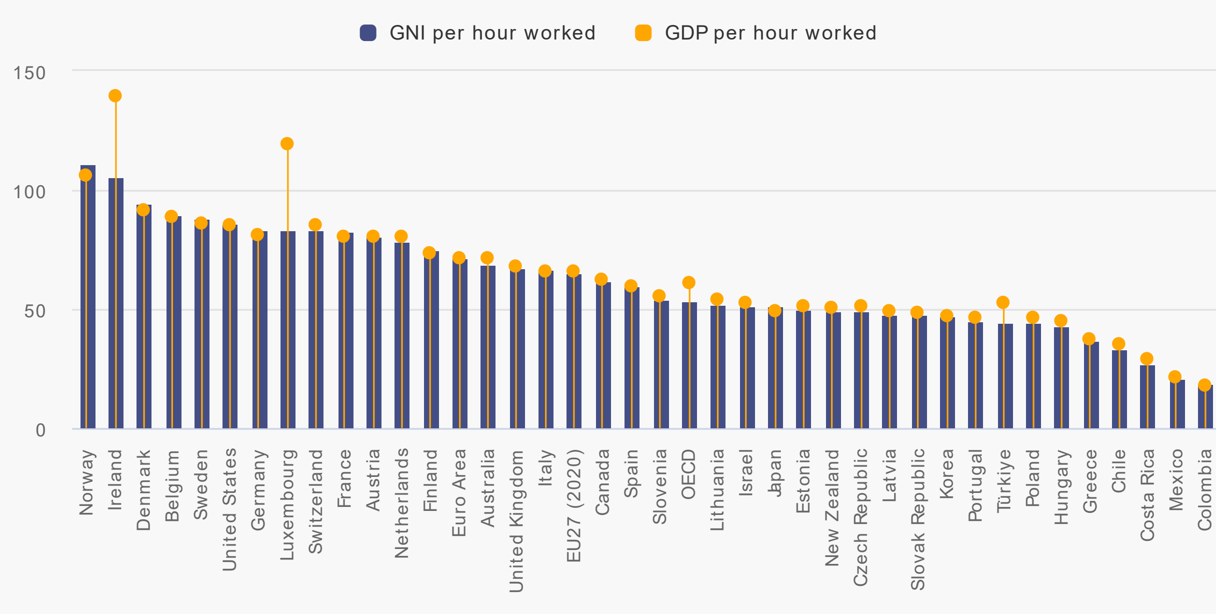


Figure 2.8: Labour productivity comparison across countries

GDP per hour worked and GNI per hour worked, current prices and current PPPs, 2021



How to read the indicators

Following national accounts conventions, and consistently with the measure of output, the measure of labour input in an economy includes the contribution of cross-border workers working in resident production units. Conversely, it excludes all persons working in non-resident production units. Depending on the original data sources used to estimate employment (e.g. labour force survey, administrative data, business statistics), various adjustments are needed to ensure consistency between labour and output measures.

In the above charts, national accounts figures on hours worked for Austria, Estonia, Finland, Greece, Latvia, Lithuania, Poland, Portugal, Sweden and the United Kingdom have been replaced with estimates obtained with the OECD simplified component method described in the section on Employment and hours worked. However, the impact of this correction on labour productivity growth rates is marginal (Ward, Zinni and Marianna, 2018).

For further methodological information, consult the *OECD Productivity Statistics – Methodological notes* at https://www.oecd.org/sdd/productivity-stats/OECD-Productivity-Statistics-Methodological-note.pdf.

Data sources

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OECD Productivity Statistics (database), http://dx.doi.org/10.1787/pdtvy-data-en.

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3 Productivity and economic growth

Context

Productivity growth over the last two decades has been sluggish in many OECD economies, with the slowdown in productivity preceding the global financial crisis in some countries. The COVID-19 pandemic and the war in Ukraine that started in February 2022 have triggered an energy crisis and increased uncertainties around economic developments, threatening the economic recovery. Concerns have risen that these developments may lead to a pronounced and long-standing fall in productivity growth.

Prior to the COVID-19 pandemic, considerable attention focused on the long-term productivity slowdown observed across countries. This was referred to as the productivity paradox, as the productivity slowdown occurred at a time of significant technological change. The increasing diffusion of digital technologies in the 2000s was expected to spark a new wave of productivity growth, similar to those seen in the past, e.g. as a result of electrification (from the mid-1880s) and, to a lesser extent, ICT investments (in the 1990s). However, this has not yet materialised, raising a number of open questions, ranging from the potential lagged effects of these new technologies to structural factors and statistical measurement issues.

Indeed, several views have been put forward to address the paradox:

- **The transformative nature and scale of today's technological breakthroughs pale into insignificance compared with those that took place in the past.** The benefits from electricity, internal combustion engines, the invention of telephone and radio, spread out through the economy over many years. Recent innovations, such as ICT, although also revolutionary, have shown more rapid adoption and a shorter-lived impact on productivity and economic growth (Cowen, 2011; Gordon, 2012).
- **The pace of technological progress has not slowed but adoption requires parallel innovation in organisational structures and business models.** The next wave of productivity growth driven by technology breakthroughs in artificial intelligence, robotics, the Internet of Things, Big Data, 3D printing, nanotechnology and biotechnology, may lag the innovations and take time to be fully deployed (Brynjolfsson and McAfee, 2011; Baily, Manyika and Gupta, 2013).
- **A breakdown of the diffusion machine.** Some studies suggest that an important explanation for the productivity slowdown is the slowing pace at which innovations spread from the most globally advanced firms to the rest of the economy (OECD, 2015; Andrews, Criscuolo and Gal, 2016). More recent work has analysed the drivers of differences in firms' ability to achieve productivity gains, particularly focusing on managerial quality and workers' skills. Preliminary evidence suggests that low managerial quality and the lack of ICT skills curb the adoption of digital technologies and the rate of diffusion (Andrews, Nicoletti and Timiliotis, 2018), and more recent OECD work on *The Human Side of Productivity* shows that more productive firms tend to employ a larger share of skilled employees and operate with a larger share of managerial roles (OECD, 2019; Criscuolo et al., 2021).
- **Sectoral changes.** Another factor that may explain the longer-term decline in productivity growth across (developed) economies is the long-term shift from manufacturing to services, in particular the shift to lower productivity personal services. Demographic changes and more service orientated

consumption patterns, notably from ageing populations, may exacerbate this effect. Nevertheless, several converging studies conclude that the impact of this phenomenon is limited so far (Barnett *et al.*, 2014; Kierzenkowski *et al.*, 2018; Riley *et al.*, 2018; Sorbe *et al.* 2018, Mourougane and Kim, 2020). See Chapter 4 on Industry contributions to aggregate labour productivity growth in this publication for a more detailed discussion on the impact of reallocations across industries on aggregate labour productivity developments.

- **Measurement.** Several measurement challenges can limit the analysis of recent productivity trends. Many of these challenges concern longstanding issues relating to the measurement of factors of production and output, and especially the distinction between price and volume changes. New forms of doing business, driven by digitalisation and the sharing economy, as well as the increasing importance of knowledge-based assets, have added new measurement challenges and exacerbated the long-standing ones. While the jury is still out on the underlying causes, a growing body of evidence has suggested that measurement, or rather "mismeasurement", is not the cause of the observed productivity slowdown (Syverson, 2017; Byrne, Fernald and Reinsdorf, 2016; Ahmad and Schreyer, 2016; Ahmad, Ribarsky and Reinsdorf, 2017).

GDP growth: contributions from employment, hours worked per worker, and labour productivity

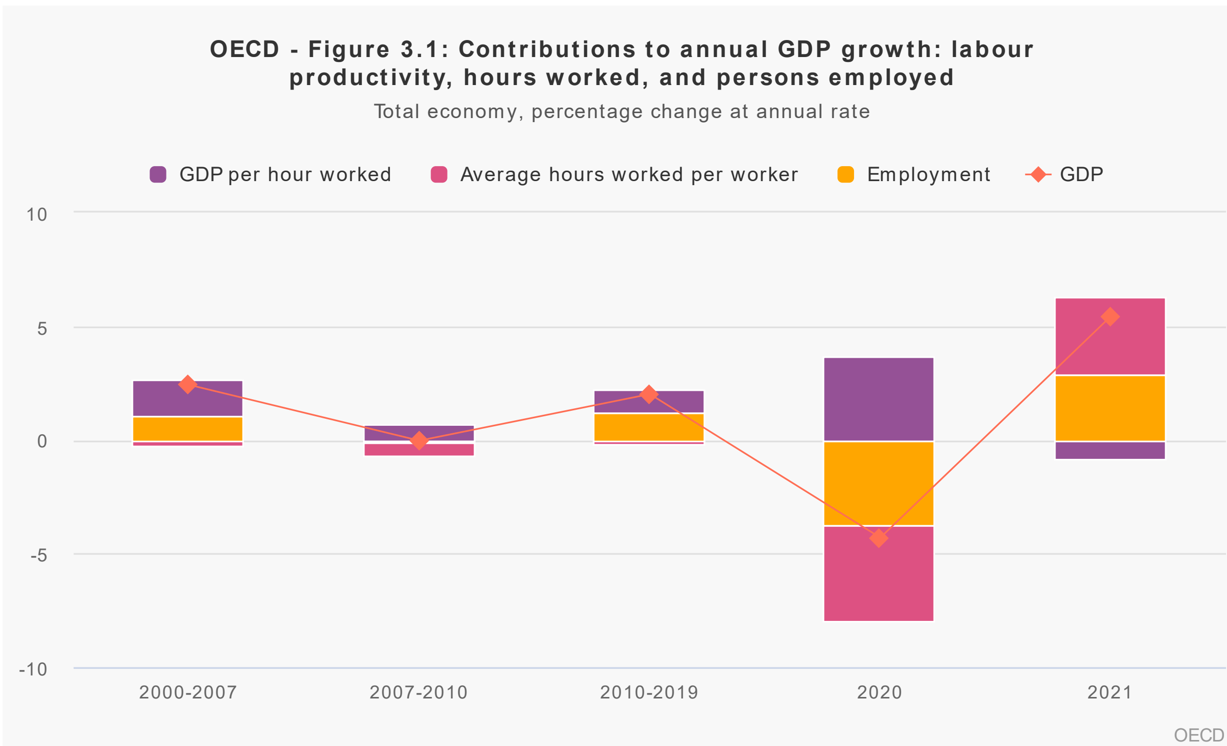
Productivity gains reflect the ability to produce more output by better combining inputs, owing to new ideas, technological breakthroughs and augmented business models. These transform the production of goods and services, fostering economic growth and rising living standards and well-being.

Key findings

- **The COVID-19 pandemic has triggered a global recession. GDP shrank in all OECD countries and G20 economies during the first wave of the COVID-19 outbreak (second quarter of 2020), with the downturn in 2020 being even more severe than the 2007-2009 recession in most countries.** Nevertheless, not all countries were affected equally. In 2020, the largest contraction in GDP growth was recorded in Spain, at around minus 12%, followed by those observed in the United Kingdom, Italy and Greece. By contrast, output losses have been rather small in a few countries including Estonia, Lithuania, and New Zealand.
- **GDP rebounded swiftly in 2021 in all countries despite the second wave of COVID-19 infections.** Chile, Colombia, Ireland and Türkiye are those that experienced the highest growth in 2021, while the recovery was subdued in Germany and Japan.
- **The decomposition of GDP growth into growth in labour productivity per hour worked, growth in the number of persons employed, and growth in hours worked per worker, shows a large positive contribution of growth in labour productivity per hour worked in 2020, followed by a negative contribution in 2021 in most countries.** As explained in more detail in Chapter 4 on Industry contributions to aggregate labour productivity growth, the 2020 upsurge in aggregate labour productivity was largely driven by the fact that hours worked declined more in contact-intensive sectors with lower productivity levels. These movements were themselves related to temporary mobility restrictions and lockdowns of economic activities to contain the pandemic, thus explaining opposite aggregate labour productivity developments in 2020 and 2021.
- Depending on countries, the number of persons employed or hours worked per worker were the main drivers of the GDP contraction in 2020. This contrasted picture is largely related to differences in the statistical treatment of workers in temporary lay-off in official labour statistics. These workers were recorded as employed in European countries, while they were registered as unemployed in

Canada and the United States (see the section Measuring labour input in Chapter 1). This largely explains why, in Canada and the United States, the main contributor to the 2020 decline in GDP was the number of persons employed, while it was hours worked per worker in European countries.

Indicators



Compare: https://www1.compareyourcountry.org/compendium-productivity-indicators-2023/en/2/5129/default/all/OECD+FRA/?embed=noHeaderNoNav

How to read the indicators

In the charts above, national accounts figures on hours worked for Austria, Estonia, Finland, Greece, Latvia, Lithuania, Poland, Portugal, Sweden and the United Kingdom have been replaced with estimates obtained with the OECD simplified component method described in the section on Employment and hours worked of Chapter 2. However, the impact of this correction on labour productivity growth rates is marginal (Ward, Zinni and Marianna, 2018).

For further methodological information, consult the *OECD Productivity Statistics – Methodological notes* at https://www.oecd.org/sdd/productivity-stats/OECD-Productivity-Statistics-Methodological-note.pdf.

GDP growth: contributions from labour, capital and multifactor productivity

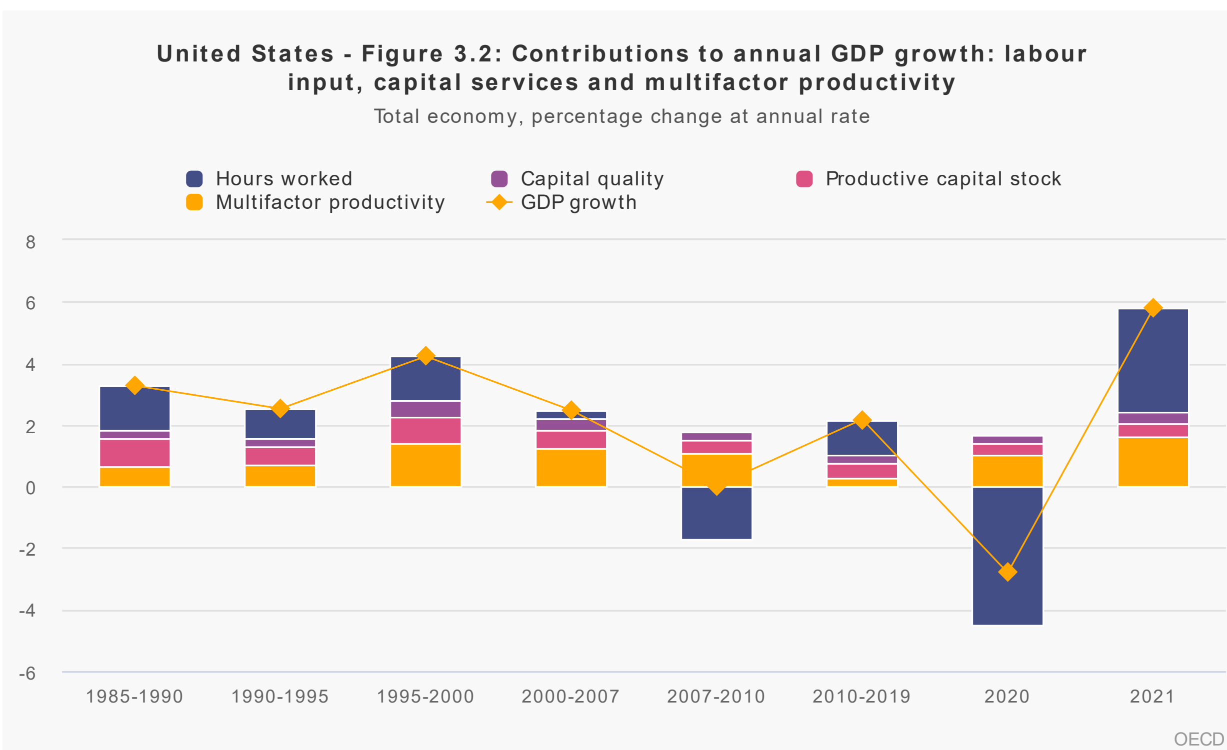
Economic growth can be fostered either by raising the labour and capital inputs used in production, or by improving the overall efficiency with which these inputs are combined, meaning higher multifactor productivity (MFP) growth. Growth accounting decomposes total output growth, measured here as GDP growth, into these three components. As such, they provide a useful tool for policy makers to identify the underlying drivers of economic growth.

The contribution of labour (capital) to GDP growth is measured as the growth in labour (capital) input, multiplied by the share of labour (capital) in total costs of production. In the figures below, the contribution of capital to GDP growth is further broken down to highlight the contribution made by changes in the volume of the productive capital stock used in production and gains from changes in the composition of capital (i.e. capital quality). The sum of the contributions from the productive capital stock and capital quality is the overall contribution of capital services to GDP growth.

Key findings

- When contributions to GDP growth are analysed in the growth accounting framework, **changes in labour input, measured as total hours worked, stand out as the driving force of the GDP contraction in almost all OECD countries in 2020. Total hours worked are also the key driver of the recovery in 2021**.
- **The deterioration of multifactor productivity (MFP) performance was a striking feature of both the Global Financial Crisis and the first year of the COVID-19 pandemic.** Indeed, all countries recorded negligible or negative MFP growth in 2007-2010 and 2020. However, MFP contributed positively to the 2021 recovery of GDP growth in most countries for which 2021 data are available.

Indicators



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How to read the indicators

For productivity analysis, the appropriate measure of capital input is the flow of capital services, i.e. the flow of productive services that can be drawn from the productive capital stock. This productive capital stock is the cumulative stock of past investments in capital assets adjusted for the losses in their productive capacity (or efficiency) and retirement (Schreyer, Bignon, and Dupont, 2003). Conceptually, capital services should not be confused with the value of capital that is measured by the net wealth capital stock. For example, the capital services provided by a taxi relate to the number of trips, distance driven, and comfort of the taxi, rather than the market value of the vehicle, which would instead relate to the net wealth capital stock concept. These services are estimated using the rate of change of the productive capital stock of different capital goods and aggregated using rental prices or user costs shares as weights (as opposed to market price shares used to aggregate net wealth capital stocks).

Countries use different approaches to deflate investment in information and communication technologies (ICT) assets (i.e. computer hardware, telecommunications equipment, and computer software and databases), where constant-quality price changes are particularly important but difficult to measure. Moreover, they tend to use different depreciation and retirement profiles for all assets. Unexplained differences in depreciation and retirement profiles across countries may harm the cross-country comparability of capital stocks and macroeconomic indicators and recent analyses highlighted the need for national statistical agencies to regularly review and update these profiles (Bennet et al., 2020; Giandrea et al., 2021; Kornfeld and Fraumeni, 2022; Pionnier et al., 2023). To adjust for potential measurement differences, the OECD estimates productive capital stocks and computes aggregate measures of capital services using a set of harmonised ICT investment deflators as well as common depreciation rates and retirement profiles for all assets across countries (Schreyer, 2002; Schreyer, Bignon and Dupont, 2003).

MFP growth is measured as a residual, i.e. by the part of GDP growth that cannot be explained by the contributions of labour and capital inputs to GDP growth. Traditionally, MFP growth is seen as a measure of technical change but, in fact, technical change can also be embodied in factor inputs, e.g. improvements in design and quality between two vintages of the same capital asset. In practice, MFP only captures disembodied technical change, e.g. network effects or spillovers from production factors, the effects of better management practices, organisational change and improvements in the knowledge base. Moreover, MFP picks up other factors such as adjustment costs, economies of scale, effects from imperfect competition, variations in capacity utilisation (if not captured by the capital input measures), and errors in the measurement of output, inputs and input weights. For instance, increases in educational attainment or a shift towards a more skill-intensive production process, if not captured by labour input measures (i.e. labour services) will end up in measured MFP. Therefore, accurate estimates of output and input measures is key to get a reliable measure of MFP.

In the above charts, national accounts figures on hours worked for Austria, Estonia, Finland, Greece, Latvia, Lithuania, Poland, Portugal, Sweden and the United Kingdom have been replaced with estimates obtained with the OECD simplified component method described in the Section on Employment and hours worked of Chapter 2. However, the impact of this correction on labour productivity growth rates is marginal (Ward, Zinni and Marianna, 2018).

For further methodological information, consult the *OECD Productivity Statistics – Methodological notes* at https://www.oecd.org/sdd/productivity-stats/OECD-Productivity-Statistics-Methodological-note.pdf.

Labour productivity growth: contributions from capital and multifactor productivity

Labour productivity growth points to changes in the volume of output for a given volume of hours worked. Higher levels of labour productivity can be achieved if more capital is used in production, if capital quality increases, and if labour and capital are used together more efficiently, which means higher multifactor productivity growth (MFP).

By reformulating the growth accounting framework described in the previous section, labour productivity growth can be decomposed into the contribution of capital and MFP. In the figures below, the contribution of capital to labour productivity growth is further broken down to highlight the contribution of changes in the productive capital stock to GDP ratio (i.e. capital stock-output ratio) and in the composition of capital (i.e. capital quality).

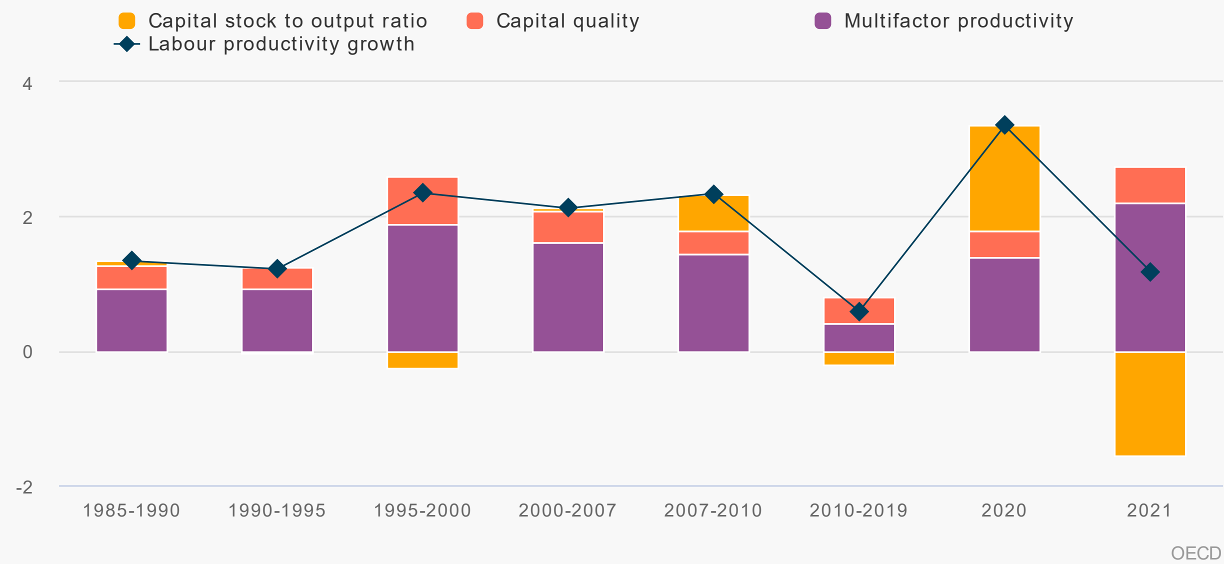
Key findings

- The evolution of the capital-stock-to-output ratio contributes to aggregate labour productivity growth in a countercyclical way. It increases during economic downturns and declines during economic rebounds, as capital stock moves more slowly than GDP. During periods of stable economic growth, its contribution is typically small. Capital quality tends to have a small and stable contribution to aggregate labour productivity growth.
- MFP growth is usually the main driver of labour productivity growth, but, over the course of the last two decades prior to the COVID-19 crisis, its contribution has been declining in most countries, particularly in Finland, Greece, Korea, Sweden, the United Kingdom and the United States.
- Most countries recorded a decline in MFP growth in 2020, followed by an increase in 2021. This reflected the large fluctuations in GDP growth and the overall stability of the measured capital input. Accounting for fluctuations in capital utilisation during the business cycle may result in smoother MFP developments in 2020 and 2021 (see the section Measuring investment and capital utilisation in Chapter 1).
- The United States currently stands out as an exception, with an increase in MFP growth in 2020, and an even more significant increase in 2021. While national accounts data for these two years are still subject to revisions, these developments should be put in relation with positive and increasing contributions of within-industry contributions to aggregate labour productivity growth in the United States in both years (see Chapter 4).

Indicators

United States - Figure 3.3: Contributions to annual labour productivity growth: capital stock to output ratio, capital quality and multifactor productivity

Total economy, percentage change at annual rate



Compare: https://www1.compareyourcountry.org/compendium-productivity-indicators-2023/en/2/5132+5133/default/all/USA+JPN/?embed=noHeaderNoNav

How to read the indicators

As explained in the previous section, the OECD estimates productive capital stocks and computes aggregate measures of capital services using a set of harmonised ICT investment deflators as well as the same depreciation rates and retirement profiles for the different assets across countries (Schreyer, 2002; Schreyer, Bignon and Dupont, 2003). OECD also applies a consistent methodology to estimate MFP growth.

While MFP growth contributes to both GDP and labour productivity growth, the corresponding contributions are different. MFP growth contributes to GDP growth with a weight equal to one, but it is weighted by the inverse of the labour cost share to calculate its contribution to labour productivity growth.

In the above charts, national accounts figures on hours worked for Austria, Estonia, Finland, Greece, Latvia, Lithuania, Poland, Portugal, Sweden and the United Kingdom have been replaced with estimates obtained with the OECD simplified component method described in the Section on Employment and hours worked in Chapter 2. However, the impact of this correction on labour productivity growth rates is marginal (Ward, Zinni and Marianna, 2018).

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Data sources

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4 Industry contributions to aggregate labour productivity growth

Context and key findings

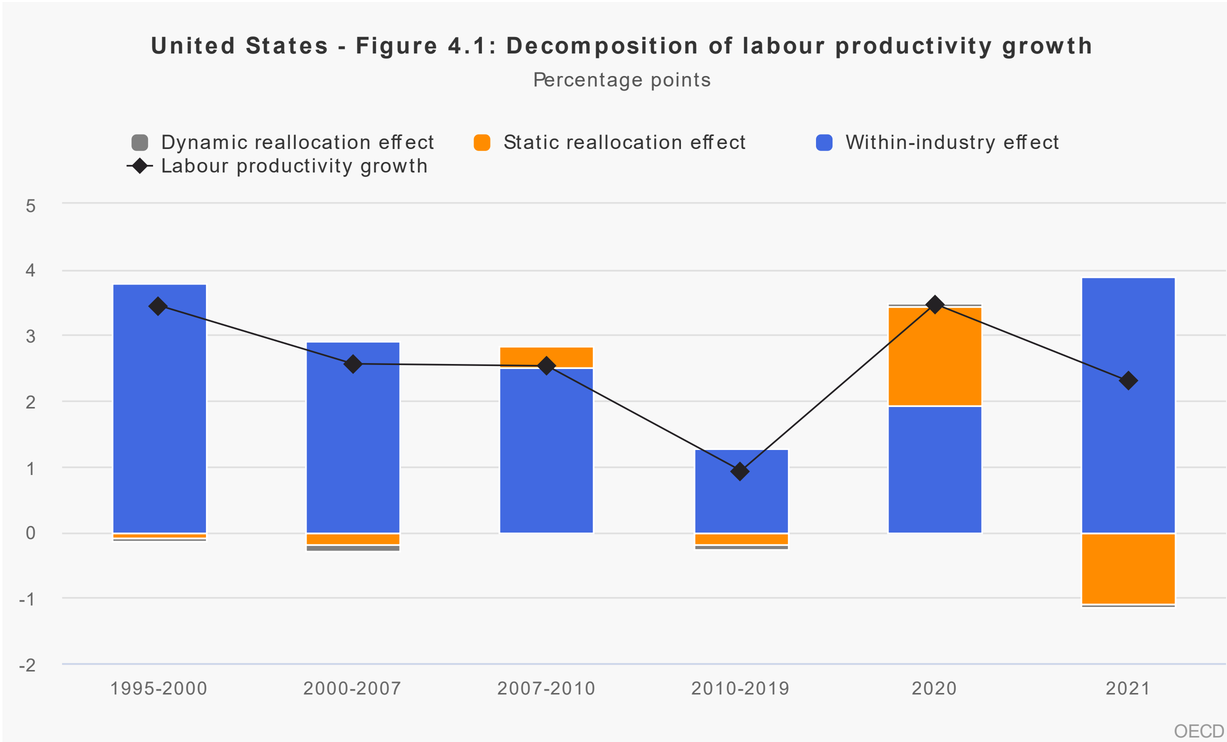
Industries differ from each other in terms of their labour productivity level (defined as the ratio of value added to hours worked) and labour productivity growth. Such differences relate, for instance, to the intensity with which industries use skilled labour and capital in their production process, their capacity to innovate, and their exposure to competition and knowledge sharing through their participation in international trade and global value chains.

Decomposing aggregate labour productivity growth into the effects of within-industry labour productivity growth and reallocations between industries with different productivity levels and growth rates helps to better understand the drivers of overall labour productivity growth, especially in 2020-2021.

Key findings

- Under normal economic circumstances, reallocations across industries only play a limited role in explaining aggregate labour productivity growth. Overall reallocations are the sum of reallocations of hours worked between industries with different productivity levels (static reallocation effect) and between industries with different productivity growth rates (dynamic reallocation effect). The static effect usually dominates the dynamic effect.
- A more significant and positive reallocation effect on labour productivity growth is usually observed during recessions. The COVID-19 recession was no exception and the scale of the overall reallocation effect in 2020 was unprecedented. It largely contributed to the rebound in aggregate labour productivity growth that was observed in most countries in 2020. Nevertheless, early evidence from the few countries for which detailed industry data are available for 2021 shows that the effect of reallocations observed in 2020 was largely related to temporary disruptions brought by the pandemic.
- In the future, major structural changes induced by the digitalisation and the decarbonisation of economies may lead to more significant reallocation effects across industries.

Indicators



Compare: https://www1.compareyourcountry.org/compendium-productivity-indicators-2023/en/2/5167/default/all/FRA+USA?embed=noHeaderNoNav

Reallocations across industries and within-industry productivity developments

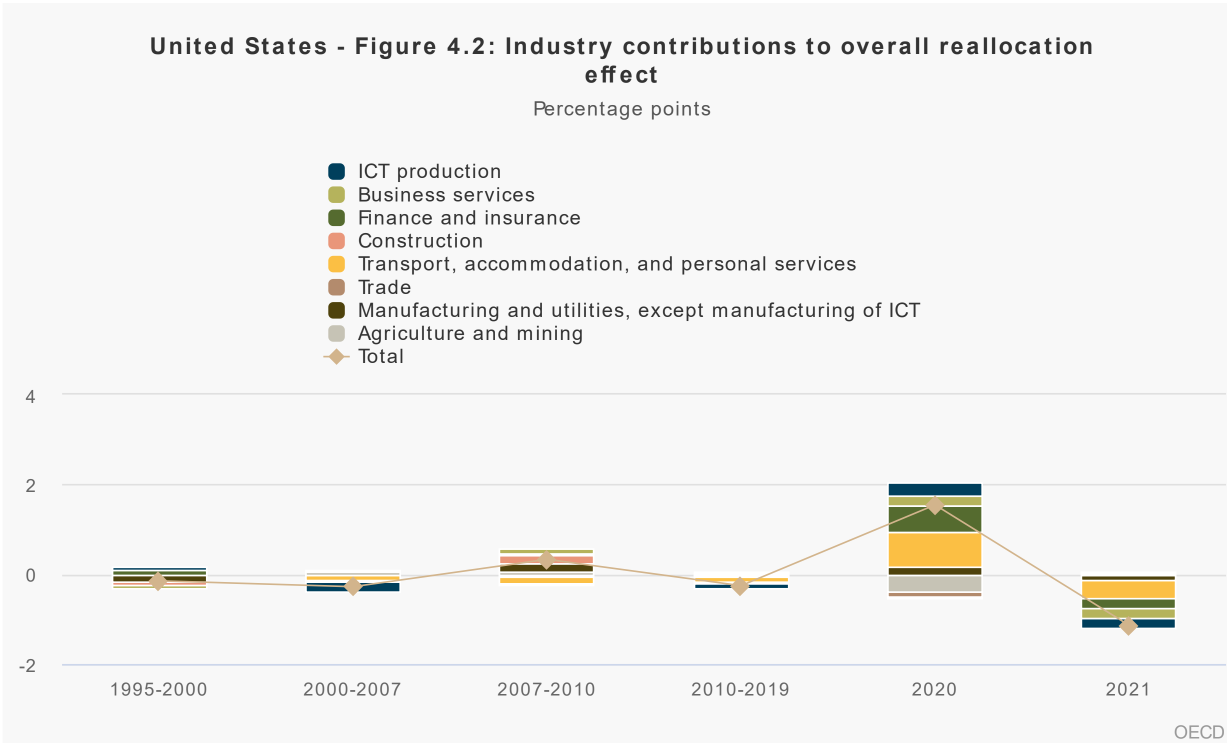
Except during recessions, reallocations across industries tend to play a limited role in aggregate labour productivity developments

- The limited overall reallocation effect during normal economic circumstances is often the result of industry contributions with opposite signs (see Figure 4.2 below). For example, the opposite effects of declining hours worked in agriculture and manufacturing are related to the fact that agriculture has a below-average and manufacturing an above-average productivity level in most countries. These two effects tend to compensate each other.
- The unusually large reallocation effect observed in 2020 was largely due to the lockdown of contact-intensive industries such as accommodation and personal services or travel bans affecting the transport sector during the pandemic. These industries tend to have below-average labour productivity levels, explaining why the sharper decline in hours worked in these industries than in other parts of the economy acted as an overall boost to productivity. As a result, the overall reallocation effect was the main source of aggregate labour productivity growth in 2020 in most countries for which data is available. It was larger in countries that implemented more stringent lockdown measures in 2020.
- Less contact-intensive industries experienced a lower decline in hours worked, which had an heterogenous impact on aggregate labour productivity growth in 2020. For example, the limited decline in hours worked in low-productivity sectors such as agriculture and construction acted as a drag on aggregate labour productivity growth in some countries (e.g. France, Greece and the United States). By contrast, the resilience of hours worked in high-productivity industries such as

information and communication, and finance and insurance, likely related to the rapid development of teleworking in these sectors, boosted aggregate labour productivity growth.

- Early evidence from the few countries for which detailed industry data are available for 2021 shows that the effect of reallocations observed in 2020 was largely related to temporary disruptions brought by the pandemic. In most countries, the allocation across sectors started to revert to its pre-pandemic level in 2021. The large positive effect on aggregate productivity of the shutdown of low-productive sectors such as accommodation and restauration in 2020 vanished or even turned negative in 2021, depending on the duration of lockdowns. In Austria, Italy and Slovenia, the overall reallocation effect went back to small values, while in the United States it reached a low negative value that nearly cancelled the large positive effect that was observed in 2020.
- Considering the rapid increase in job quit rates following the first lockdowns in different countries, a phenomenon coined as the “Great Resignation”, it was initially thought that the pandemic may be inducing a durable change in worker preferences for certain types of jobs. Nevertheless, recent empirical evidence shows that quit rates were highest in industries and occupations that also had the highest job growth (Hobijn 2022). These industries and occupations are those that were the hardest hit by lockdown measures during the pandemic, e.g. accommodation and food services. Moreover, only a small share of job quitters in the United States seems to be changing industry of employment or occupation, which goes against the initial view that the wave of resignations is largely driven by workers who are reconsidering their career choices. Additional data for 2021 and the subsequent years will allow to fully assess the effect of reallocations induced by the pandemic in the long term.
- In the future, major structural changes induced by the digitalisation and the decarbonisation of economies may lead to more significant reallocation effects across industries.

Indicators



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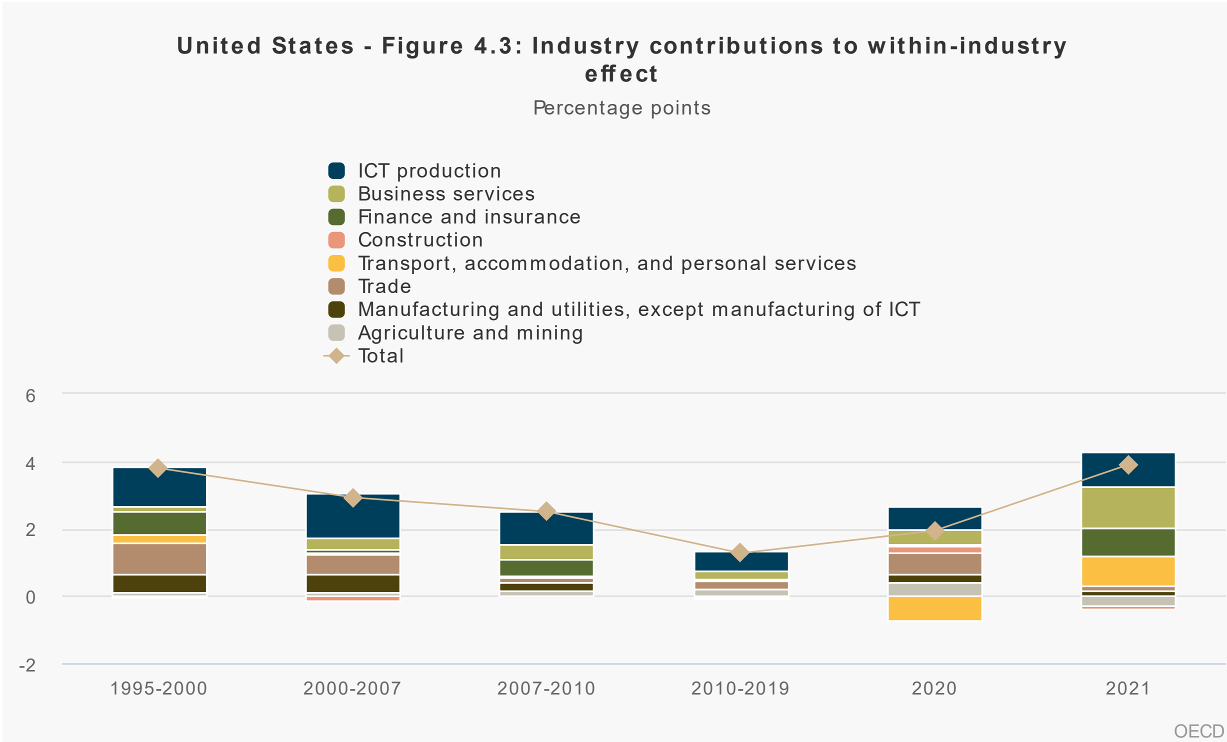
Over the past decades, within-industry developments explain most of aggregate labour productivity growth

- Within-industry developments explain most of the aggregate labour productivity growth in OECD countries, including the surge in labour productivity growth from the mid-1990s until the mid-2000s and the slowdown in labour productivity growth since then. The overall contribution of within-industry developments can be further broken down into industry contributions (see Figure 4.3 below).
- As explained by Jorgenson et al. (2008) and Cette et al. (2016), Information and Communication Technology (ICT) is behind the surge in aggregate labour productivity growth at the turn of the 21st century. This includes productivity gains in ICT-producing sectors (manufacturing of computers, electronic and electrical equipment, and provision of ICT services), as well as the increased use of ICT by some services sectors (e.g. trade; finance and insurance; and business services). The surge in ICT-related labour productivity gains that started in the mid-1990s was more significant and durable in the United States than in Europe and Japan, partly due to higher ICT investments and, more importantly, to higher MFP gains in ICT-using industries (Timmer et al., 2011; Gordon and Sayed, 2020). It is important to note that labour productivity growth reflects both capital accumulation and MFP growth (see the section in Labour productivity growth: contributions from capital and multifactor productivity Chapter 3).
- The years following the ICT-related productivity boom have seen a decline in aggregate labour productivity growth. In the United States, it can be largely attributed to a decline in the contribution of ICT-producing and ICT-using industries (e.g. trade, finance and insurance, and business

services) to within-industry labour productivity growth from the mid-2000s onwards. Among G7 countries, a similar phenomenon took place in the United Kingdom, with an even larger role played by finance. In France and Germany, the contribution of ICT-producing and ICT-using industries is less visible, and the decline in within-industry labour productivity growth between the early 2000s and the 2010s seems to be more related to manufacturing. Labour productivity developments within the manufacturing sector also largely contributed to the decline in aggregate labour productivity growth from the early 2000s onwards in Finland and Mexico.

- The within-industry contribution to labour productivity growth in 2020 declined in most countries for which data is available, as compared to the previous decade (2010-2019). It even turned negative in the Czech Republic, Denmark, Finland, France, Germany, Greece, Mexico, and the Netherlands. By contrast, this contribution was higher in 2020 than over 2010-2019 in Austria, Italy, and the United States. In most countries, transport, accommodation and personal services contributed negatively to within-industry productivity growth in 2020, while trade, ICT, finance and insurance, and business services contributed positively. Countries mainly differed in the relative magnitude of these negative and positive contributions.
- In the few countries for which detailed industry data are available for 2021, the within-industry contribution to labour productivity growth usually had an opposite sign in 2021 and 2020, thus bringing back the average contribution over 2019-2021 closer to the value recorded over 2010-2019. The only exception is the United States, where this contribution is both higher in 2020 than over 2010-2019, and higher in 2021 than in 2020. In the United States, all negative contributions turned positive and most positive contributions were maintained or even increased between 2020 and 2021.
- While aggregate macroeconomic data sourced from national accounts are insufficient to fully understand the unusual evolutions of within-industry contributions to labour productivity growth in 2020, they are consistent with a temporary reduction in hours worked during the pandemic, driven by furlough programmes or labour hoarding decisions by firms which were confronted with temporary declines in output. Large-scale firm closures in 2020 are unlikely to explain within-industry developments, as bankruptcies declined at the start of the pandemic (OECD, 2021). Nevertheless, firm-level data would be necessary to go beyond the evidence provided by national accounts data and fully understand within-industry labour productivity developments.

Indicators



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How to read the indicators

The decomposition of aggregate labour productivity growth that is used in this chapter includes three main terms, each of them corresponding to a sum of industry contributions:

- A *within-industry effect*, where labour productivity growth in each industry is weighted by the industry share in total value added in year t-1.
- A *static reallocation effect*, accounting for changes between t-1 and t in the share of total hours worked of industries with different productivity levels. Industries with an increasing share in total hours worked contribute positively to aggregate labour productivity growth if they have an above-average labour productivity level.
- A *dynamic reallocation effect*, accounting for changes between t-1 and t in the share of total hours worked of industries with different productivity growth rates. An increase in the total hours worked share of industries with positive productivity growth has a positive effect on aggregate labour productivity growth. This effect is all the more significant that the industry value added is high.

The sum of the two reallocation effects is referred to as *overall reallocation effect*.

For additional information on this decomposition of aggregate labour productivity growth, see the methodological note.

This chapter focuses on a subset of the total economy that excludes real-estate, public administration and defense, education, and health activities (i.e. total economy less industries L, O, P, Q in the ISIC rev. 4 classification). Real-estate activities are excluded because their value added is largely imputed (it includes the value of both actual and imputed housing rents in the economy) and disproportionate as compared to the corresponding work force in national accounts (mostly real-estate agents and employees of notary offices are attached to the real-estate industry in national accounts). Public administration and defense, education and health services are excluded because they are largely non-market. Hence, their output value is measured as the sum of input costs, and in several countries their output volume is measured by deflating input costs, thus conventionally excluding any productivity gains.

For most countries, the above decompositions of aggregate labour productivity growth rely on breakdowns of value added and hours worked into economic sectors at the 2-digit level of the NAICS 2017 classification (for Canada, Mexico, and the United States) or the ISIC rev. 4 classification. Due to data limitations, the decompositions for France, Germany, Italy, and the United Kingdom rely on a mix of 1-digit and 2-digit level data corresponding to the A38 level of the ISIC rev.4 classification, and the decomposition for Australia relies on 1-digit level data according to the ANZSIC 2006 classification. This corresponds to between 20 and 64 industries, depending on data availability in different countries. Except for a few cases, this is the most granular industry data publicly available in national accounts, but it might not be sufficient to fully capture the heterogeneity of economic activities. Therefore, it cannot be excluded that part of the within-industry effects presented above actually correspond to resource reallocations between firms or economic activities belonging to the same 2-digit industry. A complete assessment of the contribution of reallocations and business dynamism (entries and exits of firms) to aggregate labour productivity growth would require firm-level data.

Even though a more granular breakdown is used for all calculations, the following breakdown by industry is used to visualise the contributions of reallocation and within-industry effects to aggregate labour productivity growth in the figures included in this Chapter:

- Agriculture and mining: industries A and B in the ISIC rev. 4 classification; industries 11 and 21 in the NAICS 2017 classification
- Manufacturing and utilities, excluding manufacturing of ICT: industries C, D and E except C26-27 in the ISIC rev. 4 classification; industries 22 and 31-33 except 3361MV and 3364OT in the NAICS 2017classification
- Construction: industry F in the ISIC rev. 4 classification; industries 23 in the NAICS 2017 classification
- Trade: industry G in the ISIC rev. 4 classification; industries 42 and 44RT in the NAICS 2017 classification
- Transport, accommodation, and personal services: industries H, I and R to U in the ISIC rev. 4 classification; industries 48TW, 71, 72 and 81 in the NAICS 2017 classification
- ICT production: industries C26-27 and J in the ISIC rev. 4 classification; industries 3361MV, 3364OT and 51 in the NAICS 2017 classification. This includes the manufacturing of computers, electronic and electrical equipment, as well as the production of information and communication services.
- Finance and insurance: industry K in the ISIC rev. 4 classification; industry 52 in the NAICS 2017 classification
- Business services: industries M and N in the ISIC rev. 4 classification; industries 54 to 56 in the NAICS 2017 classification.

It should be kept in mind that macroeconomic data for recent years are subject to revisions, especially in the years 2020 and 2021 covering the COVID-19 pandemic.

Data sources

OECD National Accounts Statistics (database), http://dx.doi.org/10.1787/na-data-en.

References and further reading

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5 Productivity in SMEs and large firms

Context

Focusing on relatively aggregated industries can mask **heterogeneity in productivity among firms** within the same industry and, in particular, the contribution of small and medium-sized enterprises (SMEs). In several countries, a fat tail of low-productivity firms (composed in large part of small firms) co-exists with large firms, which are very productive and exposed to international competition. To the extent that large firms can exploit increasing returns to scale, productivity tends to increase with firm size. However, new small firms can also spur aggregate productivity growth when they exploit new technologies and stimulate productivity-enhancing changes by incumbents.

Productivity by firm size

Firm-level productivity depends on a variety of factors, including the size of the enterprise and its sector of activity. While larger firms tend to be more productive than smaller ones, productivity in smaller firms may benefit from the intensive use of information and communication technologies (ICT), digital tools, and innovations. This is particularly true for new or younger firms. Other factors such as human capital (e.g. workforce skills, management skills) also explain differences in productivity across firms (Criscuolo et al., 2021).

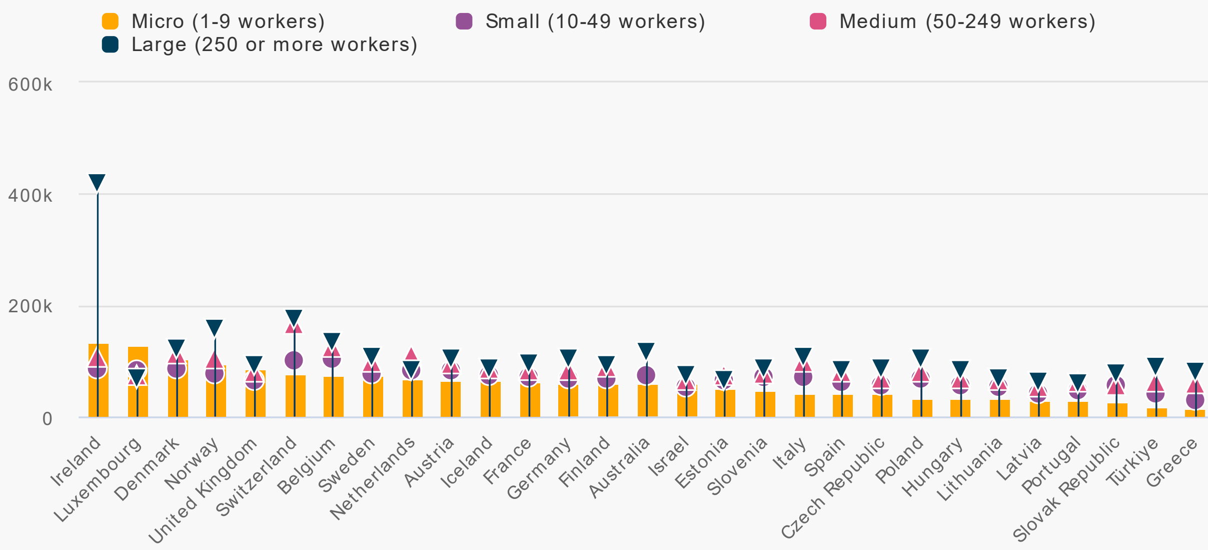
Key findings

- **Larger firms are on average more productive than smaller ones, particularly in the manufacturing sector.** This typically reflects increasing returns to scale through capital-intensive production.
- **In some cases, smaller firms can outperform larger counterparts, particularly in the business services sector**, reflecting competitive advantages in niche, high brand or high intellectual property content activities as well as the intensive use of information and communications technologies (ICT). This is consistent with (Andrews et al.,2015) showing that young, often small, firms tend to be more innovative than their mature counterparts.
- In most countries, labour productivity gaps between micro and, to a lesser extent, small and medium-sized firms on the one hand, and large firms on the other hand are relatively high, particularly in the manufacturing sector. Differences in productivity across size classes are relatively smaller in business services.

Indicators

Figure 5.1: Labour productivity in SMEs and large firms, business economy

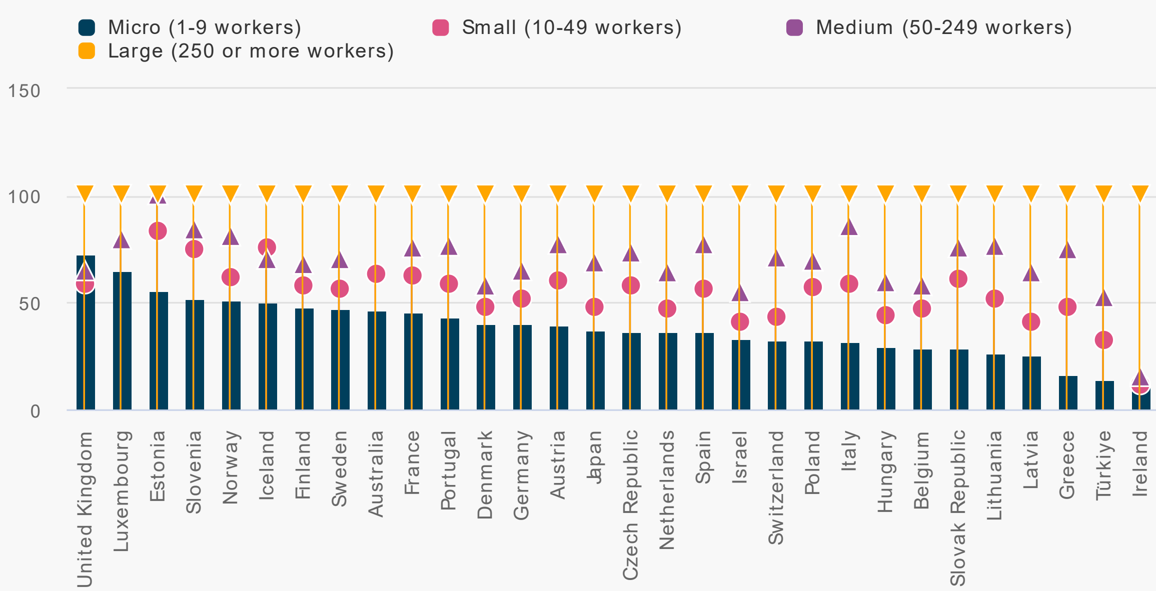
Value added per person employed, US dollars, current PPPs, 2020 or latest available year



OECD

Figure 5.2: Labour productivity in SMEs and large firms, manufacturing

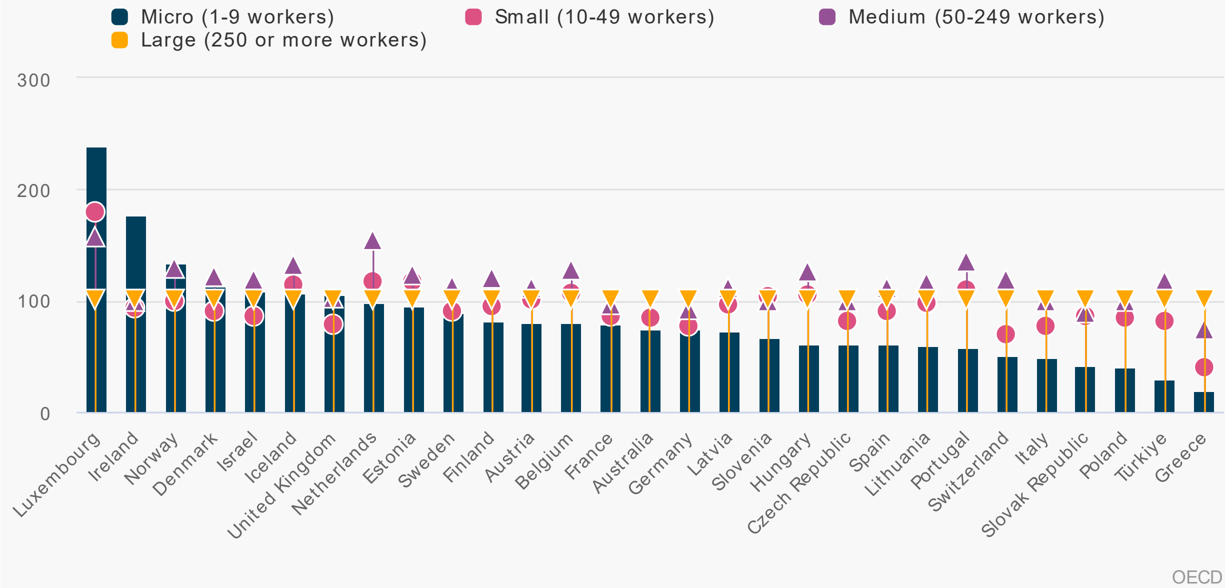
Value added per person employed, index 250+ = 100, 2020 or latest available year



OECD

Figure 5.3: Labour productivity in SMEs and large firms, business services

Value added per person employed, index 250+ = 100, 2020 or latest available year



How to read the indicators

Labour productivity by enterprise size class is measured as gross value added in current prices per person employed. Labour input is measured as total employment, which includes employees and all other paid or unpaid persons who worked during the reference year. Data on hours worked by all persons employed are typically not available by enterprise size class.

Value added and total employment for different enterprise size classes are sourced from [OECD Structural and Demographic Business Statistics (database).](#) They typically do not perfectly align with the corresponding estimates in national accounts. The latter include several adjustments to reflect businesses and activities that may not be covered in structural business statistics, such as those made to reflect the non-observed economy. Since labour input is measured as total employment, the cross-country comparability of labour productivity measures by size class may also be affected by differences in the share of part-time employment. In addition, productivity differences in the main aggregate sectors could mask different productivity patterns in more narrowly defined industries.

In this chapter, "business economy" covers mining and quarrying (B), manufacturing (C), electricity, gas, steam and air conditioning supply (D), water supply, sewerage, waste management and remediation activities (E), construction (F) and business services (excluding finance and insurance activities). Business services include wholesale and retail trade, repair of motor vehicles and motorcycles (G); transportation and storage (H); accommodation and food services (I); information and communication services (J); real estate activities (L); and professional, scientific, administrative and support activities (M and N) (letters between brackets correspond to the industry codes in ISIC rev. 4).

Data sources

OECD Structural and Demographic Business Statistics (database), http://dx.doi.org/10.1787/sdbs-data-en.

References and further reading

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6 Investment

Context

Breaking down investment and capital by asset type helps to better understand the main drivers of GDP and productivity growth. For example, it allows assessing the state of infrastructure and the volume of investment in growth-enhancing technologies, such as ICT. Moreover, different asset types contribute in different ways to GDP and productivity growth. As explained in Chapter 3 Productivity and economic growth, capital services are the appropriate measure of capital input in productivity analysis and their measurement depends on the composition of the capital stock.

The diagramme below presents the minimum level of asset breakdown recommended by the 2008 System of National Accounts (2008 SNA). For the measurement of capital stocks and capital services, homogeneous asset groups with similar price deflators and depreciation patterns are required. One of the innovations introduced by the 2008 SNA was the enlargement of the asset boundary by capitalising expenditures in weapons systems and research and development (R&D), whereas they were previously considered as intermediate consumption. Nevertheless, important intangible assets such as brand equity, data, and organisational capital remain outside the national accounts' asset boundary.

Depending on the purpose of the analysis, different assets can be grouped into different aggregate categories. For example, Dwellings, Other buildings and structures, Machinery and equipment and weapons systems, and Cultivated biological resources may be grouped into tangible assets, as opposed to intangible assets, also referred to as Intellectual Property Products (IPPs). A different classification often used in economic analysis distinguishes information and communication technology (ICT) and non-ICT assets. ICT assets include Computer hardware, Telecommunication equipment, and Computer software and databases, while non-ICT assets include Dwellings, Other buildings and structures, Transport equipment, Other machinery and equipment and weapons systems, Cultivated biological resources, and Intellectual property products except Computer software and databases.

Table 6.1. Breakdown of fixed capital assets according to the System of National Accounts 2008

	2008 SNA code	Produced fixed assets	
Tangible assets	**N111**	**Dwellings**	Non-ICT assets
	N112	**Other buildings and structures**	
	N11M	**Machinery and equipment and weapons systems**	
	N1131	Transport equipment	
	N1132	ICT equipment	ICT assets
	N11321	Computer hardware	
	N11322	Telecommunications equipment	
	N110	Other machinery and equipment and weapons systems	Non-ICT assets
	N115	**Cultivated biological resources**	
Intangible assets	**N117**	**Intellectual property products**	
	N1171	Research and development (R&D)	
	N1172	Mineral exploration and evaluation	
	N1173	Computer software and databases	ICT assets
	N1174	Entertainment, artistic and literary originals	Non-ICT assets
	N1179	Other intellectual property products	

Source: OECD elaboration based on the 2008 System of National Accounts.

Key findings

- **The investment rate (investment over GDP) fell in most countries in 2020 as compared with 2019.** The largest declines were recorded in Chile, Colombia, Mexico, the Slovak Republic and South Africa, where the contraction of investment was much more pronounced than the contraction in GDP.
- **However, the investment rate bounced back in most countries in 2021, reflecting the recovery of economic activity. The investment rate reverted to or exceeded its pre-pandemic level in 2021 in more than half of the countries covered in this chapter.** The pace of recovery has been faster than in the aftermath of the financial crisis. Indeed, in many countries it took on average a decade for the investment rate to reach its pre-financial crisis level.
- Austria, Italy, Iceland and Slovenia saw the largest increases in the investment rate between 2020 and 2021. However, the investment rate continued to decline in 2021 in some countries, including the Czech Republic, Poland, Indonesia, and the Slovak Republic, where the rebound of investment was much more modest than the rebound in GDP.
- **Lower investment in Other machinery and equipment and weapons systems and Transport equipment accounted for most of the fall in the investment rate at the onset of the COVID-19 crisis**. The largest contractions of investment in these assets were observed in the Czech Republic, Mexico, the Slovak Republic and Switzerland. By contrast, investments in dwellings and Intellectual Property Products (IPPs) were more resilient, with only a marginal decline or even no

decline in 2020 and 2021 in most countries. For IPPs, this is a continuation of a trend already observed in the decade before the pandemic. Note that the increasing share of dwellings in overall investment partly reflects the rapid increase in the prices of new dwellings in most countries during the pandemic.

Indicators

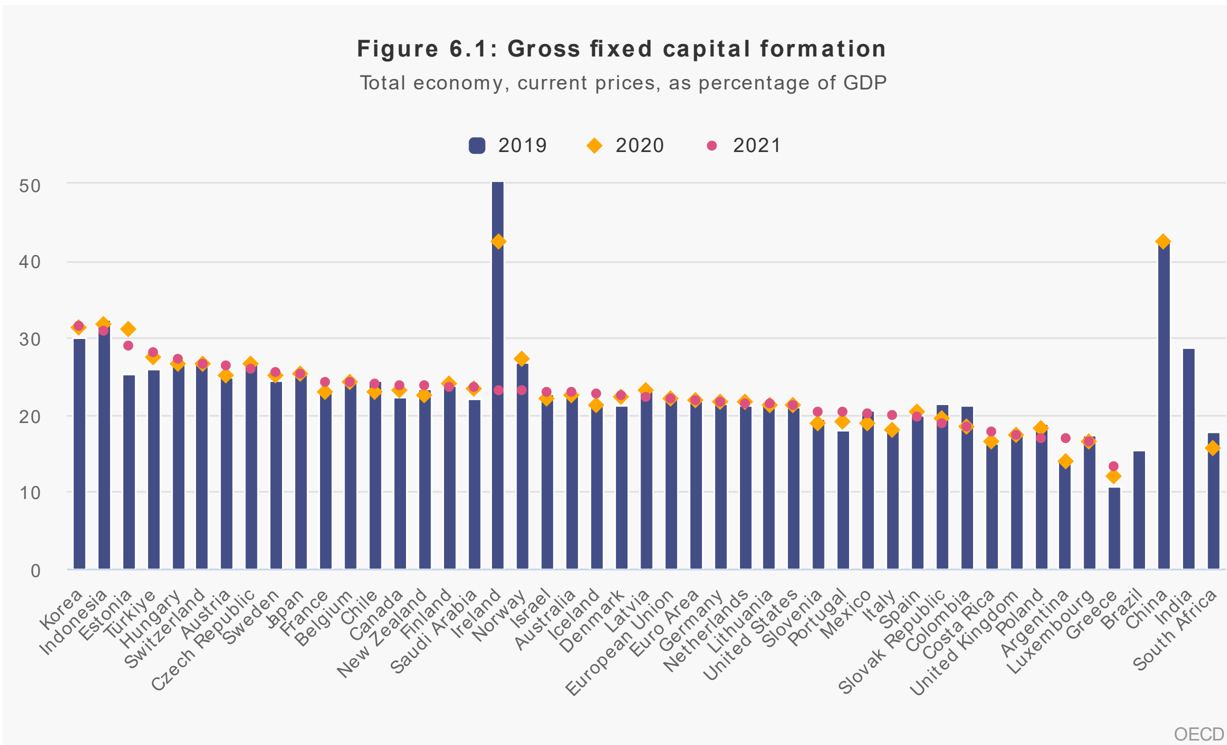

Figure 6.1: Gross fixed capital formation
Total economy, current prices, as percentage of GDP

Compare: https://www1.compareyourcountry.org/compendium-productivity-indicators-2023/en/2/5136/default/all/FRA+ITA/?embed=noHeaderNoNav

How to read the indicators

While ICT assets are internationally traded and should be subject to similar price changes across countries, statistical agencies tend to use (very) different price indices to deflate nominal investment in ICT assets. In addition, they also assume different depreciation rates and service lives for these assets. For these reasons, the OECD estimates productive capital stocks and capital services using a set of harmonised ICT investment deflators as well as common depreciation rates and average service lives for all assets and countries (Schreyer, 2002).

The asset breakdown presented in figure 6.1 differs from the one recommended by the 2008 SNA for a few countries. In Korea, ICT equipment is included in Other machinery equipment and weapons systems. In Australia, ownership transfer costs are included in total GFCF but are not allocated across assets. Consequently, the sum of GFCF for individual assets is lower than total GFCF for this country. In Norway, total GFCF excludes investment in weapons systems. In Indonesia, Other buildings and structures are included in Dwellings. In Argentina, China, Colombia, India, Saudi Arabia and Türkiye, the classification of GFCF by type of asset is not available. Therefore, only total GFCF is presented. In Canada and the United States, total GFCF excludes GFCF in Cultivated biological resources.

For further methodological information, consult the *OECD Productivity Statistics – Methodological notes* at https://www.oecd.org/sdd/productivity-stats/OECD-Productivity-Statistics-Methodological-note.pdf.

Data sources

OECD National Accounts Statistics (database), http://dx.doi.org/10.1787/na-data-en.

OECD Productivity Statistics (database), http://dx.doi.org/10.1787/pdtvy-data-en.

References and further reading

OECD (2009), Handbook on Deriving Capital Measures of Intellectual Property Products, http://dx.doi.org/10.1787/9789264079205-en.

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7 Labour income and productivity

Context

Labour income is the most direct mechanism through which the benefits of productivity gains, and thus economic growth, are transferred to workers. Indeed, employers' ability to raise wages and other forms of labour income depends on increases in labour productivity, highlighting the welfare implications of productivity growth and its role as the main driver of long-term living standards. However, the empirical evidence points to a **decoupling of labour productivity growth from real labour income growth in the majority (two thirds) of OECD countries since the mid-1990s**. The decline in the labour income share (i.e. the share of labour income in gross value added) observed in these countries precisely reflects the decoupling between real labour income and labour productivity growth.

Labour income shares and the decoupling between labour income and productivity

The decline in labour income shares observed since the mid-1990s in the majority of OECD countries can be reformulated as a decoupling between labour productivity and real labour income growth, when nominal labour income is adjusted for inflation using the same price index applied to deflate value added (and hence productivity).

The developments in the total economy labour income share may be partly driven by specific industries for which there are significant conceptual and measurement issues. For example, the value added of the real-estate sector includes all (actual and imputed) housing rents in an economy, whereas the corresponding labour income is only related to the people working in the real-estate sector. Therefore, the labour share in the real-estate sector is well below the labour share of the total economy and does not reflect the labour market mechanisms connecting labour income to productivity. Moreover, housing rent developments can induce large fluctuations in total-economy labour shares when the real-estate sector constitutes a large component of overall economic activity. Similarly, for countries with large primary (i.e. agricultural or mining) sectors, developments in total-economy labour shares may be largely driven by fluctuations in commodity prices. For example, when commodity prices increase, aggregate profits rise without commensurate increases in aggregate wages. Lastly, national accounting conventions in the non-market sector (e.g. education, health, and public administration) may bias labour share developments. Indeed, value added in the non-market sector is measured as the sum of labour compensation and capital consumption, which artificially limits variation in its labour share over time. For these reasons, it is useful to look at labour income share developments and at the decoupling between labour income and productivity after excluding primary, real estate, and non-market sectors (Schwellnus et al., 2017).

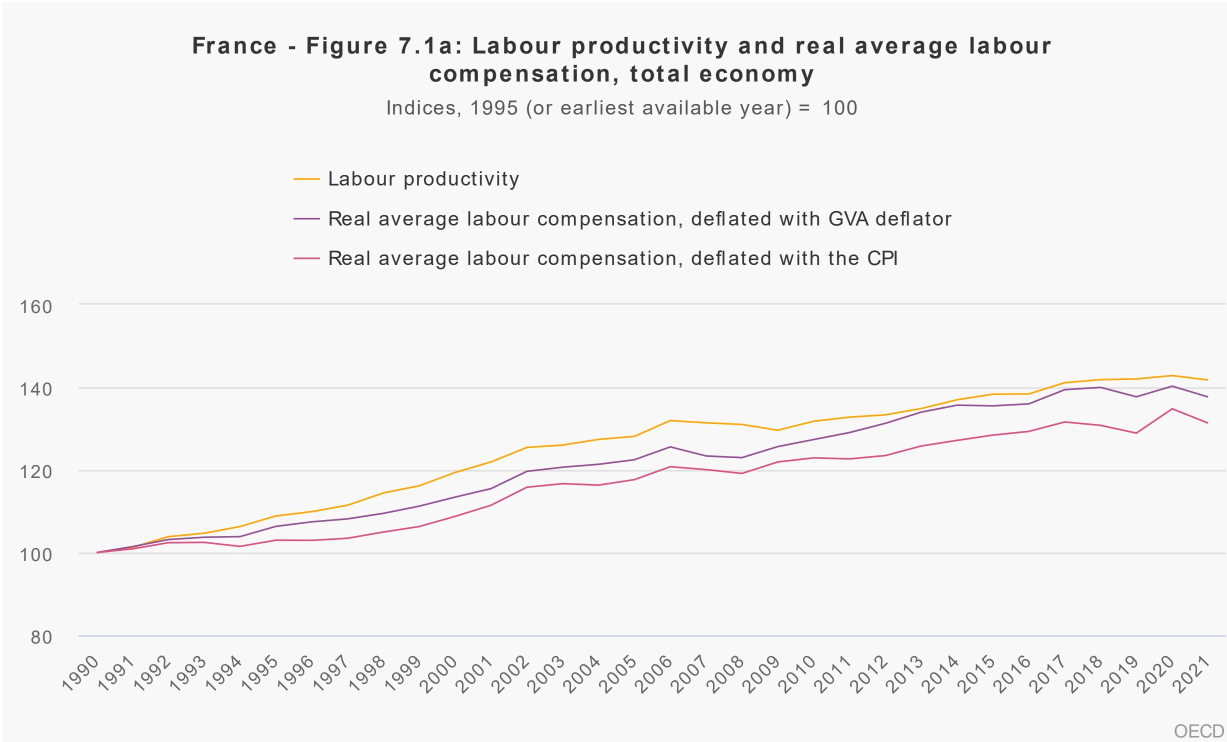
The impact on material well-being of the decoupling between labour income and productivity is further exacerbated by the widespread slowdown in productivity growth, and in some countries even more so when real labour income is adjusted for inflation using the consumer price index (CPI). This is because inflation based on value added or consumer prices can differ significantly, reflecting the effect of terms of trade. Indeed, the value-added deflator reflects movements in the prices of goods and services domestically produced, whereas the CPI captures movements in the prices of goods and services consumed within the economy, either imported or domestically produced.

Note that labour income shares and comparisons between average labour income and productivity developments in this chapter do not account for labour income inequalities across workers. The majority of OECD countries have experienced a further dissociating between median and average labour income since the mid-1990s, which is related to disproportionate labour income growth at the top of the income distribution (Bivens and Mishels, 2015; Schwellnus et al., 2017).

Key findings

- **Real average labour income has failed to keep up with labour productivity growth since the mid-1990s in around two thirds of OECD countries.** This has occurred in addition to the widespread slowdown in labour productivity growth observed over the past decades, which has further undermined the increase in real average labour income.
- The exclusion of the primary, real estate, and non-market sectors, where labour share developments are largely driven by commodity and asset price developments and national accounting conventions, reduces the decline in labour income shares on average across G7 and OECD countries since the mid-1990s. Looking at individual country results, this finding holds true for more than half of the countries for which data are available.
- In around half of the countries for which data are available, **the decoupling of real labour income growth from productivity growth is further exacerbated when real labour compensation is adjusted for inflation using the consumer price index** (CPI) – i.e. from a consumer/worker perspective.
- Large swings in output, hours worked and labour compensation in 2020 and 2021 reduced the decoupling between growth in real average labour income and labour productivity growth in some countries, including. Japan, Luxembourg, the Netherlands, Portugal and Spain, and intensified it in others, including Germany and the United States.

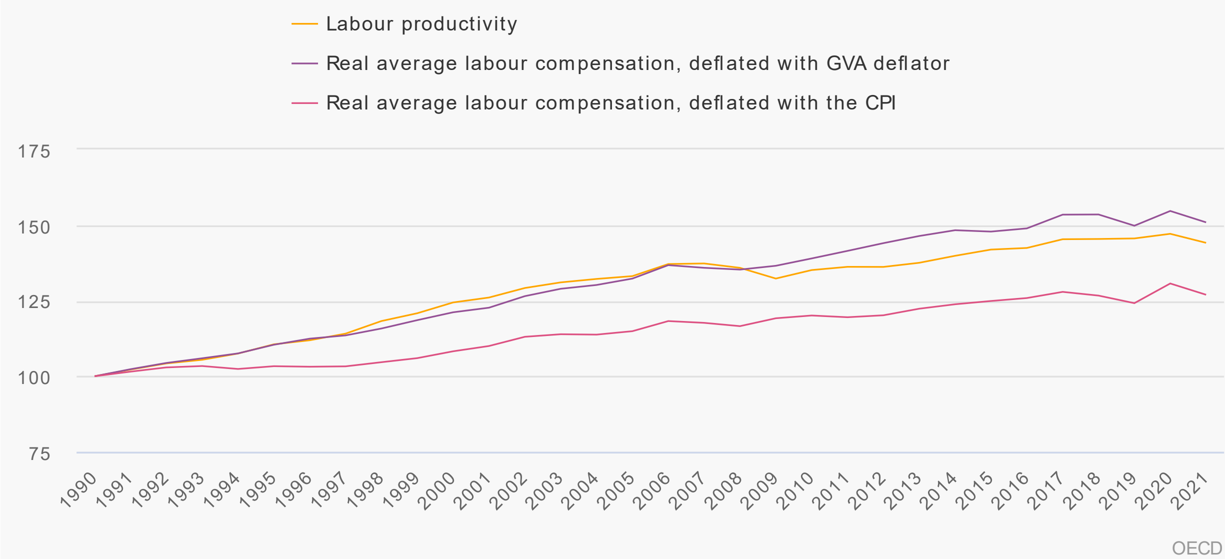
Indicators



Compare: https://www1.compareyourcountry.org/compendium-productivity-indicators-2023/en/2/5137/default/all/FRA+DEU?embed=noHeaderNoNav

France - Figure 7.1b: Labour productivity and real average labour compensation, total business economy excluding primary and real estate activities

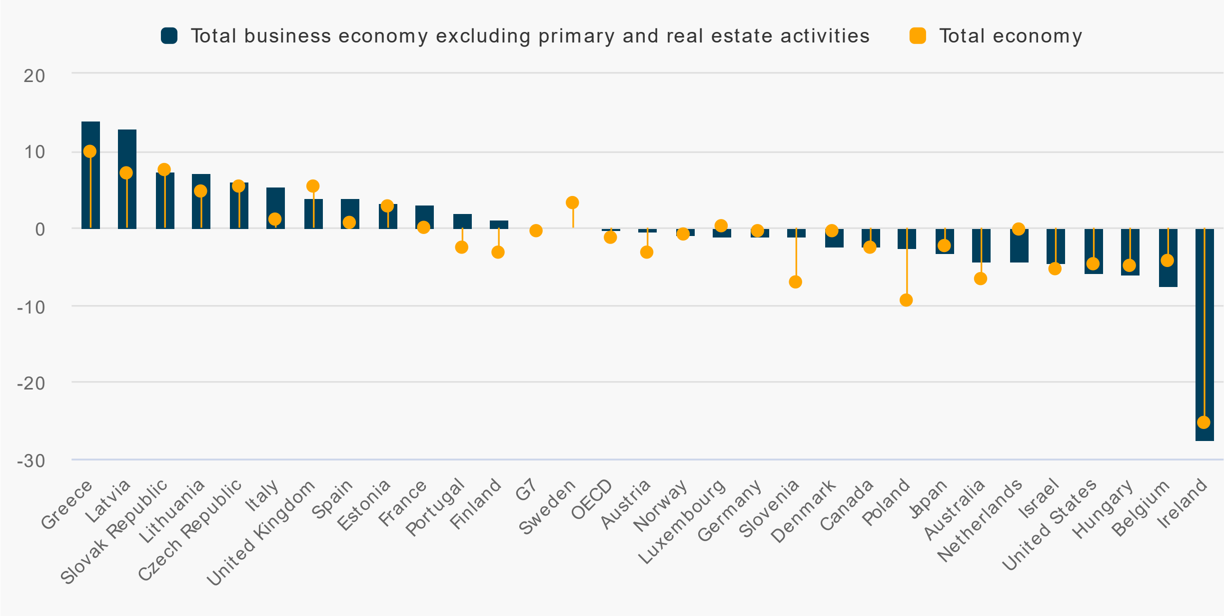
Indices, 1995 (or earliest available year) = 100



Compare: https://www1.compareyourcountry.org/compendium-productivity-indicators-2023/en/2/5138/default/all/FRA+DEU/?embed=noHeaderNoNav

Figure 7.2: Changes in labour income shares

Percentage points, 1995-2021 or latest available year



How to read the indicators

Labour productivity in this chapter is defined as the ratio of real value added *at factor cost* to total hours worked, while average labour income is defined as the ratio of total labour compensation to total hours worked. Total labour compensation is computed as the sum of the compensation of employees and self-employed workers. The labour compensation received by employees includes remunerations in cash and in kind and employees' and employers' social contributions. It is readily available in the national accounts. However, the labour income received by self-employed is recorded in national accounts as mixed income, which bundles both their labour and capital income. Therefore, the labour compensation received by self-employed needs to be imputed. From a theoretical point of view, the best procedure would be to make this imputation based on micro-level information on the socio-economic status of self-employed workers, but the corresponding data are not readily available for most countries. Therefore, following Schwellnus et al. (2017), it is assumed that the hourly compensation of self-employed workers is equal to the hourly compensation received by employees at the level of each individual industry. For a few countries, hourly compensation received by employees by industry is not available. In such cases, compensation per employee is used.

The total business economy excluding primary and real estate activities includes the ISIC Rev.4 industry codes C to N, excluding L, plus R and S. However, for Israel, Japan, Korea, New Zealand the data includes the ISIC Rev.4 industry codes B to N, excluding L, plus R to U. For Switzerland, in the absence of information by industry, total labour compensation is compiled using compensation of employees, and hours worked for the total economy.

Data sources

OECD National Accounts Statistics (database), http://dx.doi.org/10.1787/na-data-en.

OECD Productivity Statistics (database), http://dx.doi.org/10.1787/pdtvy-data-en.

OECD STAN Structural Analysis Statistics (database), https://doi.org/10.1787/data-00649-en.

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Bivens J. and L. Mishels (2015), “Understanding the Historic Divergence Between Productivity and a Typical Worker's Pay”, EPI Briefing Papers, No. 406, Economic Policy Institute, Washington.

Cho, T., S. Hwang and P. Schreyer (2017), "Has the Labour Share Declined? It Depends", OECD Statistics Working Papers, No. 2017/01, OECD Publishing, Paris, http://dx.doi.org/10.1787/2dcfc715-en.

Schwellnus, C., A. Kappeler and P. Pionnier (2017), "Decoupling of wages from productivity: Macro-level facts", OECD Economics Department Working Papers, No. 1373, OECD Publishing, Paris, http://dx.doi.org/10.1787/d4764493-en.

OECD Compendium of Productivity Indicators 2023

This report presents a comprehensive overview of productivity in OECD and, to the extent possible, G20 economies. The different chapters feature an analysis of labour productivity levels, labour and multifactor productivity growth, labour productivity by firm size, investment and labour income across countries. This edition also presents important insights on productivity measurement and evolution since the COVID-19 pandemic, including a shift-share analysis showing how within-industry developments and reallocations across industries have contributed to aggregate labour productivity developments in the recent period and in the longer term.

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