3 Productivity and regional income inequality

This chapter explores how regional productivity contributes to income inequality between regions. It is articulated in four sections. The first section describes the nexus between economic activity in tradeable sectors and productivity inequalities. The second highlights the importance of lifting productivity growth in all sectors, focusing on the role of technological change, business dynamism and innovation as drivers. The third shows how managing the potential gains and risks from trade contributes to regional development. The fourth section outlines the case for a transition towards both productive and green sectors.

In Brief

- There are large productivity differences within OECD countries. Throughout the 2010s, labour productivity in the most productive region was about twice as high as in the least productive region on average across OECD countries.
- Reducing productivity disparities is an important vehicle for reducing income inequality between regions. Between 2001 and 2019, productivity inequality declined in nearly all countries where gross domestic product (GDP) per capita inequality decreased. Productivity growth potential exists and can be exploited in all regions. Fully closing all productivity gaps across regions is, however, unrealistic as the growth potential of a region depends, among other aspects, on geographic conditions and agglomeration economies provided by (larger) cities, which are, if at all, very slow to change.
- Higher shares of economic activity in tradeable sectors go hand-in-hand with higher productivity. Between 2001 and 2019, an annual average increase of 0.1 percentage points in the share of regional employment in the tradeable goods (services) sector was associated with a nearly 0.2 (0.06) percentage point higher annual productivity growth rate for tradeable goods (services). Strengthening tradeable activities in low-productivity regions can therefore reduce productivity disparities within countries. In non-metropolitan regions, tradeable goods sectors in particular provide opportunities as the share of employment and the gross value added (GVA) they contribute to the regional economy is, on average, nearly 50% higher than in metropolitan regions. Tradeable sectors are, however, also more exposed to international competition and global shocks, which can stimulate innovation and investment to raise productivity but also make a region more vulnerable.
- Sectoral productivity gaps across regions point to untapped potential in lagging regions. Regional differences in total productivity partly reflect differences in sectoral compositions but also productivity differences within the same sectors. This implies scope to boost productivity growth through active innovation, innovation diffusion and scale-up policies and investments in infrastructure (e.g. digital technologies).
- Regional disparities in technological progress and innovation have contributed to widening productivity disparities. Technological progress, especially in tradeable services, raises productivity for all firms but more so for firms with workers with higher levels of education and skills. These workers tend to live and have jobs in larger cities or metropolitan regions that are already among the more productive regions within their country. Similarly, innovation that leads to patents is highly concentrated, with only 10% of regions accounting for more than 60% of international patents.
- The necessary transition toward climate-neutral economies may further exacerbate disparities across space. Industries that are among the most difficult to align with climate neutrality goals tend to be concentrated in specific regions that are often socio-economically weaker. The associated jobs are among the most productive and high-paying in those regions. Therefore, unless adequate policies support regions to weather these changes, the transition to climate neutrality is likely to drive up economic disparities within OECD countries.

Introduction

Productivity is widely recognised as a key driver of economic growth and higher levels of income. Higher levels of employment, in part driven by population growth, are also important drivers of higher levels of income. But with 14 OECD countries facing population decline by 2040 (see Chapter 2), including 40% of OECD regions (with many also ageing), the emphasis on productivity to address regional disparities in income cannot be overstated.

Unsurprisingly, given the strong relationship between productivity and income, differences in productivity between regions tend to translate into differences in income. These, in part, reflect spatial factors and in particular specialisation in activities that relate to the comparative advantage in regions, including for example access to natural assets, markets, infrastructure and increasingly skills and knowledge. However, productivity differences also relate to challenges associated with scale, and, in particular, economies of scale. These are increasingly important drivers of productivity growth, especially in knowledge-intensive service activities. Metropolitan regions have in this respect a distinct comparative advantage through agglomeration effects. Productivity is indeed between 2-5% higher for each doubling in size of a city (OECD, 2015[1]).

Given these, largely structural differences in regions, it is unrealistic to fully eradicate all inequality in productivity. But a better understanding of the drivers of inequality does provide scope to narrow the gaps, in particular in the context of rapid advancements made through digitalisation, the need to accelerate the green transition and shifting patterns of trade, including through the greater emphasis being placed on resilience, all of which are beginning to shift notions of regional comparative advantages, presenting challenges but also opportunities.

Non-metropolitan regions for example tend to be in a less favourable position as they often have worse access to infrastructure or the intensity of innovation and innovation uptake are lower than in other regions, both of which are important drivers of regional productivity, but there is significant scope to address this (OECD, 2022[2]). Inadequate transport connections, for example, can limit the productivity growth potential of non-metropolitan regions where natural resources are important assets (OECD, 2020[3]). Lower levels or quality of digital infrastructure can also reduce the productivity level that regions can attain. But again, these structural differences are not irresolvable and addressing them can also deliver gains beyond productivity growth alone (OECD, 2020[3]).

Productivity gains come through different channels, including deeper labour markets that allow for better matching of the skills of workers with jobs, greater specialisation by suppliers and greater ease of formal and informal knowledge exchange and learning. These channels are particularly important for high-value-added – tradeable – activities that require specific skills and constant learning and innovation. Bigger cities leverage these channels by bringing firms close to each other and close to a large pool of workers, suppliers, customers or clients. In short, they provide “agglomeration economies”. Smaller cities can achieve some of the benefits that agglomeration benefits provide by increasing the concentration of activities or by strengthening links across and within regions to create local critical mass (OECD, 2016[4]).

As resilience has gained importance in economic policy making, there is also a greater appreciation of the costs that may be associated with higher productivity, including economic as well as social costs. For example, the potential gains from agglomeration economies also elicit higher costs, including those that impact the bottom line of firms, such as higher rental costs, and those that impact society as a whole, such as greater congestion or higher levels of air pollution in bigger cities. The historical growth of cities itself can become a challenge as fragmented governance arrangements can be a drag on productivity in large cities. In the absence of effective multi-level governance mechanisms, such as metropolitan governance bodies, the more municipalities that are part of a metropolitan area, the lower its agglomeration benefits and the higher the productivity penalty of administrative fragmentation (Ahrend et al., 2017[5]).

Most non-metropolitan regions have greater specialisation in primary economic activities and, often, labour-intensive, manufacturing of tradeable goods, which have been exposed to high levels of international competition and the offshoring of activities to lower-income economies in recent decades. This trend has been slowing in recent years, though, and may even be beginning to reverse as firms increasingly look to reshore strategic activities.

The insights presented in this chapter complement and expand the analysis contained in the second edition of the *Regional Outlook* (OECD, 2016[4]). They reinforce the view that closing productivity gaps through growth in low-productivity regions can reduce income inequality and that tradeable sectors play an instrumental role in this effort (OECD, 2018[6]).[1]

The discussion is articulated along five main messages. First, albeit somewhat stating the obvious, productivity growth matters to close GDP per capita gaps between regions. Second, structural changes in specialisation, including those being driven by the green and digital transitions, especially towards higher productivity – tradeable – sectors, can help low-productivity regions catch up. Third, significant productivity gaps in the same activity across regions within the same country demonstrate the untapped potential to boost productivity in all sectors. Fourth, for trade to benefit regional development, it is essential to manage the risks posed by international competition and global shocks. Fifth, an excessive emphasis on high-productivity sectors should not come at the expense of investment in green sectors. The analysis presented in this chapter focuses on long-run trends in small (TL3) regions. It covers the period between 2001 and 2019 to exclude the economic disruptions that OECD economies have faced since 2020 due to the COVID-19 pandemic and Russia's war of aggression against Ukraine.

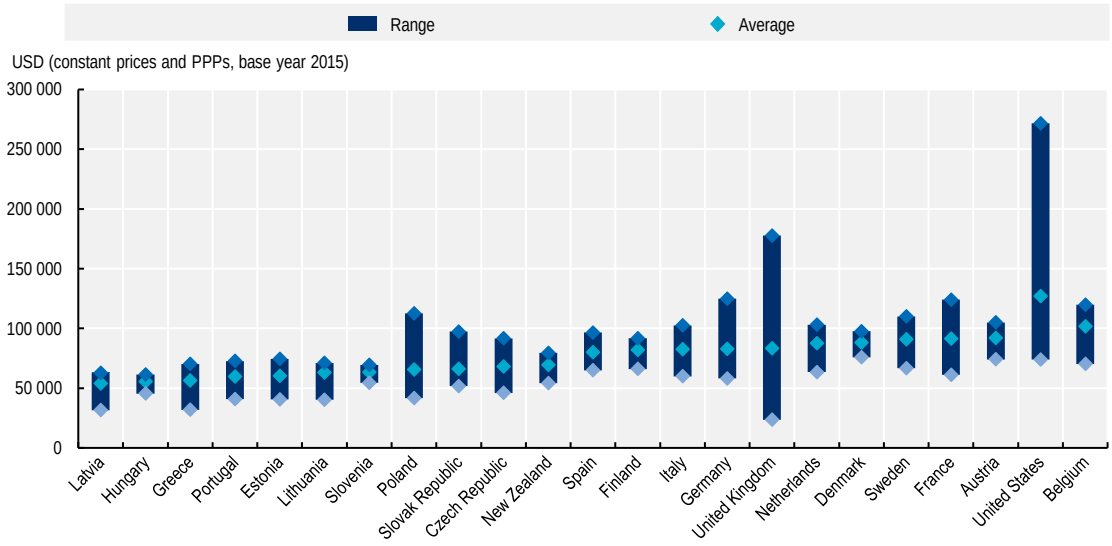
Disparities in labour productivity within countries are large

Disparities in labour productivity, the measure of productivity used in this chapter, within OECD countries are large.[2] The most productive small (TL3) regions in countries with, on average, low productivity are often as productive as the middle- or even high- productivity countries (Figure 3.1). Labour productivity in Poland's capital city Warsaw and its surrounding regions, for example, is around the same level as average productivity in Belgium, the second most productive among the 23 OECD countries included in the analysis in this chapter. Generally, labour productivity is highest in metropolitan regions. In 2019, labour productivity in metropolitan regions was, on average, about USD 115 000 compared to about USD 106 000 in non-metropolitan regions.[3]

Overall, labour productivity disparities declined across OECD regions between 2001 and 2019 (Figure 3.2). The trend was purely driven by relatively faster aggregate productivity growth in less productive countries, evident in a continuous decline in between-country inequality. In contrast, productivity gaps within countries rose and fell in the runup to and recovery from the global financial crisis (GFC), with regional productivity inequality remaining above the levels of the early 2000s ever since. In particular, non-metropolitan regions have struggled to close productivity gaps since then. Non-metropolitan regions close to metropolitan areas have grown slower than metropolitan regions before the GFC, during the crisis and since 2013, when most countries had weathered the shock of 2008. Non-metropolitan regions far from metropolitan areas went from catching up in the runup to the GFC to falling behind since 2013 as productivity growth slowed from 1.8% before the crisis to 0.7% between 2013 and 2019 (Figure 3.3).

Figure 3.1. Productivity disparities within countries are larger than between countries in 2019

Labour productivity (GVA per employee) in TL3 regions



Notes: Average labour productivity is the national average calculated by weighting regions according to employment.
Source: Based on data from OECD (2022[7]), *OECD Regional Statistics (database)*, https://www.oecd.org/regional/regional-statistics/.

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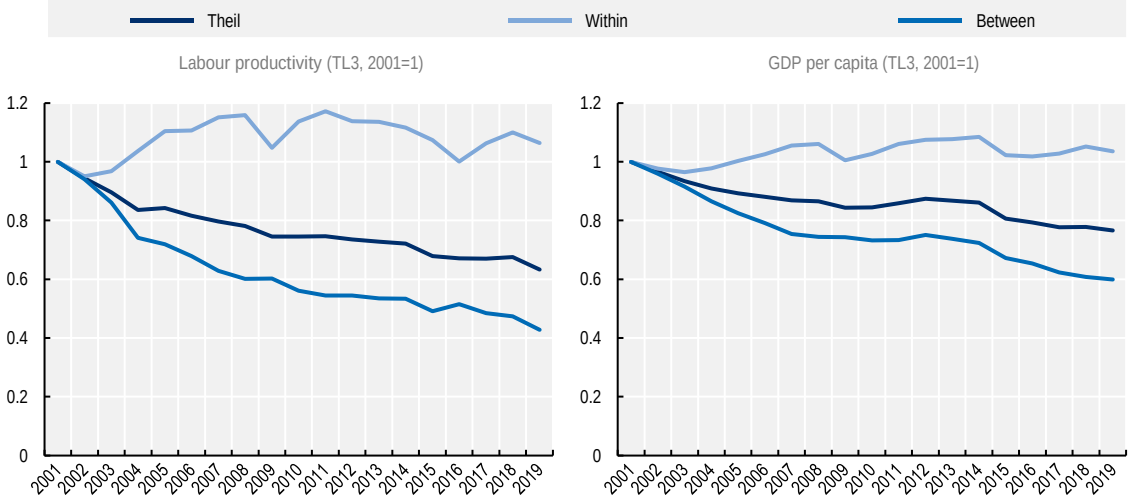
Figure 3.2. Regional inequality in labour productivity declined more than regional income inequality



Note: The Theil index measures the spread (variance) in labour productivity and GDP per capita levels across regions (see Chapter 2). Countries included are AUT, BEL, CZE, DEU, DNK, ESP, EST, FIN, FRA, GBR, GRC, HUN, ITA, LTU, LVA, NLD, NZL, POL, PRT, SVK, SVN, SWE and USA. Between inequality refers to variability across country means with respect to the overall (OECD) mean. Within inequality refers to variability in regional values with respect to the country mean.
Source: Based on data from OECD (2022[7]), *OECD Regional Statistics (database)*, https://www.oecd.org/regional/regional-statistics/.

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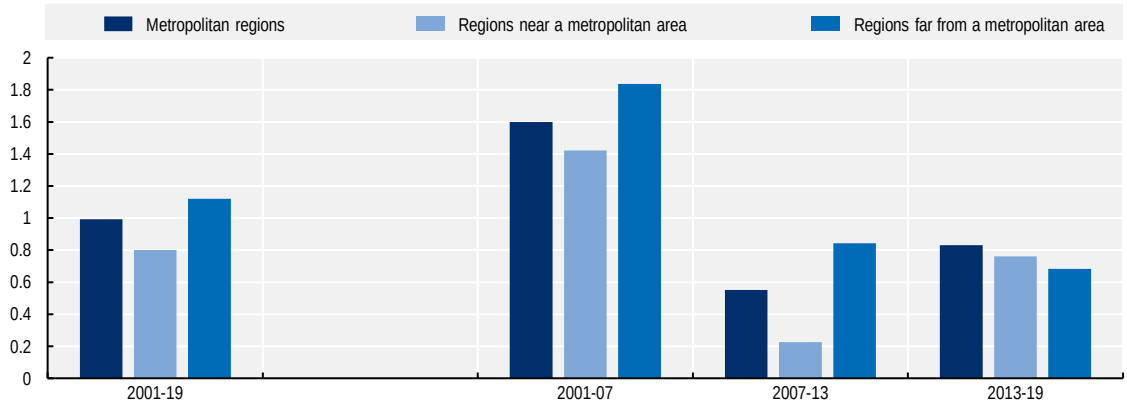
Figure 3.3. Catching up has stalled for remote regions after the global financial crisis

Annual average growth rate of labour productivity across types of TL3 regions, 2001-19 (%)



Note: Labour productivity is GVA per employee in USD at constant 2015 prices and purchasing power parity (PPP). Countries included are AUT, BEL, CZE, DEU, DNK, ESP, EST, FIN, FRA, GBR, GRC, HUN, ITA, LTU, LVA, NLD, NZL, POL, PRT, SVK, SVN, SWE and USA.
Source: Based on data from OECD (2022[7]), *OECD Regional Statistics (database)*, https://www.oecd.org/regional/regional-statistics/.

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Leveraging labour productivity to reduce GDP per capita inequality

Differences in productivity between regions are large. On average, within countries, labour productivity in the most productive region is nearly twice as high as the productivity of the least productive region. Labour productivity growth is equally unevenly distributed. More than half of OECD countries had at least one region where productivity declined over the past two decades despite generally positive average labour productivity growth at the national level (OECD, 2022[8]).[4] Such differences in productivity and its growth matter also for regional GDP per capita or income inequality. GDP per capita can be broken down into a demographic component (the share of the working-age population among the overall population), the employment rate, i.e. the share of workers in the working-age population, and (labour) productivity (see Box 3.1). It follows that, with demographic pressures mounting for many regions (see Chapter 2) and employment rates naturally limited, productivity will need to take a central role in curbing income inequality across regions.

Box 3.1. Making the link between GDP per capita and labour productivity

GDP per capita and labour productivity are tightly linked economic concepts. GDP per capita can be decomposed as follows:

$$\frac{GDP}{Population} = \frac{WorkingAgePopulation}{Population} \times \frac{Employment}{WorkingAgePopulation} \times \frac{GDP}{Employment}$$

The first term, the working-age population ratio, reacts primarily to shifts in the demographic structure of the population. The second term, the employment rate, depends in turn both on labour force participation and the unemployment rate. The third, i.e. the ratio between GDP and employment, is tightly linked to labour productivity, namely GVA divided by total employment (by place of work), where GVA adjusts GDP by the value of subsidies and taxes on products:

$$GVA = GDP + Subsidies - Taxes\ on\ products$$

GDP per capita inequality can increase because of diverging trends between regions in the working-age population ratio, in the employment rate or in labour productivity.

Figure 3.4 considers a hypothetical scenario in which productivity growth

$$\frac{\left(\frac{GVA_{r,2019}}{Employment_{r,2019}} - \frac{GVA_{r,2001}}{Employment_{r,2001}}\right)}{\frac{GVA_{r,2001}}{Employment_{r,2001}}}$$

is constant across regions and equal to productivity growth at the national level

$$\frac{\left(\frac{GVA_{2019}}{Employment_{2019}} - \frac{GVA_{2001}}{Employment_{2001}}\right)}{\frac{GVA_{2001}}{Employment_{2001}}}$$

In countries that featured regional productivity catching up during 2001-19, the hypothetical scenario of equal productivity growth – by construction – will lead to greater GDP per capita inequality. Comparing the actual change in income inequality with the hypothetical scenario shows how much the "catching up" of less productive regions contributed to reducing income inequality. Conversely, in countries that featured regional productivity divergence, the scenario will show a decline in GDP per capita inequality. The difference between the actual change in inequality and the level of inequality under the hypothetical scenario allows to quantify by how much income inequality would have improved if the productivity differences had remained stable.

Between 2001 and 2019, within-country productivity inequality increased in 10 of the 14 countries considered for this chapter that experienced a rise in GDP per capita inequality. In the remaining four countries, Estonia, Lithuania, Poland and Slovenia, demographic shifts, differences in labour force participation and unemployment rates drove the rise in GDP per capita inequality, more than offsetting the catching-up by low-productivity regions. The link between productivity and income inequality is even more evident in countries with falling GDP per capita inequality, with productivity inequality falling in eight out of nine countries (Table 3.1).[5]

The GFC was the starting point for rising productivity disparities in 4 out of 11 countries where disparities went up during 2001-19 (Denmark, France, Italy, Spain). For instance, in France, productivity disparities remained constant until the GFC but rose markedly thereafter. In Italy, productivity inequality had even been declining before a reversal in the trend in 2008. Conversely, the rise in productivity disparities appears to have been the result of longer-term drivers in 5 out of 11 countries (Belgium, Hungary, the Slovak Republic, the United Kingdom).

To what extent can productivity growth be leveraged to address income inequalities? A hypothetical scenario can help answer this question (see Box 3.1).[6] The scenario assumes that, between 2001 and 2019, productivity grew at the same – national average – rate across regions, thus holding productivity gaps between regions constant. This scenario highlights the benefit of the actual "catching up" of less productive regions that occurred in the 12 countries where labour productivity inequality decreased and the potential gains for the remaining 11 countries where inequality increased.

In the 12 countries where labour productivity inequality decreased, income inequality would have grown, on average, by 1.7 percentage points more if labour productivity growth had been the same across regions instead of the actual "catching up" that occurred (Figure 3.4). For the 11 countries where labour productivity inequality increased, the gains from the hypothetical scenario would have been sizeable, with 1 percentage point lower growth in income inequality. Given the actual annual average increase of income inequality by 1.4% in these countries, equal productivity growth across all regions would have reduced the actual change by more than two-thirds.[7]

Table 3.1. Closing productivity gaps is important to reduce income inequality

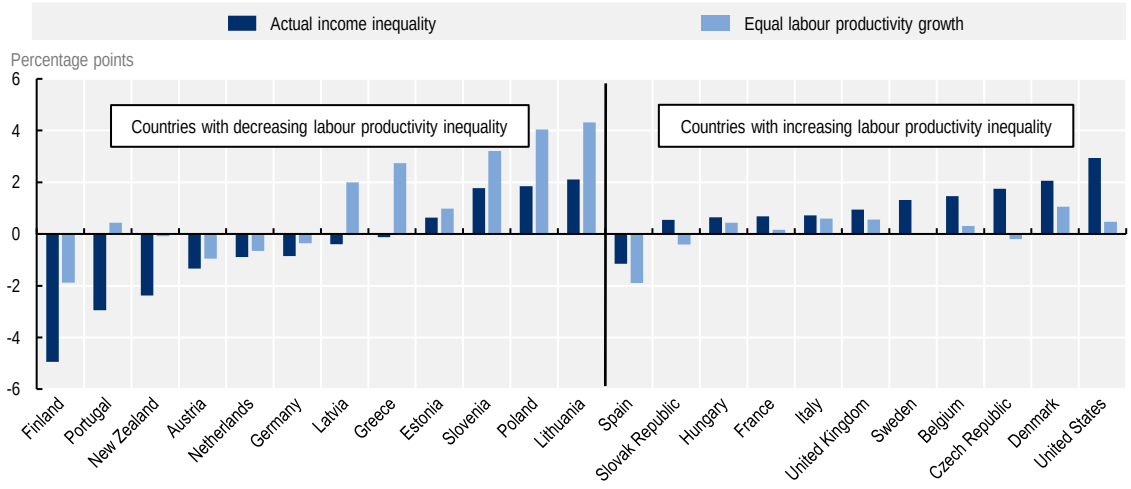
Changes in labour productivity and income (GDP per capita) within-country inequality, 2001-19

GDP per capita inequality decreasing		GDP per capita inequality increasing	
Labour productivity inequality decreasing	Labour productivity inequality increasing	Labour productivity inequality decreasing	Labour productivity inequality increasing
Austria	Spain	Estonia	Belgium
Finland		Lithuania	Czech Republic
Germany		Poland	Denmark
Greece		Slovenia	France
Latvia			Hungary
Netherlands			Italy
New Zealand			Slovak Republic
Portugal			Sweden
			United Kingdom
			United States

Note: Based on the growth rate of the average in the cross-TL3 regions Theil index in 2001/02 and 2018/19 for GDP per capita and labour productivity, where the latter is measured as GVA divided by employment. Japan, Korea, Norway and Türkiye are excluded from the analysis in this chapter. Türkiye regional data on labour productivity are missing and Japanese, Korean and Norwegian regional data on labour productivity start only in 2009 (Japan) and 2008 (Korea and Norway) respectively. Data for the United Kingdom start in 2004 (Northern Ireland missing due to boundary changes).
Source: Based on data from OECD (2022[7]), *OECD Regional Statistics (database)*, https://www.oecd.org/regional/regional-statistics/.

Figure 3.4. Reducing labour productivity inequality results in a sizeable reduction in regional income inequality

Annual average change in cross-TL3 income inequality between 2001 and 2019 (%) compared to a hypothetical "equal labour productivity growth" scenario



Note: According to the equal labour productivity growth scenario, regional labour productivity is assumed to grow at the same rate as the national one in each region between 2001 and 2019. Income inequality is measured by the Theil index of GVA per capita both for the actual change and under the hypothetical scenario. Inequality as measured by the Theil index in 2001 is obtained as the average of the values in 2001 and 2002; inequality in 2019 is obtained as the average of the values for 2018 and 2019. Data for the United Kingdom start in 2004 (Northern Ireland missing due to boundary changes). Countries are sorted in ascending order of their change in income inequality between 2001 and 2019. Labour productivity is calculated as gross value added/employment, where employment corresponds to employment by place of work.
Source: Based on data from OECD (2022[7]), *OECD Regional Statistics (database)*, https://www.oecd.org/regional/regional-statistics/.

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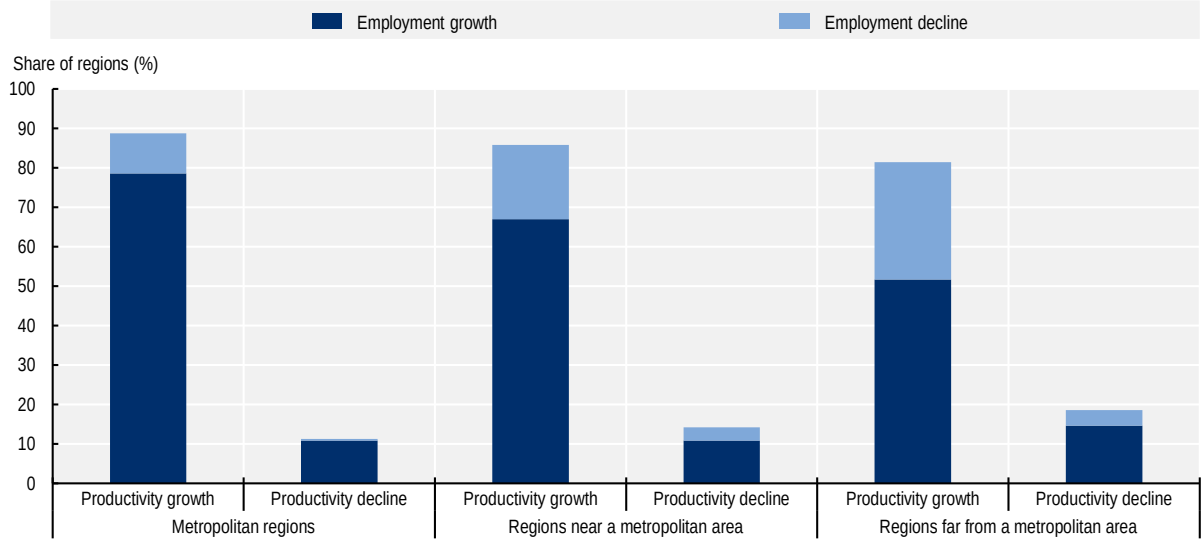
Raising productivity alone is insufficient to fully address all regional challenges. If productivity growth comes through, for example, capital investment, overall employment may decline as labour is substituted with capital, creating additional socio-economic challenges in regions. Similarly, productivity growth and higher productivity can also emerge as an outcome of less productive firms exiting the market at the cost of overall lower output, as well as less employment. Hence, some care is needed in ensuring that productivity growth is seen as a means to an end, with higher income and more jobs of better quality being the end.

That being said, employment grew in nearly 90% of metropolitan regions alongside growth in productivity between 2001 and 2019 (Figure 3.5). However, for regions near metropolitan areas, employment declined in more than 22% of regions with productivity growth, a share that increased to nearly 37% for regions located far from metropolitan areas. Productivity is also not the only metric of regions' success, as they increasingly need to support the transition towards climate neutrality and the development of green but not necessarily productive (yet) industries and firms.

Figure 3.5. Many non-metropolitan regions experience employment decline as productivity grows

Share of TL3 regions by growth or decline in labour productivity and employment, type, 2001-19



Note: Labour productivity is GVA per employee in USD at constant 2015 prices and PPP. Countries included are AUT, BEL, CZE, DEU, DNK, ESP, EST, FIN, FRA, GBR, GRC, HUN, ITA, LTU, LVA, NLD, NZL, POL, PRT, SVK, SVN, SWE and USA. Growth rates for GBR are for the 2004-19 period.
Source: Based on data from OECD (2022[7]), *OECD Regional Statistics (database)*, https://www.oecd.org/regional/regional-statistics/.

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Productivity growth through reallocation towards high-productivity sectors

Reallocating economic activity towards high-productivity – tradeable – sectors is a source of productivity growth (Baumol, 1967[9]). Trade integration and the greater degree of competition it entails favour technology upgrading and productivity, among all firms and not just those engaged in exporting. Consequently, tradeable sectors tend to feature higher productivity on average, at least in developed countries (Mano and Castillo, 2015[10]).[8]

This section discusses the nexus between labour productivity and the shift of employment towards tradeable sectors. It discusses cross-and within-country sectoral reallocation trends. Finally, it shows that the shift of employment towards the tradeable goods sector in non-metropolitan regions has reduced productivity inequality.

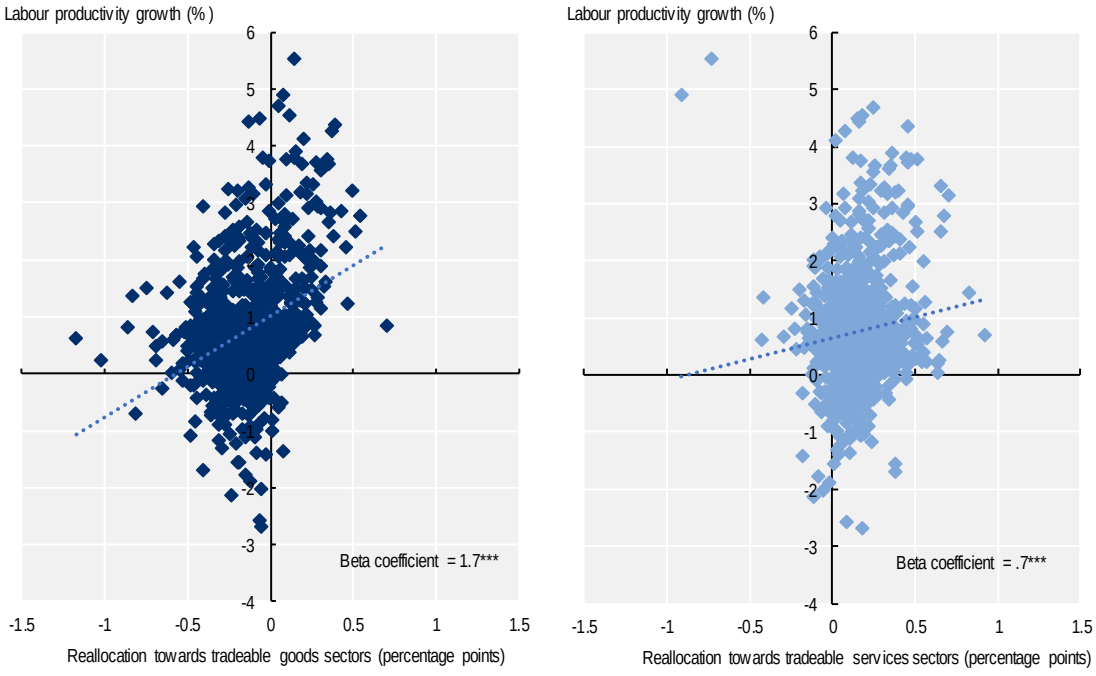
The shift towards tradeable sectors is boosting regional labour productivity growth

During 2001-19, labour productivity growth was higher in regions where employment grew in tradeable sectors. Reallocation towards (away from) tradeable sectors in a region is captured by an increase (decrease) in the share of regional employment in these sectors. Using information on 973 TL3 regions, an annual average increase of 0.1 percentage points in the employment share in the tradeable goods sector over the 2001-19 period is associated with 0.17 percentage points higher annual average productivity growth in the region. The correlation is weaker for the tradeable services sector but still positive and statistically significant, and equal to 0.07 (Figure 3.6).

The two macro sectors differ also in terms of average expansion or contraction of employment. The change in the share of regional employment was negative in 80% of regions for the tradeable goods sector (used interchangeably in this chapter for the industrial sector), while positive in nearly 90% of regions for tradeable services. Harnessing the productivity growth potential from these two sectors requires different approaches that can be mixed and tailored to the region with the aim of preventing employment in the industrial sector from further declining or favouring an expansion of employment in tradeable services.

Figure 3.6. Overall productivity growth is higher in regions reallocating jobs towards tradeable sectors

TL3-level yearly change in the employment share of tradeable sectors and overall productivity growth between 2001 and 2019



Note: The 2001 values are obtained as an average between 2001 and 2002; the 2019 values are obtained as an average between 2018 and 2019. The industrial sector includes NACE group B-E, while tradeable services include NACE groups J, K, L, M-N. For Austria, Germany, Poland, Spain and the United Kingdom, tradeable services include G-J, K, L, M-N. Data for the United Kingdom start in 2004 (Northern Ireland missing due to boundary changes). Data from the United States are not included in the analysis due to the low quality of employment data by sector/TL3 region.

Source: Based on data from OECD (2022[7]), *OECD Regional Statistics (database)*, https://www.oecd.org/regional/regional-statistics/.

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Employment in high-productivity sectors rose at different speeds

During 2001-19, employment in OECD countries shifted from the industrial (tradeable goods) sector towards tradeable services. As a result, the employment share of the industrial sector shrank from 14% to 12%.[9] The GFC was an important contributor to this shift, with nearly 5 million industrial jobs lost during 2008-10 (see Annex 3.B for the longer-lasting consequences of the GFC).[10] To compensate for the decline of the industrial sector, OECD countries have witnessed robust growth in tradeable services, with the employment share rising from 17% to 19% on average across countries and a total of 16 million jobs added in less than 20 years (from 54 million workers in 2001 up to 70 in 2019) (see Annex 3.A for country-specific figures).

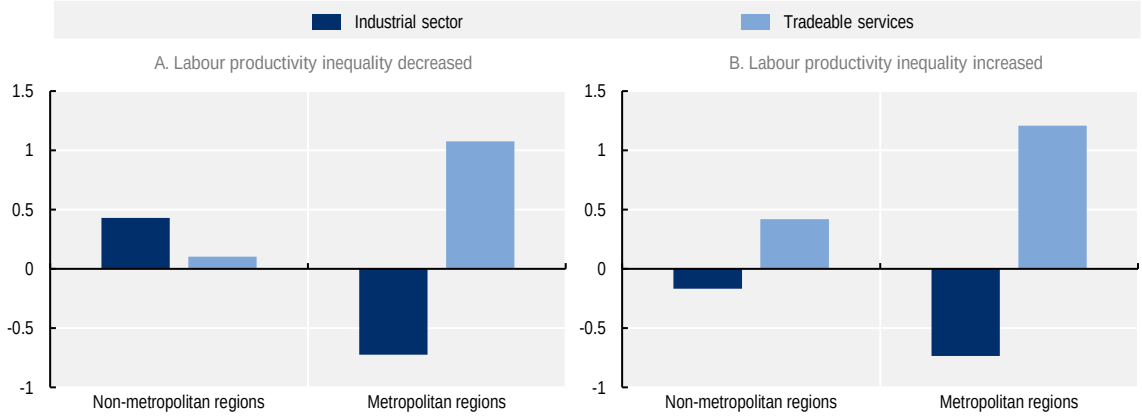
Between 2011 and 2019, the share of employment in tradeable sectors diverged across OECD regions. This trend is likely to have increased productivity inequality.[11] In Spain, for instance, the employment share in the industrial sector declined faster in regions where this share was already low (12% decline as opposed to 5% in other regions), resulting in an increase in productivity inequality between 2011 and 2019. Conversely, productivity inequality decreased in some countries that managed to close gaps in the employment share. In Poland, the employment share in tradeable services rose by 9% during 2011-19 in

regions with an initially lower share, while it stayed approximately constant in other regions and overall productivity inequality decreased.

The evolution of employment shares in the industrial sector in non-metropolitan regions has been a driver of convergence in OECD countries. Countries where the industrial sector in non-metropolitan regions performed better than in metropolitan ones, saw, on average, a decrease in productivity inequality (Figure 3.7).

Figure 3.7. Non-metropolitan regions added employment in the industrial sector in countries where labour productivity inequality decreased

TL3-level change in the employment share in high-productivity sectors between 2011 and 2019, averages by metropolitan/non-metropolitan status and country groups (percentage points)



Note: The 2011 values are obtained as an average between 2011 and 2012; the 2019 values are obtained as an average between 2018 and 2019. The industrial sector includes NACE group B-E, while tradeable services include NACE groups J, K, L, M-N. For Austria, Germany, Poland, Spain and the United Kingdom, tradeable services include G-J, K, L, M-N. Data for the United Kingdom start in 2004 (Northern Ireland missing due to boundary changes). Data for the agricultural sector missing for the United Kingdom. Countries where labour productivity inequality increased are Belgium, the Czech Republic, Denmark, France, Hungary, Italy, the Slovak Republic, Spain, Sweden and the United Kingdom; countries where it decreased are all the remaining others. Data from the United States are not included in the analysis due to the low quality of employment data by sector/TL3 region.
Source: Based on data from OECD (2022[7]), *OECD Regional Statistics (database)*, https://www.oecd.org/regional/regional-statistics/.

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Increasing productivity in all economic sectors and regions

There is significant potential for low-productivity regions to boost productivity growth in all economic sectors. In 2019, close to 25% of productivity differences between regions within OECD countries were due to differences in productivity within the same macro sectors (tradeable services, tradeable goods, non-tradeable services and primary). Empirical evidence based on firm-level data also highlights the importance of "within-sector" differences. About 75% of productivity differences between firms occur within the same industry (Criscuolo et al., 2021[11]). Indeed, productivity gaps within sectors are often growing. For example, in the metropolitan region of Paris, productivity in the tradeable services sector in 2001 was 9% higher than in the other French regions combined and the gap widened between 2001 and 2019 as productivity in Paris grew by 30%, while it declined on average by 1.6% across all other French regions. Similarly, the increase in wage inequality among United States' commuting zones between 1980 and 2015 can be attributed to differential growth in business services-related industries (Eckert, Ganapati and Walsh, 2022[12]).

In 2004, the average productivity difference in the tradeable services sector between the top- and bottom-50% of productive regions in Germany and the United Kingdom was quite similar and equal to, respectively, 31 and 39 percentage points. However, between 2004 and 2019, productivity in tradeable services grew by 11% in the bottom 50% of regions in Germany compared to 5% in the top 50% of regions. Conversely, productivity in tradeable services grew by 12% in the top 50% of United Kingdom (UK) regions, compared to 9% in the bottom 50% of regions. Over the same period, total productivity inequality declined in Germany, while it increased in the United Kingdom.[12]

This section considers a set of drivers of within-sector labour productivity growth, namely technological change, business dynamism and innovation and their connection with productivity inequality.

The impact of technological change is neither skill- nor place-neutral

Starting in the 1980s, technological change in areas such as information and communication technology (ICT), artificial intelligence and robotics has neither been skill- nor place-neutral. There is evidence that automation, which enables capital to replace labour, and computerisation, which replaces repetitive tasks has caused a shift in labour demand away from low- and middle-skill occupations to high-paying professional segments of the labour force (OECD, 2019[13]). The trend continues as the OECD estimates the share of jobs at risk of automation ranging from 4% to 40% across TL2 regions (OECD, 2020[14]). At the same time, technological change has contributed to the creation of new types of jobs and created an increase in demand for others – often those requiring high levels of skill. The "skill-biased" increase in employment has mitigated the negative impact of technological progress on aggregate employment but at the cost of increased interpersonal inequality (OECD, 2020[14]; 2019[13]).[13]

Technological change has also contributed to worsening productivity inequality (Moretti, 2012[15]; Eckert, Ganapati and Walsh, 2022[12]). Using data on US regions, Giannone (2021[16]) estimates that 50% of the decline in regional catching-up observed in the United States since the 1980s can be attributed to skill-biased technological change. Using data on French local labour markets, Davis et al. (2022[17]) highlight that the disappearance of middle-skilled jobs has triggered the creation of low-skilled jobs in smaller cities and high-skilled jobs in larger ones. Agglomeration forces disproportionately benefitting high-skilled individuals are likely to reinforce their choice to find jobs in already highly productive "skill-rich" regions, thus widening productivity inequality (Moretti, 2012[15]).

The rise of remote work can become an opportunity for low-productivity regions

The COVID-19 pandemic has provided an unprecedented stimulus towards the digitalisation of the economy and society. Regional differences in terms of access to digital infrastructure have been narrowing since the pandemic under the impulse of increased demand by firms and households. However, gaps remain large in certain countries. For example, the gap in the share of households with access to broadband Internet between better-off and worse-off regions was around 10 percentage points in 2021 across OECD countries. However, it reached as much as 20 percentage points in countries such as Chile, Israel, Japan and Mexico (OECD, 2022[8]).

The stimulus induced by the pandemic has both reinforced the ongoing labour market structural transformation and introduced some new powerful diversification drivers, such as the rise in remote work, primarily among service sector jobs. During the first wave of the pandemic, the share of workers teleworking at least once per week went up from 31% to 58% across OECD countries. In surveys, managers and workers tend to provide a positive assessment of remote work in terms of both productivity and well-being. Furthermore, two years after the COVID-19 outbreak, the share of remote workers has not gone back to pre-pandemic levels. This trend seems to suggest that, overall, remote work is likely to become a permanent feature of the labour market (Luca, Özgüzel and Wei, forthcoming[18]).

The implications of the rise in remote work for the spatial organisation of economic activity are profound. The uptake of remote work and the ensuing decline in commuting translated into a shift in residential preferences. The subsequent move of housing demand away from core cities towards suburban regions (Ramani and Bloom, 2021[19]; Ahrend et al., 2022[20]) has also helped to reduce regional differences in the cost of living. On a more macrogeographical scale, remote work can also benefit regions located further away from core cities. However, the scale needed for this phenomenon to have a measurable positive impact on productivity and economic development restricts the set of regions in a position to benefit from it (Baldwin and Dingel, 2021[21]). An example of regions that can benefit are those with intermediate cities known as "university towns" that featured a concentration of ICT activities already before the pandemic (Florida, Storper and Rodríguez-Pose, 2021[22]).

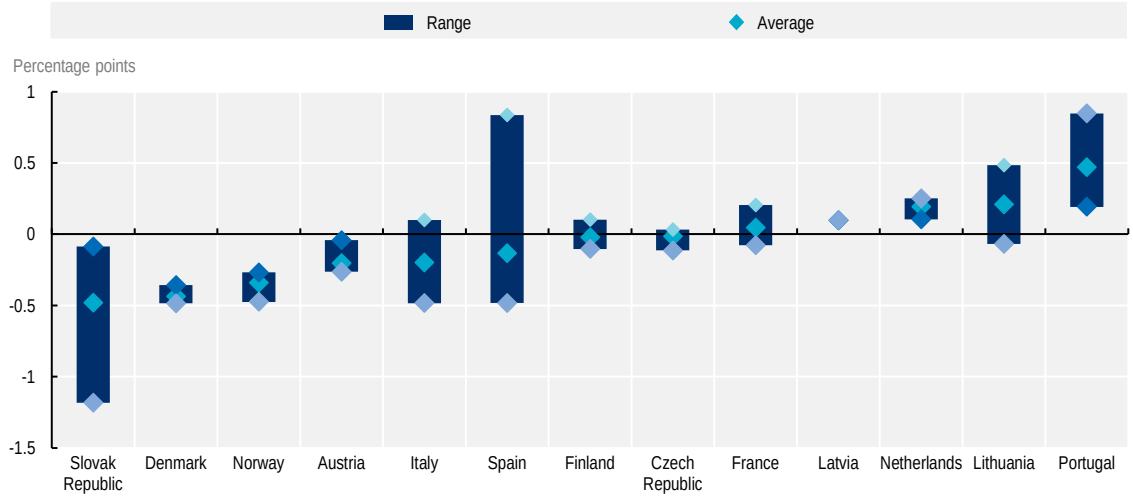
Uneven business dynamism is linked to productivity disparities

Business dynamism, and in particular the firm creation rate, has been weak across several OECD countries, affecting both productivity and employment growth, as younger firms are more likely to grow both in productivity and employment terms (OECD, 2021[23]), and lower levels of entry weaken competition and induce greater concentration (Autor et al., 2020[24]). Finally, it reduces the scope for workers in low-paying and low-productivity firms to change jobs and thereby improve both their productivity and pay (Criscuolo et al., 2021[11]). Recent OECD work analysing the impact of the GFC has shown that declines in entry rates have persistent negative effects on employment. A 20% drop in the number of entrants in a single year induced a loss of about 0.7% of aggregate employment 3 years after the GFC and 0.5% 14 years later (OECD, 2020[25]).

Regional disparities in the evolution of business dynamism might amplify differences in productivity growth between regions. Data at the TL2 level from the OECD Regional Business Demography database available for a subset of 13 OECD countries indicate that the firm creation rate declined during 2012-18 for the median region (Figure 3.8). Variation within countries has been significant. For instance, in the autonomous community of the Basque Country, Spain, the firm creation rate has declined on average by 0.5 percentage points on an annual basis during 2012-18, dropping from 10 new firms every 100 firms to 7.5 in 2018, while it increased in the Canary Islands. Similarly, the firm creation rate declined everywhere in Italy (from 9.7% firm creation rate at the start of the period down to 8.8%in 2018) except for the Autonomous Province of Bozen-Bolzano. Population ageing (Karahan et al., 2021[26]), negative net inflow rates of young people and weak ICT adoption are likely to expose less populated and remote regions to more severe declines in business dynamism. For example, in the United States, smaller cities experienced the largest declines in firm entry rates during 1982-2018 (Rubinton, 2020[27]).

Figure 3.8. Firm creation has gone down in many countries

Within-country variation at the TL2 level in 2012-18 firm creation rate changes



Note: The 2012-18 firm creation rate difference is defined as the ratio between the annualised difference between the number of new firms in 2018 and the number of new firms in the first available year (at the numerator) and the average number of existing firms between 2018 and the first available year (at the denominator). Only countries with at least four observations per region during 2012-18 are considered.
Source: Based on data from OECD (2022[7]), *OECD Regional Statistics (database)*, https://www.oecd.org/regional/regional-statistics/.

Sluggish innovation may hinder growth in regions

Innovation is a fundamental driver of productivity growth and its role is likely to be strengthened as production becomes increasingly digitalised (Brynjolfsson and McAfee, 2011[28]).[14] Innovation tends to be highly spatially concentrated. The high degree of spatial concentration is the result of the strong agglomeration externalities involved in the production of ideas and knowledge. Based on data from the European Patent Office during 1995-2014 for 30 OECD countries, 10% of cities accounted for 64% of patent applications (Paunov et al., 2019[29]). The advent of digitalisation and ICT have reinforced the incentives for innovative activity to concentrate spatially. For instance, in the United States, the share of patent applications accounted for by the top 10% of cities rose by 10 percentage points between 1995 and 2014 (Paunov et al., 2019[29]).

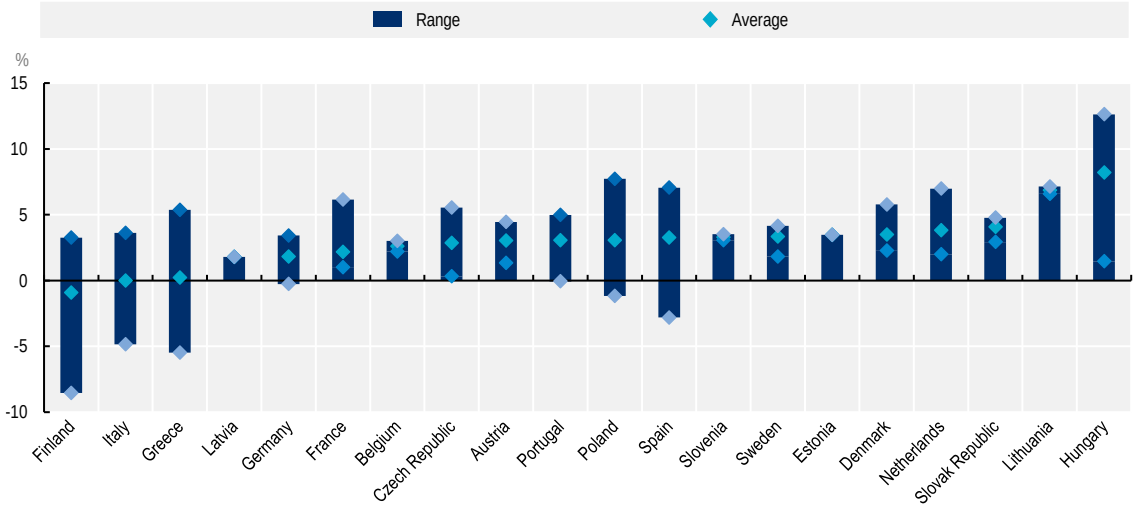
Incremental innovation or technology adoption complements frontier innovation by favouring its diffusion to other parts of the economy (OECD, 2020[30]). Firms do not in fact just develop knowledge; they also use the knowledge and technology developed by others, such as by adopting a customer relationship management software or building upon it to introduce further innovations. Regional differences are large when it comes to the diffusion of innovation. In 2021, nearly all businesses in Finland adopted cloud computing as opposed to an OECD average of approximately 70%. Large within-country differences exist also with respect to the competencies necessary to adopt new technologies. In countries such as Belgium or Hungary, the share of vacancies requiring digital skills in 2019 was 5% for the average region but as high as 15% in capital regions (OECD, forthcoming[31]).

Access to finance is a critical enabler of innovation. Barriers to access to finance are stronger for small and medium-sized enterprises (SMEs) and younger firms. SMEs usually have fewer assets to pledge as collateral. Furthermore, they tend to be less well-known by banks and investors, thus ending up suffering more heavily from negative informational asymmetries (OECD, 2022[32]). Differences in the level of capital stock between regions do not thus just translate into different levels of productive capacity. They are also reflected in different levels of assets that can be pledged as collateral to finance innovative activity,

potentially exacerbating gaps in innovation potential between regions. The sluggishness of investment recovery in the aftermath of the GFC may have exacerbated these differences. During 2012-19, gross fixed capital formation declined in 13% of large European TL2 regions.[15] Within-countries disparities are particularly high in East and Southern European countries. For instance, in the Italian region of Calabria, investment growth during 2012-19 has been -4.8%, while it has been positive and equal to 3.6% for the Autonomous Province of Bozen-Bolzano. Similarly, in the Hungarian region of Western Transdanubia, it has been 1.5%, compared to nearly 13% in the capital city TL2 region of Budapest (Figure 3.9).

Figure 3.9. Regional disparities in investment growth are particularly large in East and Southern European countries

Within-country differences at the TL2 level in investment growth during 2012-19



Note: Investment is measured by gross fixed capital formation. The cumulative growth rate in investment is calculated between 2012 and 2019, and next annualised.
Source: Knowledge Centre for Territorial Policies (2022[33]), *ARDECO Database*, https://knowledge4policy.ec.europa.eu/territorial/ardeco-database_en.

Managing the gains and risks of trade integration

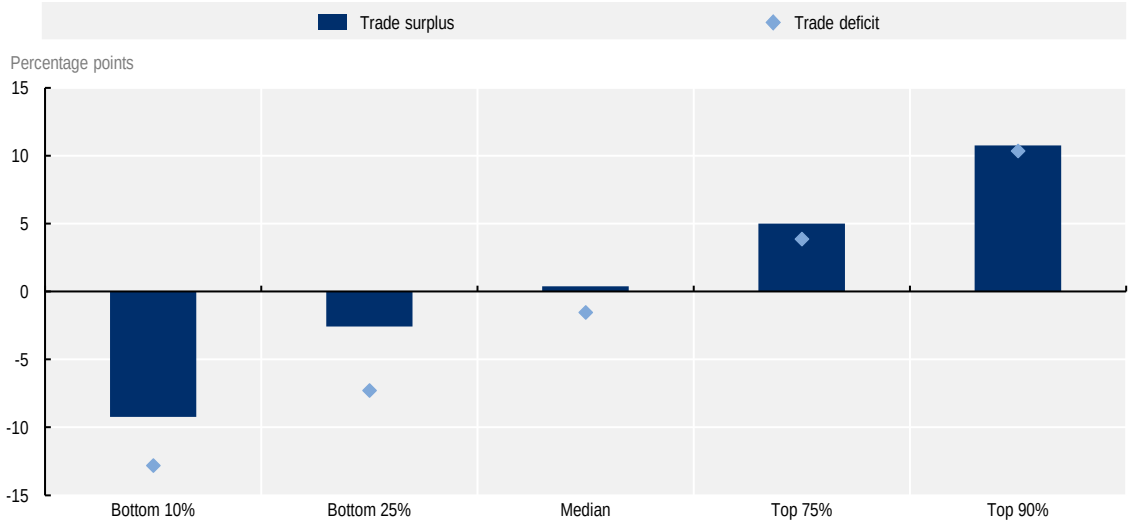
The specialisation of countries and regions prior to greater trade integration shapes the gains and losses associated with it. For example, there is some evidence that United States (US) and German regions specialised in industries exposed to import competition lost jobs during the process of trade integration with the People's Republic of China and East European countries. Production of apparel and leather goods in the United States, for example, was less than one-sixth in volume terms in 2022 than it was in 2000.[16] In contrast, regions specialised in export-exposed industries, such as car manufacturing or chemical production in Germany for example, on average, gained jobs and grew in productivity (Dauth, Findeisen and Suedekum, 2014[34]; Autor, Dorn and Hanson, 2013[35]).[17]

Customs data on goods trade collected by the OECD at the TL2 level available for a subset of 15 OECD countries allow measuring the level of regional trade openness and whether regions feature a trade deficit, i.e. the value of regional imports exceeds the value of regional exports, or vice versa a trade surplus.[18] About 52% of included regions feature a trade deficit, with the highest incidence in Latvia and Lithuania (100%), followed by the United States (73%) and the United Kingdom (67%). According to these data, export orientation is especially important among regions growing more slowly. During 2001-19, GDP per

capita grew on average 13 percentage points in the bottom 10% growing regions with a trade deficit, less than the country average. However, the GDP per capita growth gap with the national average was only 9 percentage points in the bottom 10% growing regions featuring a trade surplus (Figure 3.10).

Figure 3.10. Regions that grew less than the national average had larger trade deficits

Percentiles of the difference between TL2 and country-level GDP per capita growth during 2001-19 by regional trade surplus/deficit status



Note: Export/import data on goods trade are averaged at the TL2 level during 2010-19. Regions with a trade surplus are those regions where average exports during 2010-19 exceed average imports during 2010-19; regions with a trade deficit are those regions where the opposite is true. A unique value for regional imports and exports was obtained by estimating a regression of region/year imports or exports on time dummies. Different percentiles of the distribution of the difference between TL2 and country-level growth in GDP per capita during 2001-19 by trade surplus or trade deficit status are reported on the vertical axis. Countries included: Austria, Belgium, Germany, Greece, Spain, France, Italy, Korea, Latvia, Lithuania, Portugal, Slovenia, Sweden, the United Kingdom and the United States.
Source: Based on data from OECD (2022[7]), *OECD Regional Statistics (database)*, https://www.oecd.org/regional/regional-statistics/ and OECD customs data.

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Excessive sectoral specialisation can exacerbate the impact of global shocks on trade-open countries and regions (Di Giovanni and Levchenko, 2009[36]). On the one hand, sectoral specialisation gives rise to localisation economies, i.e. productivity gains from bringing more firms in the same or similar sectors together, thus boosting a region's competitiveness in the global economy. On the other hand, it can increase regions' exposure to global shocks (Carvalho and Gabaix, 2013[37]).

Rural regions often struggle more than other regions to seize the gains from trade integration in more complex value chains. First, rural regions suffer from greater remoteness and are thus less well-positioned to integrate (Krawchenko, 2018[38]). Second, rural regions are more exposed to import competition as they feature on average a greater incidence of low-skilled jobs that tend to have a higher degree of substitutability with jobs in countries with lower labour costs.

The increasing fragmentation of production into global value chains (GVCs) has added new opportunities and challenges to trade integration. Lead countries in GVCs such as Germany and the United States concentrate knowledge activities in some of their large metropolitan regions next to legacy industries in their non-metropolitan regions (Kemeny and Storper, 2020[39]). Other countries with cost or location advantages integrated into GVCs, such as East European countries, rapidly expanded their manufacturing

base and eventually started their own transition towards knowledge activities (Navaretti and Markovic, 2021[40]). Data from before the COVID-19 pandemic show that regions characterised by faster growth in exports with higher domestic value-added content – a key metric of participation in GVCs – also managed to stay at the forefront of the productivity frontier or to reduce their gap with more productive regions (OECD, 2018[6]), whilst firms in regions that were neither resource- nor skill-rich in advanced economies were less able to capitalise on the benefits of GVC integration (Iammarino, Rodríguez-Pose and Storper, 2019[41]).

The challenges posed by sectoral specialisation and global shocks are amplified by the greater degree of specialisation induced by GVCs. The disruptions of GVCs experienced during the COVID-19 pandemic and the volatility triggered by the recent turmoil in global energy markets have led to increased calls for reshoring or nearshoring of value chains. However, the debate on the benefits and costs of trade integration of GVC participation requires a balanced approach: according to recent quantitative evidence based on OECD countries, at the national level, re- or nearshoring to reduce volatility can induce higher overall production costs and lower international competitiveness, outweighing the benefits from reduced volatility (OECD, 2021[42]).

Participation in global trade via foreign direct investment (FDI) must also find its balance. Regions typically gain from FDI (Lembcke and Wildnerova, 2020[43]). However, increasing economic integration and the rise in global financial flows have not always generated equal opportunities across regions, potentially exacerbating regional disparities. Regions equipped with more favourable “locational factors”, such as the availability of suitable infrastructure, the proximity to a local university ecosystem (OECD, 2021[44]) or the presence of institutional bridges favouring the formation of supplier links with local firms (Crescenzi, Harman and Arnold, 2018[45]) manage to attract larger volumes (and better quality) of FDI than others. Furthermore, the receipt of FDI entails risks related to reversals of investors’ intentions and sudden stops. For instance, cross-country evidence shows that an increase in climate-related risks can lead to a reduction in FDI inflows (Gu and Hale, 2022[46]). The same conclusion might hold with respect to regions, given that they are not identically exposed to climate-related risks (OECD, 2022[8]).

Towards productive and green regions

Climate change has the potential to widen income inequality through different channels. More frequent extreme events will have a stronger impact on some regions and their economies than others. Furthermore, policy action encouraging fossil fuels phasing out and the transition to green technologies can result in job losses concentrated in a few, especially vulnerable, regions.

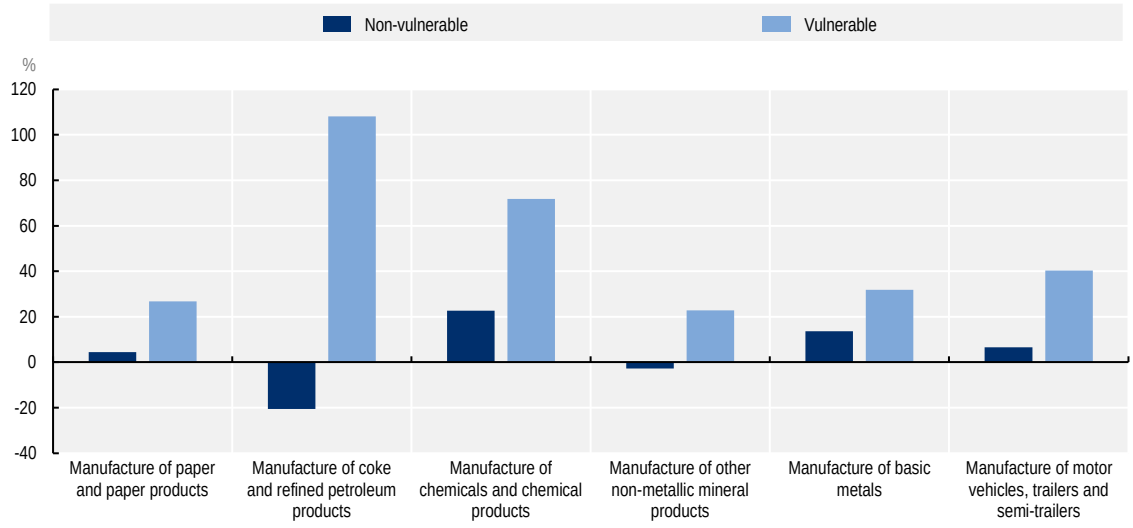
Extreme weather events do not affect all regions in the same way. For instance, in Australia, the number of additional days of strong heat stress in 2017-21 compared to 1981-2010 ranges from 0 to over 60 days in the Northern Territory TL2 region. Similarly, the share of the population exposed to river floods is 60% in the Mexican region of Tabasco, against less than 30% for the rest of the country (OECD, 2022[8]). The damage due to coastal flooding is estimated to be vastly heterogeneous, with coastal areas, particularly in Southeast Asia, experiencing losses as high as 10% of real GDP by 2200 (Desmet et al., 2021[47]). Rural regions face larger potential losses compared to urban ones, due to the higher incidence of the agricultural sector and its greater vulnerability to extreme weather events.

Rural regions play an important role in the transition towards climate neutrality. Per capita greenhouse gas (GHG) emissions declined more slowly during 1990-2018 in rural compared to urban regions, especially in those located far away from metropolitan regions or specialised in natural resource extraction (OECD, 2020[48]; 2021[49]). Rural regions also tend to be more dependent on cars. However, they also feature greener electricity production. In 2019, more than 50% of electricity generation in non-metropolitan remote regions came from renewables, compared to less than 20% in large metropolitan regions (OECD, 2022[8]).

Climate mitigation policy can contribute to the widening of income inequality if not accompanied by policies effectively supporting vulnerable regions (OECD, 2023[50]).[19] Regions featuring high per capita emissions combined with a high employment share in highly polluting manufacturing sectors are more vulnerable to the risks posed by climate mitigation policies. While being concentrated in Central Europe, most European countries feature one or more vulnerable regions. Climate-induced vulnerability often overlaps with other types of socio-economic weaknesses, such as a lower-than-average GDP per capita or tertiary education share. Climate mitigation policies threaten some of the best available jobs in these regions, where highly polluting manufacturing industries on average provide for better-productive and better-paid jobs compared to other sectors (Figure 3.11).

Figure 3.11. Highly polluting manufacturing sectors pay higher wages compared to the regional average in vulnerable regions

Wage difference in selected sectors compared to the regional average by vulnerability status of regions, 2018



Note: Data refer to NUTS 2 regions. Vulnerable regions are defined using employment shares and per capita emissions in each of the corresponding key polluting manufacturing sectors. See OECD (2023[50]) for a more detailed explanation of how vulnerable regions are defined.
Source: Eurostat Structural Earnings Survey.

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Adapting to climate mitigation regulations will have asymmetric impacts on firms too. Firms with a more solid financial situation are better able to cope with the introduction of economic and regulatory costs seeking to correct the negative externalities associated with polluting technologies. Smaller firms with fewer resources to make the investments necessary to "green" their production face a higher risk of losing competitiveness. These firms tend to be concentrated in vulnerable regions (OECD, 2023[50]). Productivity growth in green technologies can help as it makes technologies more effective and reduces the cost of entry for firms.

Finally, place-based climate mitigation policy must consider that jobs at risk of disappearing or expected to see a substantial revision of their task content in favour of green tasks are not evenly distributed across regions. Whilst, policies undertaken to mitigate the negative impact of climate change will induce job reallocation in the order of magnitude of 1.5% of aggregate employment (OECD, 2017[51]), this figure understates the real impact on labour markets as it does not account for those jobs that will also need at least some retraining and reskilling efforts. Metropolitan regions seem to be further ahead in the green transition as they already feature a high and increasing share of green jobs and a low share of polluting jobs (at risk of disappearing) (OECD, 2023[52]).

Annex 3.A. Supplementary figures and tables

Annex Table 3.A.1. Country-level employment in different sectors, millions

	Agriculture		Industry		Tradeable services		Non-tradeable services	
	2001	2019	2001	2019	2001	2019	2001	2019
Austria	0.23	0.15	0.70	0.72	0.59	0.87	2.26	2.77
Belgium	0.08	0.06	0.69	0.56	0.83	1.25	2.57	2.99
Czech Republic	0.21	0.16	1.48	1.57	0.60	0.83	2.58	2.86
Denmark	0.09	0.07	0.42	0.32	0.43	0.56	1.84	2.03
Estonia	0.04	0.02	0.15	0.14	0.06	0.11	0.34	0.39
Finland	0.13	0.09	0.47	0.38	0.34	0.53	1.41	1.65
France	0.91	0.75	3.72	2.92	5.17	6.51	16.23	18.14
Germany	0.72	0.60	8.38	8.34	6.82	9.16	23.84	26.96
Greece	0.64	0.50	0.54	0.43	0.45	0.61	2.75	3.13
Hungary	0.27	0.19	1.13	0.98	0.44	0.84	2.28	2.68
Italy	1.06	0.93	4.88	4.28	3.58	4.63	14.17	15.60
Latvia	0.14	0.07	0.18	0.14	0.10	0.15	0.53	0.54
Lithuania	0.24	0.09	0.27	0.25	0.09	0.18	0.77	0.86
Netherlands	0.24	0.20	1.00	0.86	2.18	2.67	4.98	5.77
New Zealand	0.13	0.16	0.48	0.29	0.26	0.51	0.99	1.66
Poland	2.69	1.53	3.23	3.96	1.17	2.07	6.88	8.84
Portugal	0.64	0.40	1.07	0.84	0.55	0.81	2.88	2.88
Slovak Republic	0.11	0.07	0.57	0.59	0.23	0.40	1.12	1.37
Slovenia	0.10	0.07	0.27	0.24	0.13	0.19	0.43	0.53
Spain	0.98	0.79	3.03	2.26	2.23	3.63	11.22	13.41
Sweden	0.11	0.10	0.79	0.64	0.74	1.04	2.75	3.33
United Kingdom	0.36	0.40	3.90	3.04	6.40	8.74	18.32	21.57
United States	1.38	1.42	8.81	10.57	20.05	23.46	90.72	107.27

Source: OECD (2022[7]), *OECD Regional Statistics (database)*, https://www.oecd.org/regional/regional-statistics/.

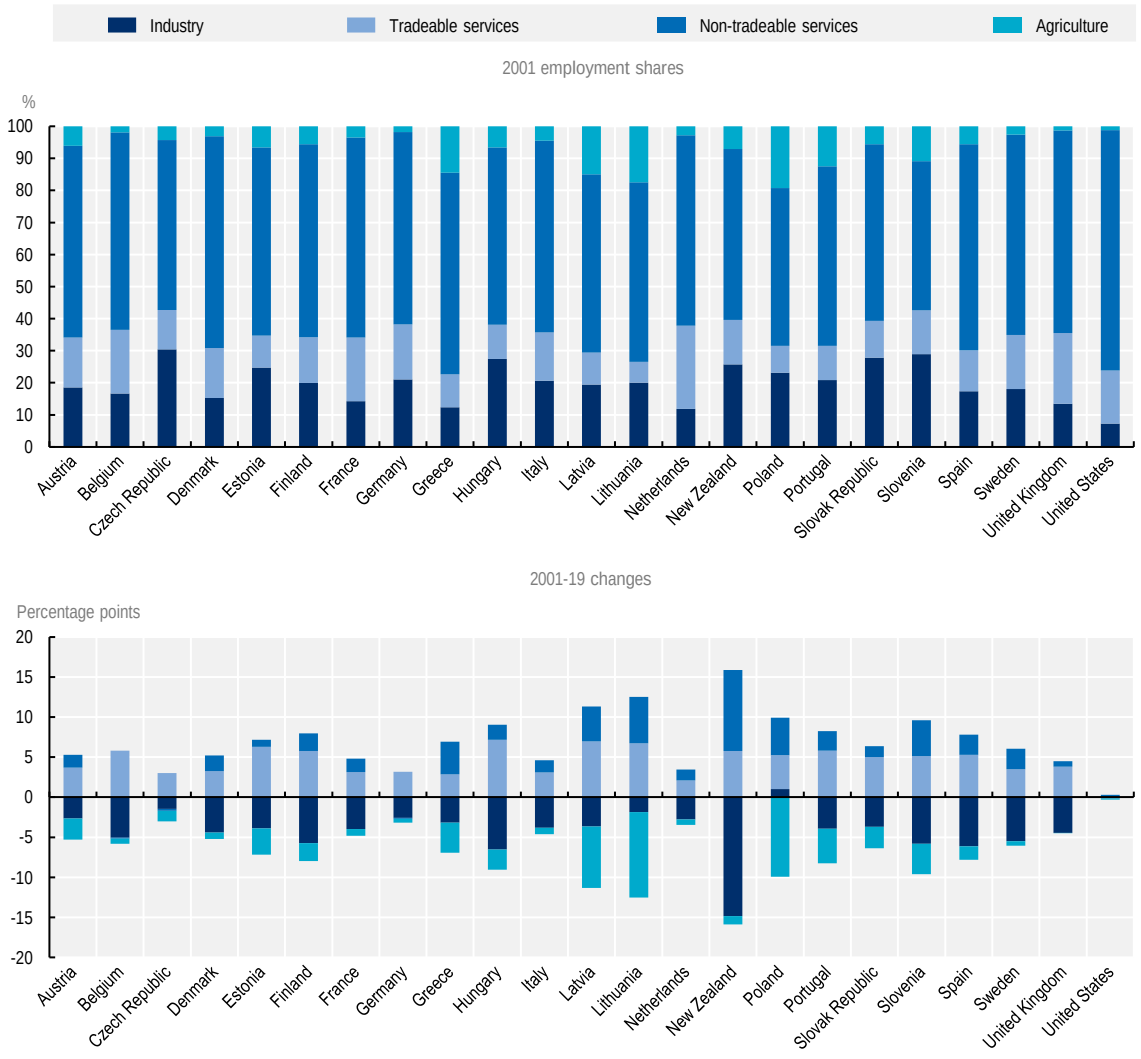
Annex Table 3.A.2. Growth rate of regional inequality, selected indicators

2001-19 yearly change in Theil index according to different metrics (%)

Country	GVA per capita	GVA per capita with equal labour productivity growth	Labour productivity
Austria	-1.34	-0.95	-0.69
Belgium	1.51	0.31	2.11
Czech Republic	1.75	-0.19	2.85
Denmark	2.06	1.05	2.54
Estonia	0.64	0.98	-0.45
Finland	-4.95	-1.88	-3.83
France	0.70	0.17	0.55
Germany	-0.87	-0.35	-1.55
Greece	-0.12	2.74	-2.09
Hungary	0.65	0.43	1.68
Italy	0.73	0.59	0.21
Latvia	-0.39	2.00	-3.27
Lithuania	2.11	4.32	-0.93
Netherlands	-0.89	-0.66	-1.01
New Zealand	-2.38	-0.09	-3.24
Poland	1.75	4.05	-3.10
Portugal	-2.95	0.44	-4.10
Slovak Republic	0.54	-0.40	2.27
Slovenia	1.78	3.21	-3.71
Spain	-1.15	-1.89	1.04
Sweden	1.34	-0.02	1.73
United Kingdom	0.79	0.50	2.54
United States	2.94	0.47	2.59

Note: Data for the United Kingdom start in 2004 (Northern Ireland missing due to boundary changes). According to the equal labour productivity growth scenario, regional labour productivity is assumed to grow at the same rate as the national one in each region. Inequality as measured by the Theil index in 2001 is obtained as the average of the values in 2001 and 2002; inequality in 2019 is obtained as the average of the values for 2018 and 2019. Countries are sorted in ascending order of GVA per capita disparities 2001-19 percentage change. Labour productivity is calculated as GVA/employment, where employment corresponds to employment by place of work.
Source: OECD (2022[7]), *OECD Regional Statistics (database)*, https://www.oecd.org/regional/regional-statistics/.

Annex Figure 3.A.1. 2001 employment shares and 2001-19 changes



Note: Shares in 2001 are obtained by averaging the values for 2001 and 2002; shares for 2019 are obtained by averaging values for 2018 and 2019. The industrial sector includes NACE group B-E, while tradeable services include NACE groups J, K, L, M-N. The category "Non-tradeable services" comprises the remaining sectors.
Source: OECD (2022[7]), *OECD Regional Statistics (database)*, https://www.oecd.org/regional/regional-statistics/.

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Annex 3.B. Hysteresis and the effect of the global financial crisis

Adverse economic shocks can have permanent negative impacts on regions and countries. For instance, in 2018, about half of TL2 regions still had higher unemployment rates than in 2008 (OECD, 2020[14]). "Hysteresis" refers to a situation where an adverse economic shock to a country or region permanently and negatively affects the path of the economy. Martin (2012[53]) distinguishes three types of hysteresis: economic shocks followed by a permanent decline in the level of economic activity; economic shocks followed by a permanent decline in the growth rate; and economic shocks followed by a permanent decline in the level and growth rate.

Based on GDP per capita data, a substantial number of countries have displayed hysteresis in the aftermath of the 1991-92 and 2008-12 (double) recessions.[1] Post 2008-12 recession, several countries, such as France, Greece and Italy, have featured hysteresis in the level of GDP per capita, in contrast with zero countries after the 1991-92 recession. Further, less than half of the countries – among those with data available for both expansion periods – have managed to recoup the growth rate of GDP per capita after both recessions (Annex Table 3.B.1).

Annex Table 3.B.1. Hysteresis has become more common across OECD countries over time

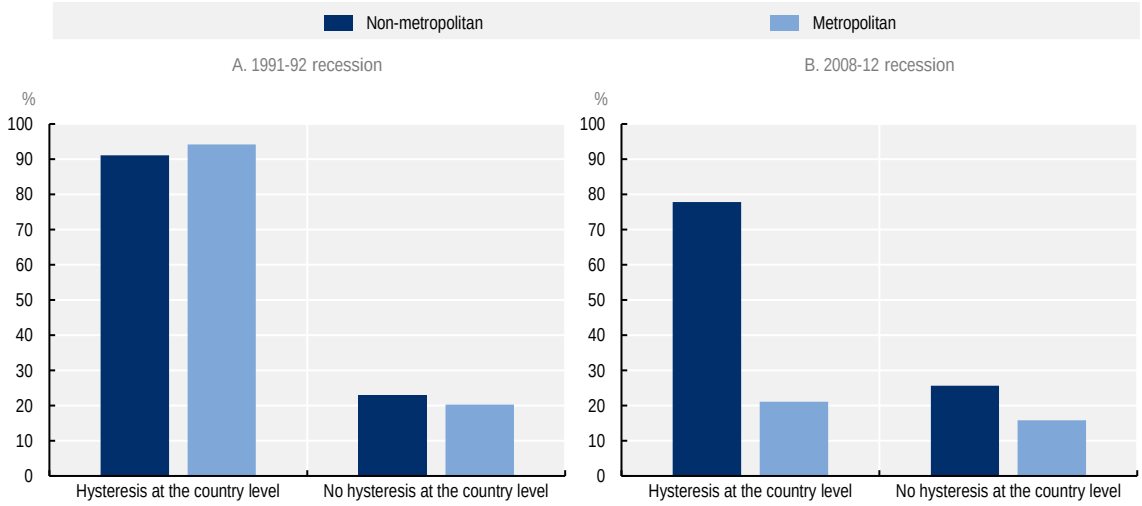
	Hysteresis – both level and growth rate	Hysteresis – only level	Hysteresis – only growth rate	No hysteresis
1991-92 recession			CZE, FIN, POL, SWE	AUT, BEL, DEU, DNK, ESP, FRA, ITA, NLD, NOR, PRT
2008-12 recession		FRA, GRC, ITA	CZE, HUN, JPN, NOR, PRT	AUT, BEL, DEU, DNK, EST, ESP, FIN, GBR, KOR, LTU, LVA, NLD, NZL, POL, SWE, SVN, SVK, TUR, USA

Note: Countries displaying growth rate hysteresis are those countries that during the expansion phase following a given recession featured an average growth rate lower than the one featured during the previous expansion. Countries displaying hysteresis in the level are those countries for which the maximum level attained during the expansion phase following a given recession was lower than the one attained during the previous expansion. Following Tsvetkova (forthcoming[54]), 1983-91, 1994-2007, 2010-11, 2013-19 are defined as expansion phases, 1992--93, 2008-09, 2011-12 are defined as recession periods. For the purpose of this analysis, the 2007-09 and 2011-12 recessions have been bundled together. The growth rate in the employment rate corresponds to the annualised absolute change, rather than the relative one.
Source: Based on Knowledge Centre for Territorial Policies (2022[33]), *ARDECO Database*, https://knowledge4policy.ec.europa.eu/territorial/ardeco-database_en.

Unlike the 1991-92 recession, a relatively larger share of non-metropolitan regions struggled to recover from the GFC compared to metropolitan regions, driving hysteresis at the country level. During the 1991-92 recession, the share of the population living in TL3 regions experiencing sluggishness in GDP per capita growth in countries featuring hysteresis was approximately 90% for both metropolitan and non-metropolitan regions (Annex Figure 3.B.1, Panel A). In contrast, during the GFC, the share for non-metropolitan regions stayed about the same, while the one for metropolitan regions dropped to 20% (Annex Figure 3.B.1, Panel B).

Annex Figure 3.B.1. The global financial crisis has increased on average within-country disparities

Population in non-metropolitan and metropolitan TL3 regions experiencing post-recession hysteresis in the growth rate of GDP per capita by recession and whether the country experienced hysteresis as a whole



Note: For each recession, the share of the population living in TL3 regions that experienced hysteresis in the growth rate of GDP per capita during the corresponding recovery period is shown. Regions are grouped by type of TL3 regions and whether the country as a whole also has experienced hysteresis in the aggregate GDP per capita growth rate. A country or a region experiences hysteresis in the growth rate of GDP per capita after a given period of recession if it does not manage to attain, not even once during the ensuing recovery period, the highest growth rate experienced during the previous expansionary phase.
Source: Based on Knowledge Centre for Territorial Policies (2022[33]), *ARDECO Database*, https://knowledge4policy.ec.europa.eu/territorial/ardeco-database_en.

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Annex 3.C. Rising dissimilarities in the local importance of tradeable sectors

Reallocation of employment towards high-productivity sectors has proceeded at different speeds across regions. The coefficient of variation of tradeable sectors' employment shares, $share_i$, calculated across regions i within a certain country measures how strong differences in the importance of these sectors are at the regional level:

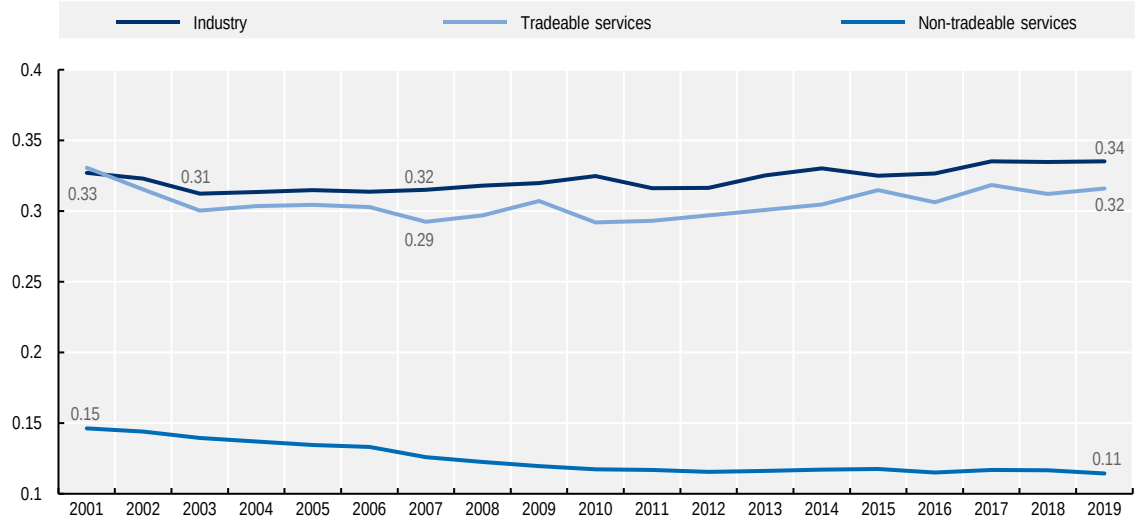
$$CV = \frac{\sigma(share_i)}{\mu(share_i)}$$

where σ is the standard deviation and μ corresponds to the mean of employment shares.

This coefficient is typically higher in tradeable sectors since firms operating in these sectors can pursue more freely location advantages compared to firms operating in non-tradeable industries given the tradeable nature of goods and services produced. In 2019, the coefficient of variation in tradeable sectors was nearly three times as high as in the non-tradeable sector across OECD countries (Annex Figure 3.C.1). To give a measure of this difference, in 2019, only 5% of employees in the Portuguese region of the Algarve worked in the tradeable goods sector, as opposed to 44% in the manufacturing-dense Ave region in northern Portugal – a ninefold difference. In contrast, the employment share in the non-tradeable sector ranged from 65% to 37% across regions, less than a twofold difference.

Annex Figure 3.C.1. Employment shares in high-productivity sectors have become more dispersed

Country-specific coefficient of variation of TL3-level employment shares by sector, average across OECD countries



Note: The industrial sector includes NACE group B-E, while tradeable services include NACE groups J, K, L, M-N. For Austria, Germany, Poland, Spain and the United Kingdom, tradeable services include G-J, K, L, M-N. Data for the United Kingdom start in 2004 (Northern Ireland missing due to boundary changes). Data for the agricultural sector are missing for the United Kingdom. Data from the United States are not included in the analysis due to the low quality of employment data by sector/TL3 region.
Source: OECD (2022[7]), *OECD Regional Statistics (database)*, https://www.oecd.org/regional/regional-statistics/.

StatLink https://stat.link/m6r1q8

Especially between 2011 and 2019, OECD regions have become more dissimilar in terms of the importance that tradeable sectors play at the local level. The incentives for regions and firms to specialise in response to the mounting competition induced by rising global economic integration have likely concurred with shaping this trend for the industrial sector. On the other hand, differences between regions in terms of the local importance of tradeable services first declined, thanks to the maturing of ICT and their spatial diffusion. The decline was driven to a halt and reverted by the GFC, owing also to the inability of certain regions to recoup their pre-crisis employment levels.

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Notes

[1] In this chapter, the expression "high- (low-) productivity" is used to refer to regions with productivity above (below) the country average.

[2] Labour productivity is measured in terms of regional GVA per worker, expressed in USD at constant prices and constant PPP (2015 base year).

[3] Data based on 23 OECD countries: AUT, BEL, CZE, DEU, DNK, ESP, EST, FIN, FRA, GBR, GRC, HUN, ITA, LTU, LVA, NLD, NZL, POL, PRT, SVK, SVN, SWE and USA.

[4] Greece and Italy are the only two OECD countries where productivity growth at the national level was negative.

[5] See Annex Table 3.A.2 for figures on the evolution of labour productivity inequality.

[6] For the analysis in this chapter, TL3 regions belonging to the same metropolitan area have been combined to avoid having changes in inequalities reflecting variation in commuting patterns between core and peripheral TL3 regions.

[7] See Annex Table 3.A.2 for figures on the evolution of GVA per capita inequality under different assumptions.

[8] Tradeable sectors include: the tradeable goods sector, or industrial sector, and the tradeable services sector. Industry includes: Mining and quarrying (B), Manufacturing (C), Electricity, gas, steam and air conditioning supply (D) and Water supply; sewerage; waste management and remediation activities (E) NACE macro sectors. Tradeable services include: Information and communication (J), Financial and

insurance activities (K), Real estate activities (L), Professional, scientific and technical activities (M), Administrative and support service activities (N). Non-tradeable services include: Wholesale and retail trade; repair of motor vehicles and motorcycles (G), Transporting and storage (H), Accommodation and food service activities (I), Public administration and defence; compulsory social security (O), Education (P) and Human health and social work activities (Q), Arts, entertainment and recreation (R), Other services activities (S), Activities of households as employers; undifferentiated goods - and services - producing activities of households for own use (T) and Activities of extraterritorial organisations and bodies (U).

[9] The decline in relative terms was mirrored by a decline in absolute terms, with a total loss of about 3.5 million jobs across OECD countries, and Southern European countries (Greece, Italy, Portugal and Spain) suffering the largest employment losses in relative terms (20% cumulated employment decline during 2001-19 against an OECD average of 9%). The decline partly reflects outsourcing of ancillary activities (e.g. cleaning, security, accountancy, etc).

[10] See Annex Table **3.A**.1 for figures on country-level employment in the different sectors.

[11] See Annex 3.C for a more in-detail discussion of the evolution of regional shares in tradeable sectors in OECD countries.

[12] For the sake of this exercise, a region is classified as top 50% if it belongs to the top half productive regions within the country for at least three years between 2004 and 2007. Conversely, it is classified as bottom 50%.

[13] Using data on US local labour markets, Acemoglu and Restrepo (2020[55]), for example, find that 1 more robot per 1 000 workers reduced the employment-to-population ratio by 0.2 percentage points and wages by 0.42%.

[14] The rise of intangibles in production presents also some challenges. For instance, industries characterised since the early 2000s by the strongest increase in intangible capital accumulation are also those where differences in firm productivity went up faster (Corrado et al., 2021[57]).

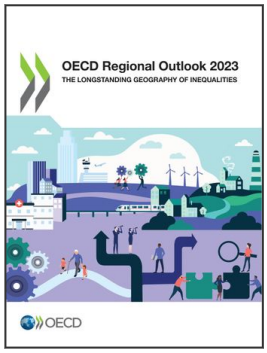
[15] Gross fixed capital formation comprises fixed asset acquisitions minus disposals by resident producers.

[16] Based on Industrial Production: Manufacturing: Non-Durable Goods: Apparel and Leather Goods (NAICS = 315.6) (IPG315A6A), FRED, St. Louis FED (accessed 06 June 2023).

[17] Differences in sectoral specialisation matter also for the impact of domestic – not just global – trade integration on within-country disparities. For intermediate levels of transport costs, the development of a new transport infrastructure spurring domestic trade integration can trigger concentration of economic activity in regions already specialised in manufacturing due to economies of scale experienced by firms when locating close to larger markets. Estimates of the impact of road network expansion in European regions during 1990-2012, for instance, highlight large differences in the amount of investment that would have been required to obtain similar gains across regions (Adler et al., 2020[56]).

[18] Trade openness is defined as the ratio between the sum of imports and exports divided by regional GDP. These data refer to 182 TL2 regions located in 15 OECD countries and span the period between 2010 and 2019.

[19] Traditionally considered highly polluting sectors are coke and oil refining, chemicals, basic metals, in particular steel and aluminium, non-metallic minerals, in particular cement, paper and pulp, motor vehicles (OECD, 2023[50]).



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