CHAPTER 3

Spatial impacts in a crisis context: promoting inclusive recovery and structural changes

1. Introduction [185]

The COVID-19 crisis is having heterogeneous territorial impacts. The effects of the COVID-19 crisis on people's lives and livelihoods depend on regional and even local factors, as argued in various recent studies and forecasts. Regional factors, such as the age distribution, access to healthcare, and exposure to air pollution affected COVID-related health risks in different ways [186]. In turn, the economic repercussions of the health crisis at the local level, as well as the speed of the recovery, also depend on structural factors, such as the structure of the local economy (e.g. the reliance on tourism industry), occupational structure, workforce characteristics (i.e. the potential for teleworking and level of education, the capacity of local economy to adapt to changes in demand patterns triggered by the pandemic), and local policies [187].

The geographically uneven impact of the crisis has often implied greater variation within countries, especially in larger ones, than between them. In Europe, a small fraction of the 500 NUTS 3 regions account for the majority of COVID-19 deaths [188]. The economic impacts are also unfolding unevenly between EU regions. Thus, the current crisis is undoubtedly also a regional one, with important consequences for local economies, well-being, transportation, and everyday life. A regional analysis is therefore essential to fully understand and manage the unequal impacts of the current pandemic. The territorial impact mainly depends on regional features and local restrictions in terms of both social and economic limitations. Some regions, given their economic structure and the magnitude of the pandemic, have shouldered a heavy part of the burden of the COVID-19 crisis: large parts of population perceive their income and future prospects to be at risk, generating negative sentiment regarding own situation (see *Box 3.2*). Such regional specificities concerning the sentiment reflect significant differences in terms of both the current impact of the crisis and expectations on its development at territorial level. But what are the regional impacts of the pandemic? And what does drive the different reactions to the shock?

Against this background, the chapter focuses on regional and territorial perspectives in terms of past trends, current effects of the COVID-19 crisis and future challenges. In doing so, it explores challenges and opportunities related to structural changes. The chapter is structured in three main sections: the first section reviews regional evolution prior to the COVID-19 crisis; the second section discusses the impact of COVID-19 and regional reactions to the shock; and the final section assesses future scenarios in the short run at both national and regional level. The chapter investigates these issues based on available evidence and sheds light on future territorial trends in the face of current challenges.

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[186] See OECD (2021) for an overview of the territorial impact of the COVID-19 crisis in a variety of domains: health, economic, social and fiscal and the policy implications for multi-level governance and local policies.

[187] Ibid.

[188] See Guibourg (2020). Findings based on a subset of the total 1345 NUTS 3 regions. See also Chapter 1.4 for an assessment of excess mortality at NUTS 3 level.

2. THE SOCIO-ECONOMIC EVOLUTION IN REGIONS BEFORE THE COVID-19 CRISIS (189)

European regions and their labour markets are undergoing profound transformations. Globalisation, which brought the offshoring and outsourcing of several manufacturing activities, has increased automation, labour mobility and competition across regions (190). These long-term trends resulted in divergent regional economic dynamics and were further exacerbated by the 2008-09 crisis (191).

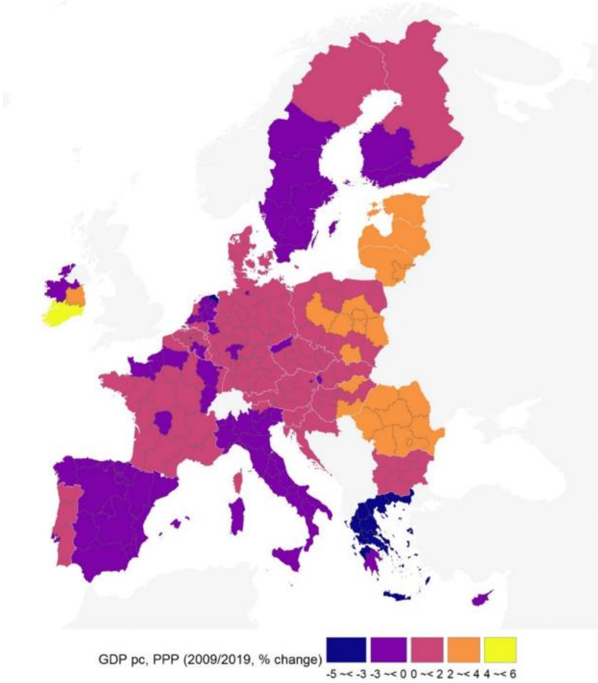
GDP trends were highly heterogeneous across EU regions between 2009 and 2019. The annual average change in GDP per capita between 2009 and 2019 provides indication of a lost decade for some regions, mostly concentrated in Southern Europe (*Figure 3.1*). Italian and Spanish regions show a slight decline in their GDP per capita following the 2009 crisis, while some Greek regions show a more severe decline. More sustained growth is instead visible in most Central and North European regions. Conversely, most Eastern European regions achieved annual growth rates that increased their GDP between 2% and 4%, which can largely be attributed to their respective economic catch-up phases following EU accession.

(189) This section benefits from contributions provided by Marco Colagrossi, Sara Flisi and Giulia Santangelo (European Commission's Joint Research Centre).

(190) Capello, R., Fratesi, U. and Resmini, L. (2011). Globalization and regional growth in Europe: Past trends and future scenarios. Springer Science & Business Media.

(191) In this respect, a recent study analyses the risk of development traps for different EU regions; how to measure the regional development trap and discusses the need for policies to end regional development traps (Iammarino et al. 2020)

Figure 3.1
Real GDP per capita, Purchase Power Parity (PPP). Average annual change 2009-2019, NUTS- 2 level



Source: European Commission's Joint Research Centre based on ARDECO, ROVGD
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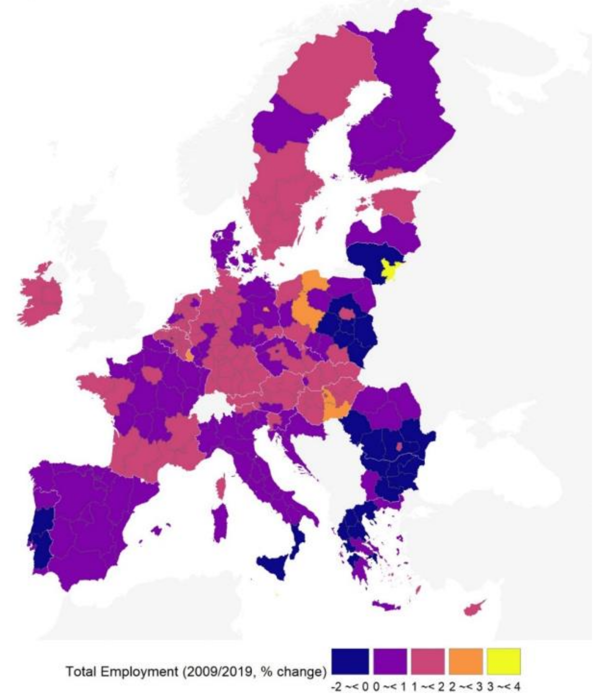
The GDP dynamics at regional level are mostly mirrored in employment (*Figure 3.2*). Regions exhibiting declining or weak economic growth also experienced a contraction – or at best weak growth – in the total number of employed individuals. Best performing regions instead show different patterns. Central and North European regions largely show positive employment dynamics – this particularly holds true for Southern Germany, Northern Germany and most Belgian and Dutch regions. Conversely, several Eastern European regions (notably in Poland, Romania, and Bulgaria) witnessed a more negative development: some regions recorded annual average loss of total employment around 1%. This development is rooted in increasing labour mobility across EU regions from East to West rather than in unfavourable cyclical conditions or an increase in unemployment or inactivity (192).

(192) Countries of origin especially in Southern and Eastern Europe already experienced population declines. Most notably, the population in Bulgaria and the Baltic States declined by between 16% and 26% over the past 25 years (European Commission, 2021a).

Figure 3.2
Total Employment. Average annual change 2009-2019, NUTS- 2 level



Source: European Commission's Joint Research Centre based on ARDECO, RNETD
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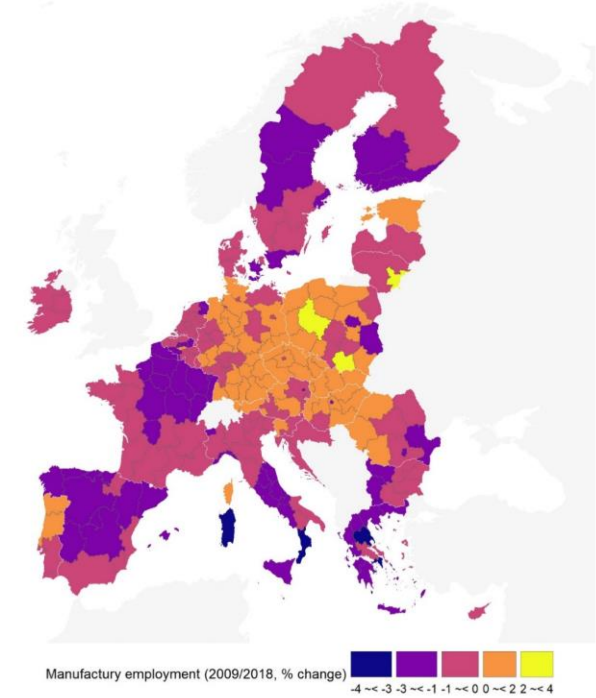
Figure 3.3
Employment in the manufacturing sector (NACE B-E). Average annual change 2009-2019, NUTS -2 level.



Source: European Commission's Joint Research Centre based on ARDECO, RNETZ
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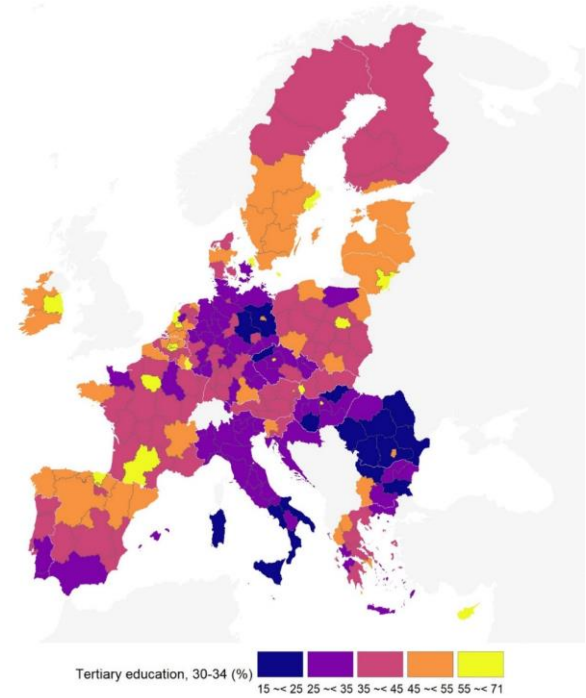
The sectoral composition of regional economies remained rather stable despite diverging trends for the manufacturing sector. In particular, non-financial services sectors in Western European regions employ the largest share of the labour force. Most Western, Southern and Northern European regions have continued to register a decline in total employment in the manufacturing sector, as manufacturing activities were either outsourced to Eastern Europe or to countries outside the EU (*Figure 3.3*). As jobs in the manufacturing sector are typically middle-income jobs ([193]), this had important (and mostly negative) consequences on the middle classes of these countries. Germany, however, displayed an average increase in employment of about 6% over ten years thanks to its high value-added manufacturing sector. Among the largest regions, only the Düsseldorf region showed a negative pattern (-5%). Even more positive developments can be found across Eastern European Regions. However, the trends are more scattered across regions. For example, the Polish regions of Wielkopolskie and Małopolskie have been among the best performing regions in Europe (+43% and +25%, respectively over ten years), while the capital region of Warszawski Stołeczny registered a 20% decline.

In a context of rapidly evolving labour market conditions, the availability of educational opportunities gives access to a broader range of jobs. The Europe 2020 strategy had set the target of increasing the share of Europeans aged 30-34 having completed tertiary education by 2020 to at least 40%. While the target has been met on average, regional differences are still stark (Social Scoreboard, *Figure 3.4*) ([194]). This is true both for regions in countries having a lower-than-average share of tertiary-educated individuals (such as those of Bulgaria, Germany, Portugal and Romania); and those who were starting from a higher-than-average situation, such as in France and Ireland.

([193]) OECD (2019).

([194]) The indicators from the Social Scoreboard of European Pillar of Social Rights by NUTS 2 are available at: https://ec.europa.eu/eurostat/web/european-pillar-of-social-rights/indicators/data-by-region

Figure 3.4
Share of tertiary education (ISCED 5-8), individuals aged 30-34, 2019, NUTS -2 level



Source: European Commission's Joint Research Centre based on Social Scoreboard - European Pillar of Social Rights

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2.1. Income trends and inequality at territorial level

Already before the pandemic, regional disparities and rural-urban cleavages were visible territorial challenges. The territorial lens has become increasingly important in explaining rising inequalities in the creation of added value, the world of work and the resulting redistributive role of local, national or EU policies. According to a consolidated body of research, the EU is currently dealing with a widening urban-rural gap ([195]), with notably urban regions displaying higher rate of GDP per capita increase (though with increasing inequalities within urban areas) and rural regions lagging behind. This widening gap is the result of a profound economic transformation driven by globalisation, technological change and the progressive economic integration with global markets, which substantially altered dynamics in spatial development ([196]). Trends such as the agglomeration of high value-added economic activities and the knowledge economy in big cities contrasted with ageing, depopulation and outward migration in rural areas have been increasingly identified as key drivers behind the territorial inequality of outcomes and opportunities.

Regional economic disparities in GDP per capita increased over the past 15 years in the majority of EU countries. Within-country differences in regional GDP per capita have increased more markedly in Ireland, France and Denmark. Conversely, in some countries the variation of GDP per capita across regions slightly declined (Portugal, Austria, Latvia and Finland). In some instances, growing regional disparities resulted from rising gaps between urban and non-urban regions as growth was generally sluggish in regions far from metropolitan areas. Although annual GDP-per-capita growth in metropolitan regions has been slow in the last 15 years (1.15%), remote regions and regions close to small or medium cities have been growing at an even-lower rate (0.9%) ([197]). These differences in GDP per capita across regions translate into differences in household disposable income.

The large variation in household incomes, especially between urban and rural areas, risks undermining inclusive growth. The level and distribution of household incomes, earnings and wealth varies substantially within countries – across regions, municipalities and neighbourhoods, and between urban and more rural areas. These geographic disparities risk compromising inclusive growth if they exclude people from opportunities, and hence from the benefits of economic growth, by preventing access to good-quality infrastructure, such as education and child care, health care, transportation, and digital services. For instance, the access to healthcare in rural areas is a challenge in many Member States. The availability of health services is limited mainly due to shortages of medical professionals, insufficient incentives for doctors and nurses to settle their practice in rural areas ([198]).In turn, these disparities further decrease development chances and wellbeing, and fuel political discontent especially in areas that are lagging behind.

The at-risk-of-poverty rate is reasonably heterogeneous within countries. In 2019, the proportion of population whose disposable income is below 60% of the national median income varies greatly across regions, especially in Member States with deep-rooted regional disparities such as Italy and Spain (*Figure 3.5*, left panel). The risk of poverty is highly heterogeneous across regions also in Romania, Poland and Sweden. This highlights potentially divergent income developments across regions.

([195]) See Eurofound (2019) and OECD (2018), with a focus on policy response to address this gap. For a contrasting view see Holzhausen and Wochner (2019).

([196]) See Rodriguez-Pose (2013) for a landmark study on the role of public institutions in addressing regional policies and development gaps in the light of these megatrends.

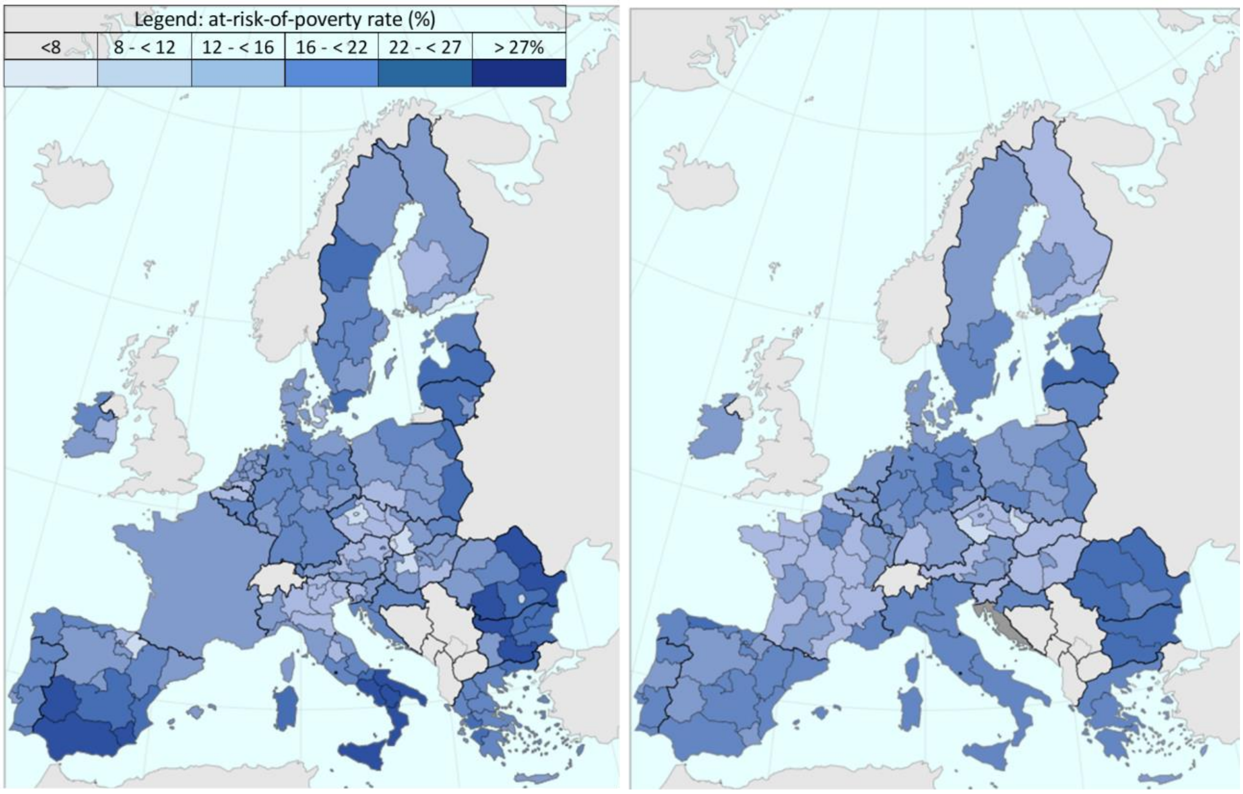
([197]) See Königs and Vindics (forthcoming).

([198]) See Eurostat (2021).

Figure 3.5

Regional differences in the risk of poverty are more pronounced under a national poverty line

At-risk-of-poverty rate by NUTS 1/ NUTS 2. % of population below 60% of the national median income [left] and below 60% of regional [NUTS 1] median income [right], 2019



Note: DG-EMPL calculations and Eurostat [ilc_li41] ; SOEP data for Germany

Source: Calculations for Germany were provided by Virmantas Kvedaras (European Commission's Joint Research Centre)

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However, when regional poverty is assessed against regional poverty lines, within-country divergences are less pronounced (*Figure 3.5*, right panel). Income poverty is primarily assessed at the national level as tax-benefit systems – the main instruments in tackling income poverty – mainly fall within the competence of each Member State. The structure and characteristics of tax-benefit systems are influenced by national preferences and are heterogeneous across Member States. Nonetheless, as income developments may continue to diverge within countries, people could be more inclined to compare their economic wellbeing in relation to the average income of their region, especially in countries with large income disparities.

Hence, in countries such as Italy and Spain, the risk of poverty is lower in relatively poorer regions (e.g. Andalucía, Southern Italy) when assessed under a regional poverty line as opposed to a national one. At the same time, the proportion of households at risk of poverty is higher in richer areas when assessed under regional poverty lines as it reflects generally higher median incomes and higher income inequality ([199]). Thus, income developments have a regional dimension, which shows upon closer inspection that increasing population segments within richer regions may not benefit from the economic prosperity of the region.

Many Member States are characterised by marked income differences between regions, at NUTS 3 level ([200]). Income trends can be analysed at a deeply granular subnational level thanks to administrative data – albeit currently available only for a subset of EU countries. Recent administrative data, derived mainly from tax registers and harmonised by the OECD, illustrate territorial income disparities and their evolution over time ([201]). Differences in disposable income between the highest- and lowest-income regions are around 25% of national median disposable income in countries such as Austria and Sweden. For different income concepts such as household gross income or employment income, differences in median incomes across regions appear larger, especially in Italy and Belgium (*Chart 3.1*). Capital regions have much higher incomes than the national average in Portugal and Sweden, while in Belgium the capital region has relatively low median incomes and surrounding areas have higher incomes (see Annex I).

([199]) See *Chart 3.2* and *Chart 3.3* for an assessment of how richer regions, especially metropolitan ones, are those with higher inequality levels.

([200]) The following analyses adopt as geographical unit of interest the OECD metropolitan/non-metropolitan typology for small regions (henceforth, TL3 level). Small regions are classified as "metropolitan" if more than half of their population lives in a Functional Urban Area (FUA) of at least 250 000 inhabitants and as "non-metropolitan" otherwise. The non-metropolitan can be further broken down into three categories depending on whether functional urban areas are accessible by the population living in each region - up to a one-hour drive (Fadic et al. 2019).

([201]) However the income concept differs across countries as highlighted in the different charts.

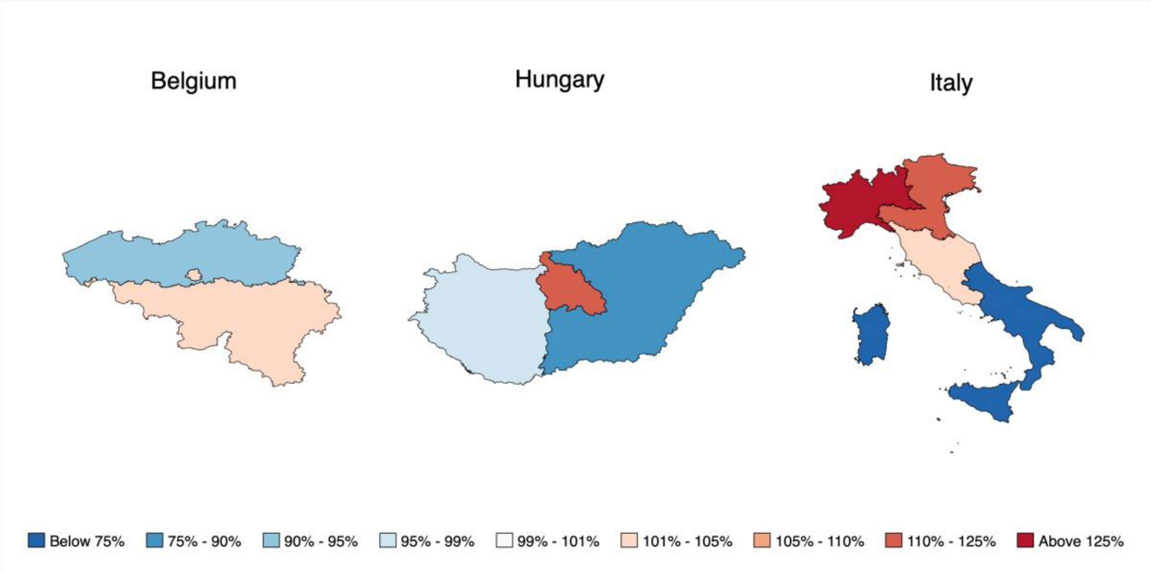
Box 3.1: Regional variations in poverty based on an absolute measurement approach

Differences in households' minimum needs and the cost of living across regions can have considerable implications for the purchasing power and the welfare of households. Standard monetary measures of poverty and social exclusion, such as the "at-risk-of-poverty (AROP)" indicator, tend to disregard this consideration when used for regional analysis. Sub-national poverty estimates are therefore often biased for sampling and non-sampling reasons alike.

The pilot initiative "Measurement and monitoring of absolute poverty (ABSPO)" can make substantial contributions to improving poverty measurement at local, regional, national, and European level ([1]). The ABSPO project explores the feasibility of developing a sound methodology for cross-country comparable absolute poverty measurement in the EU. These absolute poverty indicators are meant to contextualise and complement existing poverty indicators and provide a larger assessment of poverty in Europe, including absolute indicators ([2]).

The ABSPO project uses a mix of reference budget techniques and survey-based statistical methods to model individuals' and households' minimum financial needs. The main advantage of this so-called absolute approach to poverty measurement is that horizontal differences in individuals' minimum financial needs can be appropriately reflected in the resulting set of customised poverty lines. Individual characteristics (such as age, gender, or health status), household size and composition, as well as region of residence and the living environment all enter into the calculation of ABSPO lines. The corresponding poverty rates are then calculated in standard and AROPE-compatible manner using microdata on households' disposable income, i.e. the EU-SILC.

Figure 1
Regional variation in absolute poverty lines in selected Member States



Source: Percentage value of regional poverty lines relative to the respective country average. Household Budget Survey (HBS) data: 2015 for Italy; 2016 for Belgium and 2018 for Hungary.

The absolute approach to poverty measurement can highlight the variability of poverty lines at regional level, as illustrated with some preliminary estimates of this project for selected Member States. These are based on newly-created and regionally-priced nutritional food baskets that are harmonised across countries. These nutritional food baskets are mapped into overall poverty lines with a novel simulation-based statistical method based on national HBS data from 2016-2018 ([3]). The regional maps in Figure 1 therefore show the extent to which regional poverty lines deviate from the relevant country means due to spatial differences in food prices and household expenditure patterns. Specifically, they reveal that the

([1]) The project has been launched by the Directorate-General for Employment, Social Affairs and Inclusion and executed by the Commission's Joint Research Centre. The upcoming final report is due in September 2021.

([2]) Right now, the project has focused on a subset of EU countries. If scaled up to the EU-level the ABSPO measures could potentially allow for comparable and consistent absolute poverty measurement for monitoring purposes and to assess adequacy of social policies.

([3]) See Menyhert (2021) for more information.

(Continued on the next page)

Box (continued)

basic cost of living can vary by up to 30% within countries (see the case of Italy, for instance), which is comparable in magnitude to the degree of cross-country variation of national poverty lines in the EU. Taking into account such a varying degree of regional cost of living can provide a greater understanding of the extent and distribution of poverty in the EU.

Metropolitan regions identifiable as the capital region have thus the potential to reap the benefits of the city, favouring macro-trends described above. Countries' capital regions are strongly represented among the highest-income regions, as seen in Portugal, Slovakia and Sweden. In the case of Austria and Denmark, in the regions with the highest incomes are in close geographic proximity to the capital region. By contrast, in Belgium the capital region is the lowest-income region (Brussels Capital) ([202]).

Regional divergence over time in median incomes occurred in some EU countries, although this is not a generalised trend. There is no evidence of a systematic rise in cross-regional income disparities in countries for which longer time series data are available, i.e. of a broad divergence between higher- and lower-income regions. In Austria and Hungary cross-regional disparities in median incomes, as measured by the coefficient of variation, have declined over the last decade. Conversely, cross-regional income disparities increased markedly in Italy between 2007 and 2018 and in Finland in the 1990s, followed by stable trends thereafter. Denmark and Sweden show signs of cross-regional divergence over the last twenty years. By contrast, within-region income inequality increased in all countries analysed, especially in the mainly urban high-inequality regions ([203]).

However, income inequality differs substantially at regional level, and inequality indices tend to be highest in the capital regions. Differences in regional Gini indices amount to around 10 points in Denmark and Sweden, while these differences in regional inequality are more contained in Finland, Portugal and Slovakia (*Chart 3.2*). Regardless of the income concept adopted, the capital regions are the most unequal in all countries, except Italy where Milan is the most unequal area. Thus, the 'urban paradox' seems a reality in present-day EU as in capital regions there are more job opportunities but also higher proportions of people living at the margins of the labour market ([204]). Income inequality in the most unequal region, as measured by the Gini index, is usually around 10-25% higher than across the country as a whole, though the difference is nearly 40% in Belgium. These regional disparities in income inequality within a given country tend to be larger than the differences in overall inequality across countries, as measured by the country-level Gini indices. Moreover, a large body of evidence shows that income inequality tends to be higher in more populous regions.

Metropolitan regions have higher median incomes, though variation within metropolitan regions can be large. The finding that the capital region tends to be both a county's highest-income region and its most unequal region is indicative of the relationship between the income distribution of a region and its degree of urbanisation (*Chart 3.3*). Higher income levels are not solely a feature of capital regions. In general, metropolitan regions tend to have higher median incomes compared to the national median, while non-metropolitan regions display lower median incomes. This is the case for the majority of countries where disposable income data is available (Denmark, Portugal, Slovakia, and Sweden; top panel, *Chart 3.3*). This clear pattern of higher median incomes in metropolitan regions is less clear-cut in countries where different income concepts are available from the administrative data (Austria, Belgium, Hungary, and Italy; bottom panel, *Chart 3.3*).

The degree of urbanisation relates even more strongly to income inequality. In all countries for which administrative income data was available, the Gini index is higher in metropolitan than non-metropolitan regions [Chart A1.1 in Annex I]. Moreover, in nearly all countries, the most unequal region is metropolitan, while the least unequal region is rural. Thus, in urban areas there is a higher risk that spatial segregation reproduces and deepens these inequalities across generations.

Tax-benefit systems have the potential to redistribute across areas. Preliminary evidence shows that for Austria and Sweden, the tax-benefit redistribution for median-income households is higher in lower-income areas and in rural areas than in high-income and metropolitan areas ([205]).

([202]) See Annex I for detailed maps for Austria and Belgium.

([203]) Only in Austria within-region inequality did not increase significantly (Königs and Vindics, forthcoming).

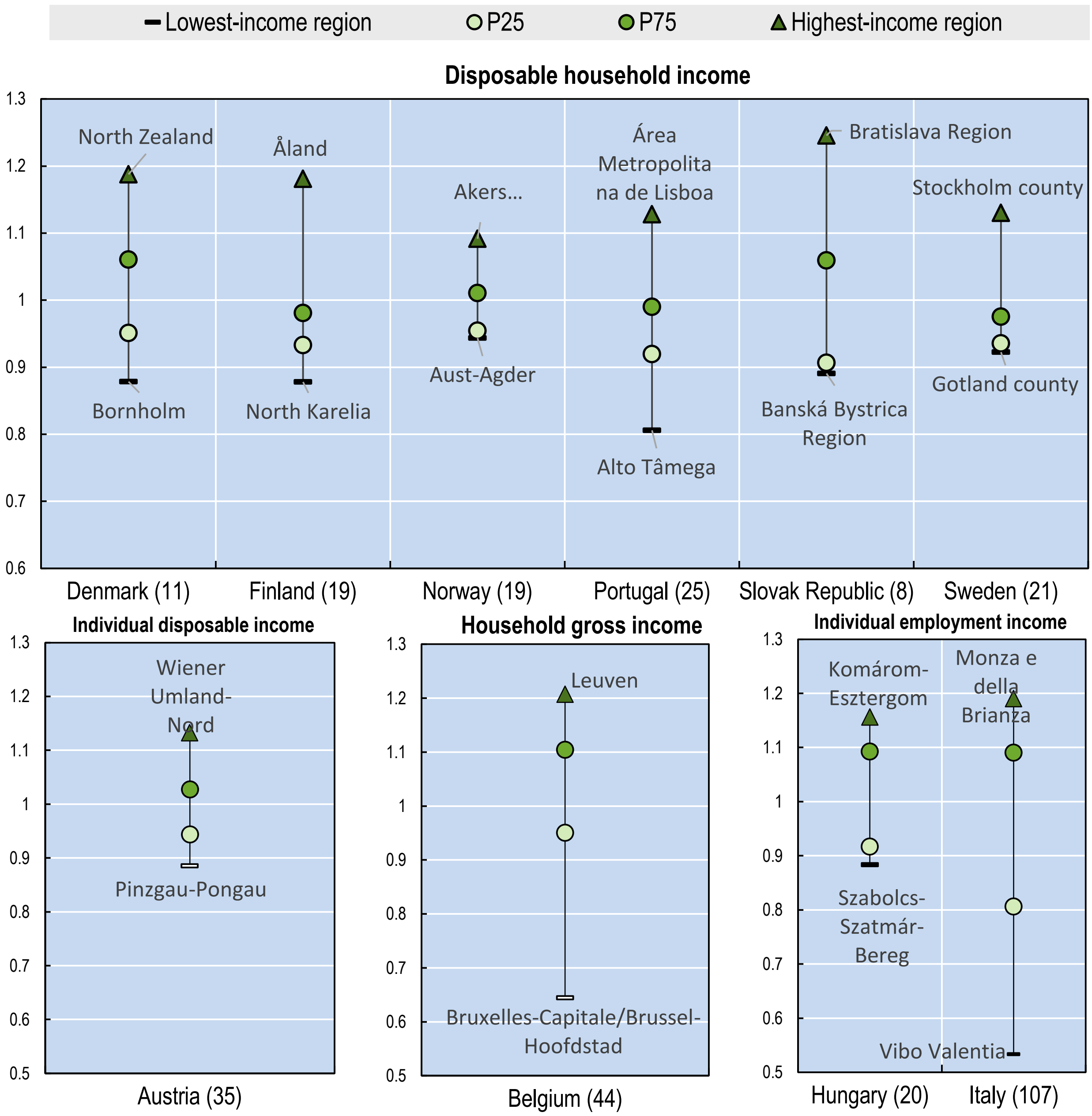
([204]) 8th Cohesion Report. European Commission (2021b).

([205]) Preliminary evidence from Königs and Vindics (forthcoming).

Chart 3.1

Regional income disparities can be large

Regional median incomes for high-and low-income regions, expressed relative to national median income, TL3/NUTS 3 level, 2017/18



Note: Minimum" and "Maximum" give the relative median incomes for the lowest-and highest-income regions, "P25" and "P75" give those for the regions at the 25th and 75th percentile of the regional income distribution. Figures in brackets behind the country name give the number of TL3/NUTS 3 regions per country.

Source: OECD calculations based on administrative income data

Click here to download chart.

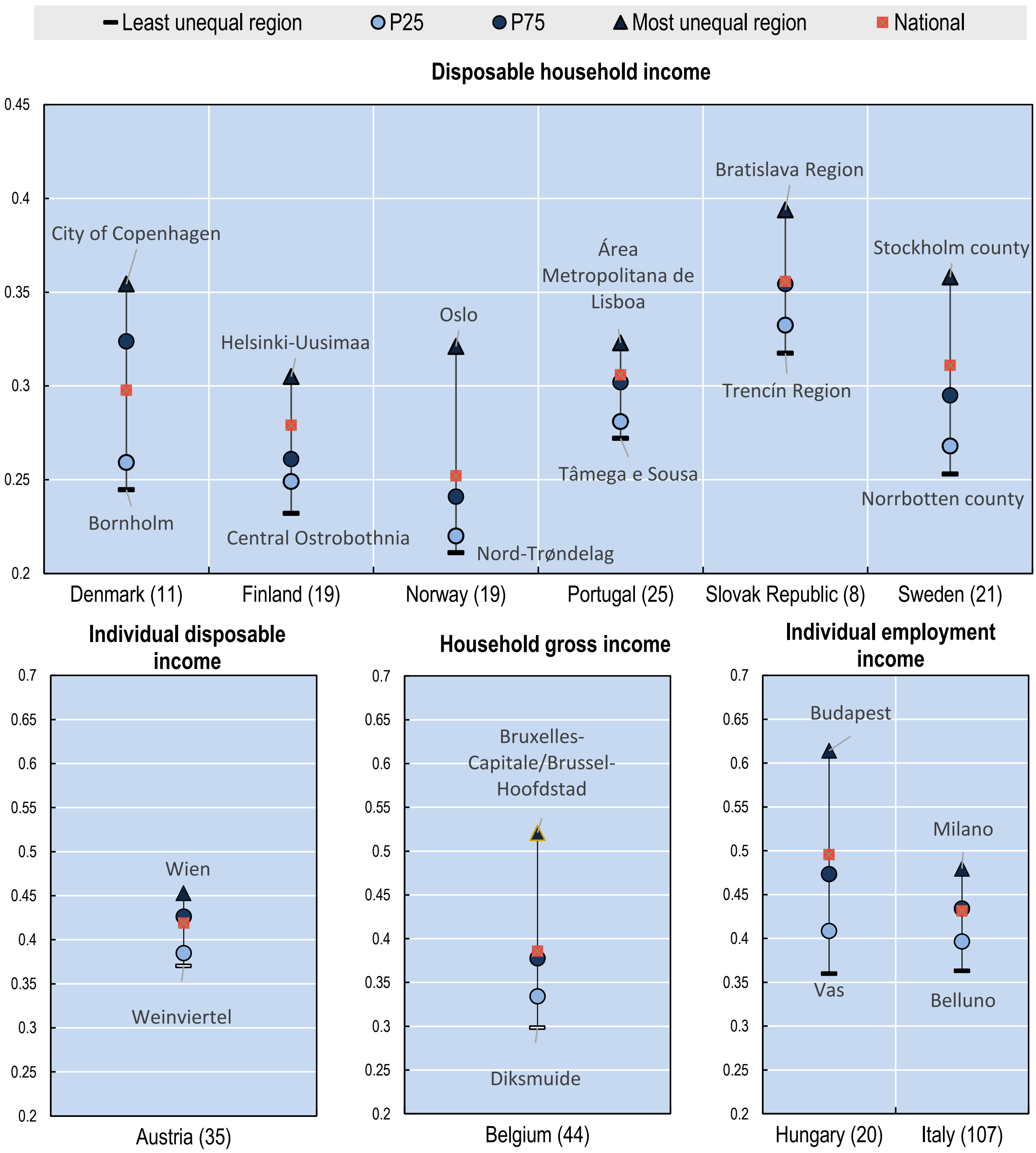
Capital areas have higher median incomes but a more unequal distribution. Preliminary evidence for capital areas in Slovakia, Sweden and Portugal highlight that their income levels may be substantially higher than across the country overall (206). In these countries the capital areas show median incomes respectively 25%, 13% and 7% higher than the national median incomes. At the same, incomes in Bratislava, Stockholm, and, to a lesser extent, Lisbon are distributed much more unequally than in their countries overall, resulting in Gini coefficients up to 4 points higher than the national ones, especially in the first two capitals.

(206) Evidence for these three capitals extends the previous TL3 classification of administrative boundaries as it comprises highly densely populated municipalities referred to as the "urban core", as well as any adjacent municipality with a high degree of social and economic integration with the urban core.

Chart 3.2

Income inequality varies substantially across regions and is often highest in the capital region

Regional income Gini coefficients for high-and low-income regions, TL3/NUTS 3 level, 2017/18



Note: "Minimum" and "Maximum" give the relative median incomes for the lowest-and highest-income regions, "P25" and "P75" give those for the regions at the 25th and 75th percentile of the regional income distribution. Figures in brackets behind the country name give the number of TL3/NUTS 3 regions per country.

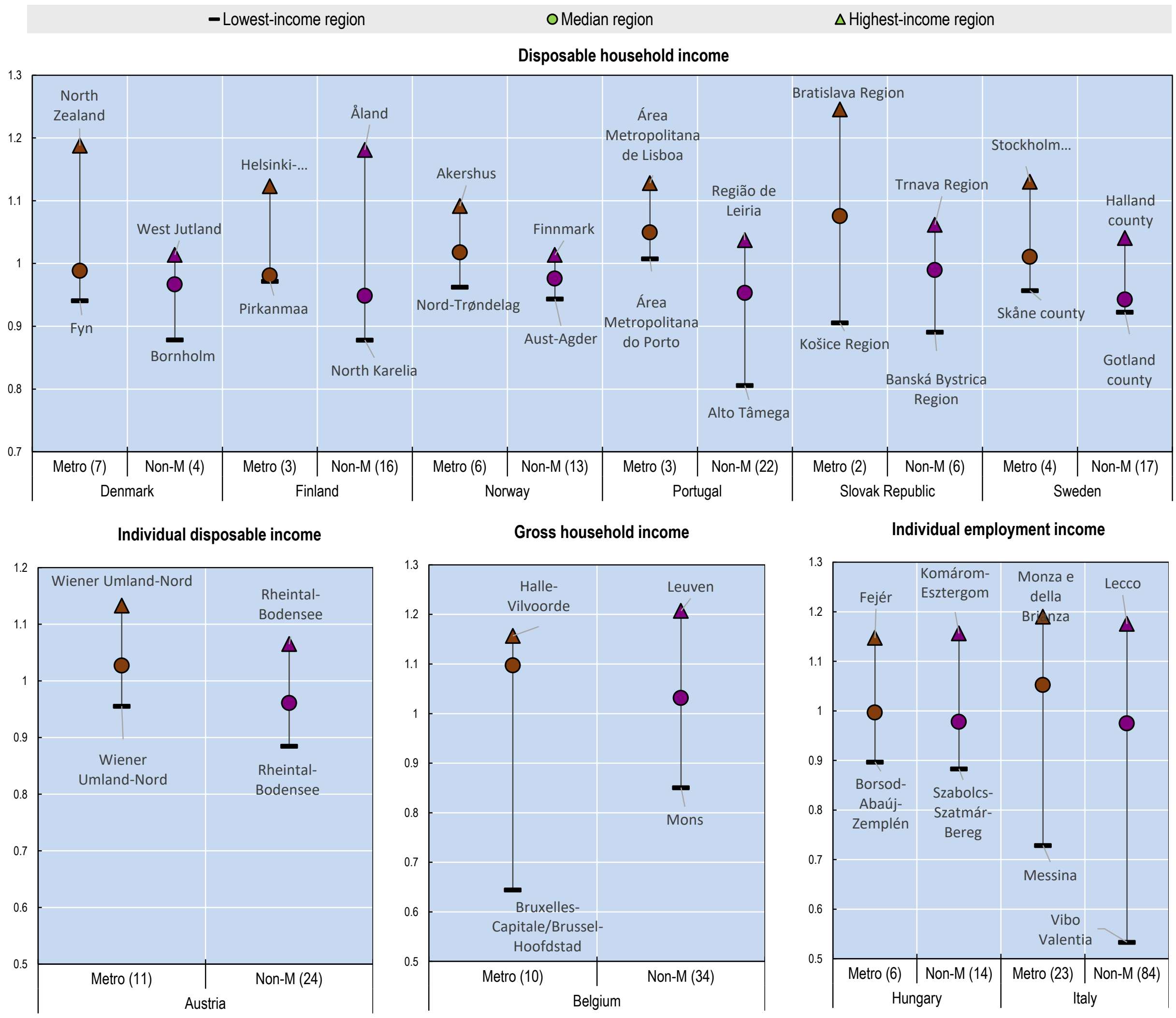
Source: OECD calculations based on administrative income data

Click here to download chart.

Chart 3.3

Median incomes are higher in metropolitan areas, but the regional disparities within these areas are much larger

Regional median incomes for high-and low-income regions by degree of urbanisation, expressed relative to national median income, TL3/NUTS 3 level, 2017/18



Note: Note: "P25" and "P75" give the relative median incomes for the regions at the 25th and 75th percentile of the regional income distribution by degree of urbanisation. Number of TL3 regions by degree of urbanisation listed in brackets behind the country name. TL3 regions are classified as metropolitan if more than half of their population lives in a functional urban area of at least 250 000 inhabitants, and as non-metropolitan otherwise

Source: OECD calculations based on administrative income data.

Click here to download chart.

3. THE IMPACT OF COVID-19 AND THE REGIONAL REACTION TO THE SHOCK

3.1. The categorization of workers at territorial level [207]

This Section explores the distribution of workers by the degree of urbanisation depending on the critical nature and the degree of "teleworkability" of their occupation [208]. First, as in chapter 2, the following four categories of occupations were identified:

i. Not teleworkable, high social interaction;

ii. Not teleworkable, low social interaction;

iii. Teleworkable, high social interaction;

iv. Teleworkable, low social interaction.

Second, the occupations were characterised as critical or non-critical, according to the list of critical occupations provided by the "Commission Communication on Guidelines concerning the exercise of the free movement of workers during COVID-19 outbreak". *Figure 3.6* and *Figure 3.7* provide a snapshot of the distribution of employment across

[207] The territorial classification adopted in this section is based on the distinction by degree of urbanisation adopted in the EU-LFS, which captures the character of the local administrative unit where the individual lives. These units are classified as either "urban centres", "urban clusters" or "rural grid cells", depending on their population densities. In more detail, cities (or "densely populated areas") are territorial units where at least 50% of the population live in urban centres; towns and suburbs (or "intermediate areas") are territorial units where at least 50% of the population live in urban clusters, but are not 'cities'; rural areas (or "thinly populated areas") are territorial units where at least 50% of the population live in rural grid cells.

[208] A different approach was used in the Labour Market and Wage Developments Report (2020a) to identify different occupations vulnerable to social distancing measures on the basis of the characteristics of tasks involved.

these categories and between areas with different degrees of urbanisation in the year before the pandemic.

Workers in critical and teleworkable occupations are located more in urban areas than in rural ones ([209]). *Figure 3.6* provides an overview of the proportion of critical and non-critical occupations by degree of urbanisation, and based on the four categories described above. For both critical and non-critical occupations, the teleworkable ones are mostly located in urban areas, regardless of their degree of social interaction (lower part of top and bottom panels, *Figure 3.6*). Conversely, for critical occupations, those that are not teleworkable and requiring low social interactions are mostly concentrated in rural areas (top panel, *Figure 3.6*). Similarly, *Figure 3.7* illustrates the distribution of employment across different occupational groups (defined at ISCO 2-digit level) in 2019. Each occupation is represented by three markers whose dimensions are proportional to the number of individuals employed in that occupation in 2019, in the three types of areas, namely cities, towns and suburbs, and rural areas, respectively ([210]). The top and bottom panels display, respectively, the critical and non-critical occupations.

The distribution of teleworkable occupations strongly depends on the degree of urbanisation, especially for critical ones. Among critical occupations (top panel *Figure 3.7*), those that are technically teleworkable display a much larger size in urban areas as opposed to rural ones. A similar pattern applies to occupations that are not teleworkable and require high social interaction, such as health professionals and protective service workers (e.g. firefighters and police officers) ([211]). For non-critical occupations, the dimension of the markers do not vary significantly by degree of urbanisation, as illustrated by the near overlap of the red, orange, and yellow markers for almost all occupations (bottom panel, *Figure 3.7*).

The impact exerted by the pandemic on employment varied greatly across occupational groups. Especially in the first phases when strict lockdown measures were adopted, non-teleworkable and non-critical occupations were deeply affected compared with teleworkable and critical ones. However, the employment impact of the crisis depended not only on the level of technical teleworkability, requisite social interaction, and the critical nature of the occupation, but also on the degree of urbanisation of the areas where individuals live.

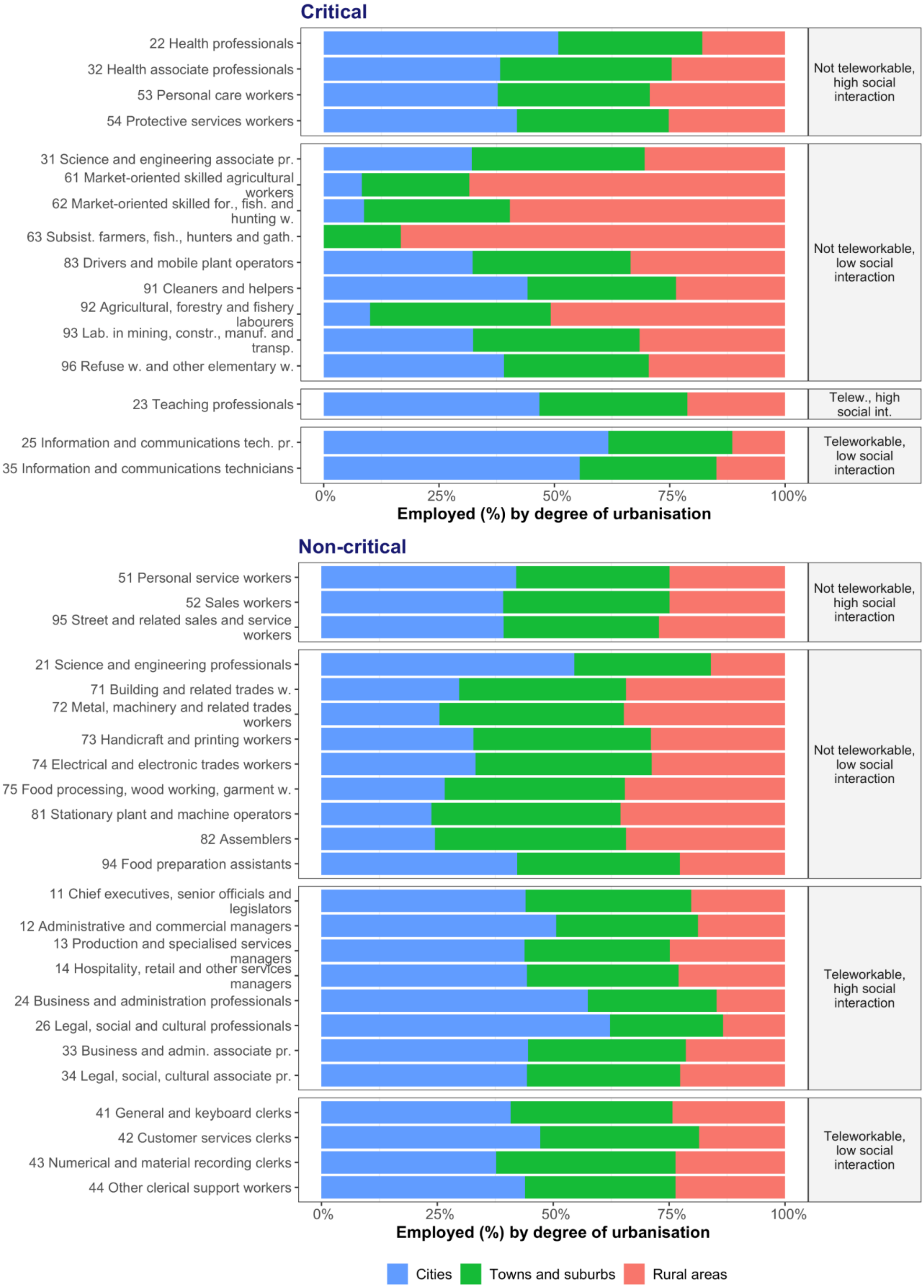
Urban areas host both substantial shares of high-skilled workers with relatively secure jobs and teleworking options, but also many workers in face-to-face service jobs that remain at risk as they are contact-intensive and cannot switch to telework. Service workers in tourism-intensive areas that have faced unprecedented decreases in visitor numbers are usually in occupations with high social interactions that are not teleworkable.

([209]) Occupations were divided into critical and non-critical as in Chapter 2. Workers exercising critical occupations are identified as those working in the following ISCO 2- and 3-digit categories: 213 Life science professionals; 214 Engineering professionals (excluding electrotechnology); 215 Electrotechnology engineers; 22 Health professionals; 23 Teaching professionals; 25 Information and communications technology professionals; 31 Science and engineering associate professionals; 32 Health associate professionals (except 323 Traditional and complementary medicine associate professionals); 35 Information and communications technicians; 53 Personal care workers; 61 Market-oriented skilled agricultural workers; 62 Market-oriented skilled forestry, fishery and hunting workers; 63 Subsistence farmers, fishers, hunters and gatherers; 751 Food processing and related trades workers; 816 Food and related products machine operators; 83 Drivers and mobile plant operators; 91 Cleaners and helpers; 92 Agricultural, forestry and fishery labourers; 93 Labourers in mining, construction, manufacturing and transport; 96 Refuse workers and other elementary workers. The list provided in the Communication was enriched to include occupations that, although beyond the scope of the Communication, might be considered critical. Finally, occupations were ranked on the basis of technical teleworkability and social interaction indexes, as defined in Sostero et al. (2020).

([210]) These occupations include, for instance, information and communication technology professionals and teaching professionals. The grey lines on the y and x axes represent the thresholds of 0.4 and 0.5 of the technical teleworkability and social interaction indexes.

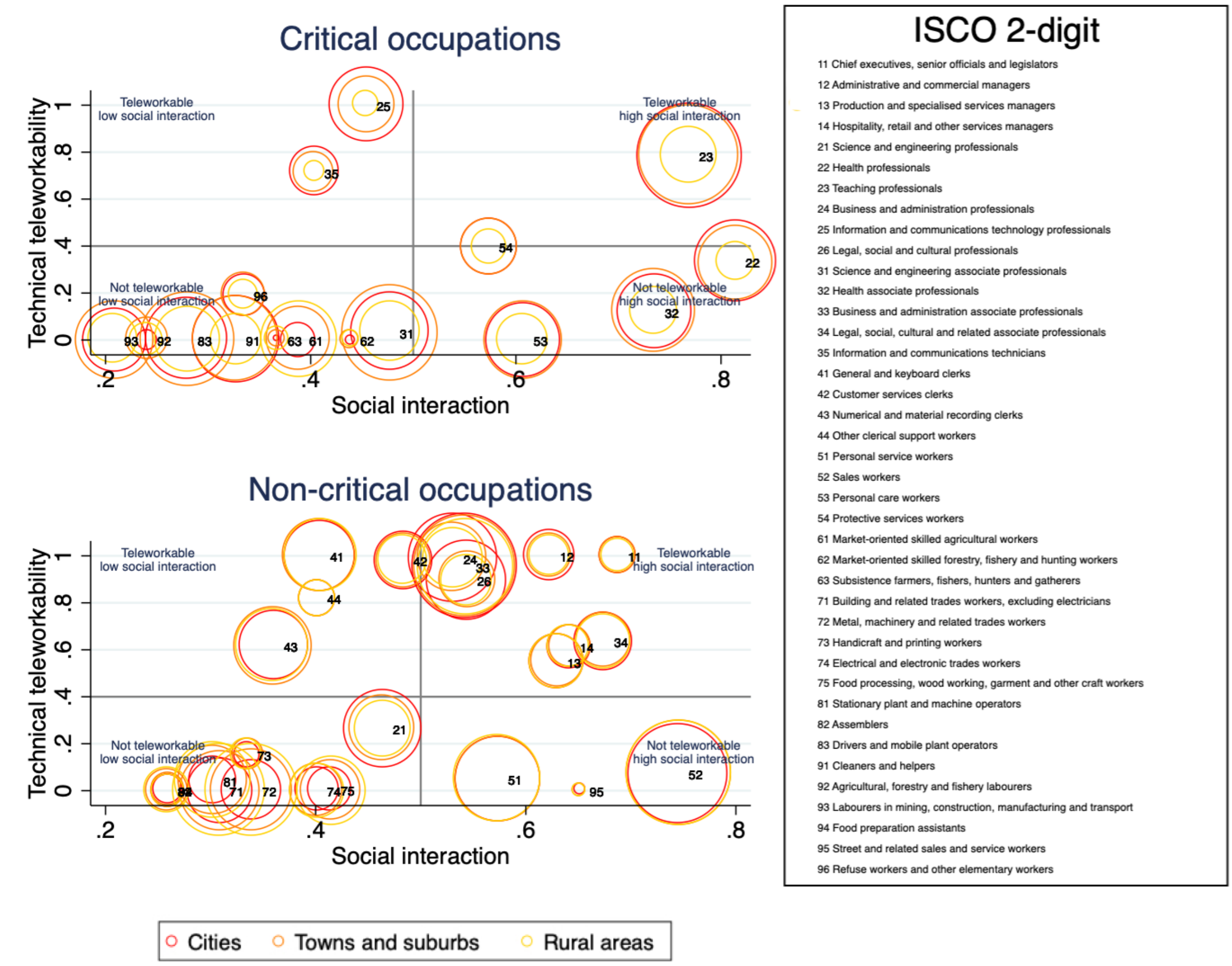
([211]) Occupations in the bottom right-hand quarters are below the 0.4 threshold of the technical teleworkability index, and above the 0.5 threshold of the social interaction index.

Figure 3.6
Employment in teleworkable occupations mainly concentrated in cities or towns and suburbs
Critical and non-critical occupations by degree of urbanisation, 2019, EU27.



Source: Calculations by the European Commission's Joint Research Centre based on a Eurostat special extraction on EU-LFS data for 2019 and on indexes produced in Sostero et al. (2020).
Click here to download figure.

Figure 3.7
Critical and teleworkable occupations are more represented in urban areas
Distribution of employment across different occupational groups by degree of urbanisation, 2019, EU27



Note: the three different colours (with the darkness proportional to the population density) allow checking whether the size of each occupation group varies by degree of urbanisation.
Source: Calculations by the European Commission's Joint Research Centre based on a Eurostat special extraction on EU-LFS data for 2019 and on indexes produced in Sostero et al. (2020).
Click here to download figure.

Non-teleworkable occupations suffered marked losses in employment declining heavily in rural areas and cities compared with towns and suburbs (*Table 3.1*). Among those occupations, rural areas saw severe drops in the number of employed, irrespective of the level of social interaction required on the job. Similar patterns are found for both critical and non-critical occupations in this group. Employment in non-teleworkable occupations in towns and suburbs was the least affected.

Teleworkable occupations suffered less than non-teleworkable ones, but the reduction of employed in these occupations seems higher in rural areas. Notably, the reduction in the number of employed in teleworkable occupations requiring low social interaction was negative and consistent in rural areas (-8% and -5.9% in 2020 Q2 and Q4, respectively, and -4.4% annually), while employment for this occupational category even increased in urban areas. Finally, teleworkable occupations with high social interaction, that generally saw an increase in employment, recorded a more marked increase in the number of employed in cities and towns, while it remained stable in rural ones.

Finally, groups such as the young, low-educated workers and, in some countries, women have been the most affected by the COVID-19 crisis from an employment perspective ([212]). These groups have been affected to different degrees in rural and urban areas; preliminary studies find that the drop in employment for the young and the low-educated was relatively higher in cities ([213]).

([212]) Although evidence is still scarce, cross-border and frontier workers are likely to have been particularly at risk from an employment perspective due to border closure and other limitations to people and workers' freedom of movement.

([213]) Königs and Vindics (forthcoming).

Table 3.1
Job losses are more concentrated in rural areas across all employment categories
Employment by occupational category, thousands of workers, degree of urbanisation, EU26

Categories / Critical occupations	Degree of urbanisation	Employed (000)		Change (%)		
		2019	2020	Q2	Q4	Annual
Total	Cities	61,022	60,528	-3	-0.5	-0.8
	Towns and suburbs	47,055	47,249	0	1.1	0.4
	Rural areas	41,373	39,738	-6	-5.2	-4
	Total	149,970	147,999	-2.8	-1.2	-1.3
Not teleworkable, high social interaction	Cities	15,443	15,032	-4.4	-3.3	-2.7
	Towns and suburbs	11,663	11,518	-2.1	-1	-1.2
	Rural areas	9,365	8,913	-6.7	-7.6	-4.8
	Total	36,590	35,574	-4.2	-3.6	-2.8
Not teleworkable, low social interaction	Cities	19,781	19,193	-5.9	-3	-3
	Towns and suburbs	20,410	20,320	-1.2	0.2	-0.4
	Rural areas	21,951	20,941	-6.2	-5.6	-4.6
	Total	62,377	60,688	-4.3	-2.8	-2.7
Teleworkable, high social interaction	Cities	15,258	15,420	-0.7	2.1	1.1
	Towns and suburbs	8,987	9,156	2.4	2.1	1.9
	Rural areas	6,221	6,218	-2.6	0.3	-0.1
	Total	30,576	30,898	-0.1	1.7	1.1
Teleworkable, low social interaction	Cities	10,541	10,884	1.2	4.4	3.3
	Towns and suburbs	5,996	6,255	4.5	7	4.3
	Rural areas	3,836	3,667	-8	-5.9	-4.4
	Total	20,427	20,838	0.5	3.3	2
Critical	Cities	24,333	24,222	-2.4	0.3	-0.5
	Towns and suburbs	19,449	19,668	0.8	2.3	1.1
	Rural areas	19,733	19,133	-4.2	-4.5	-3
	Total	63,717	63,202	-1.9	-0.6	-0.8
Non-critical	Cities	36,690	36,306	-3.4	-1.1	-1.1
	Towns and suburbs	27,606	27,581	-0.5	0.3	-0.1
	Rural areas	21,640	20,605	-7.6	-5.8	-4.8
	Total	86,253	84,797	-3.4	-1.7	-1.7

Note: The extraction does not taken into account Germany due to data reliability issues. Moreover, caution in the interpretation is needed as a shift in the classification of Italian municipalities that can affect the degree of urbanisation in Italy was implemented in 2020 Q2.
Source: Calculations by the European Commission's Joint Research Centre based on a Eurostat special extraction on EU-LFS data for 2019 and on indexes produced in Sostero et al. (2020).
Click here to download table.

3.2. The impact of COVID-19 on the regional economies ([214])

The COVID-19 pandemic has caused an unprecedented health crisis worldwide resulting in a severe recession. This was reflected also in negative sentiment as shown by *Box 3.2* ([215]).

The availability of data at territorial level face a significant delay. In this context, the RHOMOLO ([216]) model has been used to simulate the impact of the

([214]) This section is based on the contribution provided by Andrea Conte, Stylianos Sakkas and Simone Salotti (European Commission's Joint Research Centre).

([215]) The results presented in this box are an extension of van der Wielen and Barrios (2021) provided by the European Commission's Joint Research Centre.

([216]) A detailed description of the RHOMOLO model can be found in Lecca et al. (2018).

crisis at regional level, using updated information at the national level contained in the Spring 2021 European Economy Forecast [217], as well as in national account databases [218]. The model relies on a combination of supply and demand shocks in order to assess the effects of the pandemic, first at the national level and in turn at the regional level (see the *Box 3.3*).

[217] The European Economic Forecast is produced by Directorate-General for Economic and Financial Affairs.

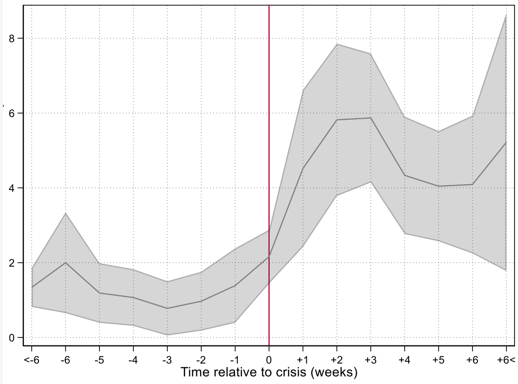
[218] AMECO.

Box 3.2: Economic sentiment during the COVID pandemic: evidence for EU regions

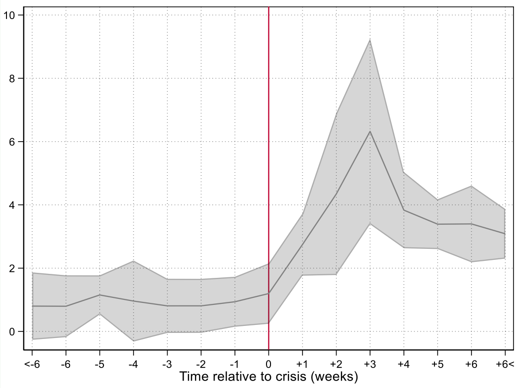
Economic sentiment [1] captures economic agents' views of future economic developments, which at the same time may drive the economy because they influence agents' decisions today. These views may reflect rational arguments and facts but also a mood of optimism or pessimism [2].

One way of measuring sentiment is using Google Trends data [3]. Google search data are available in near real-time, in various frequencies up to the daily level [4], and have been shown to track well variables such as (un)employment, consumer behaviour and inflation. This box summarizes the results of a EU panel covering business cycle, labour market and consumption related search queries for the days in January through April 2020 [5]. Internet search data are available in real-time, allowing policymakers to observe shifts as they arise. Furthermore, these non-traditional data have been show to track well actual unemployment and consumption, and possibly, cover aspects of consumer sentiment not captured by traditional surveys.

Figure 1: Impact on search intensity in weeks around the start of the pandemic – EU countries



(b) Unemployment



Internet search data document a substantial change in people's economic sentiment for the worse in the months following the coronavirus outbreak [6]. As the pandemic hits European countries, a significant increase in recession-related searches is observed (see Figure 1). People actively googled more for information on recession, unemployment and unemployment benefit related terms. This was a troublesome harbinger, since real GDP growth and real growth in consumption and imports were found to be significantly lower in quarters following increases in such searches [7]. Moreover, the ensuing shift in sentiment was significantly more outspoken in those EU countries hit hardest in economic terms. As these countries labour market conditions were often already less favourable at the onset of the crisis, there is a risk of a widening gap between EU Member States.

Note: The plot shows the marginal impact on the intensity of recession and unemployment related queries (and their 95% confidence intervals) by week, relative to the arrival of the virus in a country (>3 cases), as estimated by a difference-in-difference model. The model is estimated on the daily normalised series for the EU, includes panel and time effects and uses cluster-robust standard errors. Source: van der Wielen and Barrios (2021), European Commission's Joint Research Center

(1) The results presented in this box are an extension of van der Wielen and Barrios (2021).

(2) Nowzohour and Stracca, 2020, page 691.

(3) The Commission traditonal economic sentiment indicators are based on the Business & Consumer Surveys. https://ec.europa.eu/info/business-economy-euro/indicators-statistics/economic-databases/business-and-consumer-surveys_en

(4) The European Commission's Economic Sentiment Indicator is available at the end of each month.

(5) For each query, the Google Trends platform generates a measure of search intensity scaled from 0 to 100, with 100 representing the highest proportion among the queried terms within a selected region and time frame. Seven-day moving averages are used to rid the series of day of week effects. In addition, the search intensity covered by the series is normalised using the mean search intensity prior to the surge of the coronavirus in each country.

(6) van der Wielen and Barrios (2021) also observe a significant, coinciding slowdown in labour markets and (durable) consumption. The shift in economic sentiment during the first wave of the COVID-19 pandemic is similar or more intense than during the Great Recession of 2007-2009. This is especially the case for unemployment-related sentiment. This conclusion is in line with survey-based sentiment indicators for the EU. For example, in April 2020, the Economic Sentiment Indicator reached its lowest value on record.

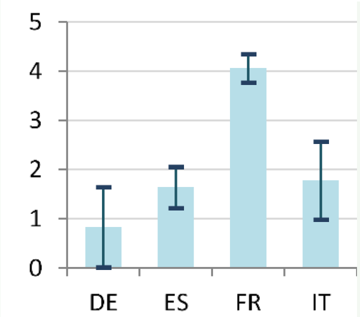
(7) Fetzer et al., 2020.

(Continued on the next page)

Box (continued)

The EU-panel is complemented with regional, sentiment-based internet searches in the four largest EU economies to highlight important inter-regional differences (8). The four large economies show substantial differences in terms of unemployment-related sentiment following the inception of the pandemic (Figure 2). While unemployment-related searches are significantly higher for each of the four Member States, the increase in search intensity (relative to the baseline) is substantially higher for France. Smaller (i.e. about half), yet similar patterns can be observed when focussing on changes in unemployment benefit searches only.

Figure 2: Change in unemployment searches upon arrival of the pandemic



Note: The plot shows the factor of change in the search intensity, relative to the mean search intensity before the COVID-19 outbreak (normalized to 1) and its 95% confidence interval. The effect is estimated using a panel fixed effects model including panel and time fixed effects and cluster-robust standard errors.

Source: van der Wielen and Barrios (2021), European Commission's Joint Research Center

The shift in economic sentiment at the national level show substantial differences across regions (Figure 3). Looking at the relative search intensity in the two months following the outbreak of the pandemic, the number of negative sentiment-related searches surges in each region. Some regions, however, show markedly larger shifts in their sentiment. For example, in Spain, unemployment queries in Murcia increased by 44% following the outbreak of the pandemic, but more than doubled in the Community of Madrid. Similar high surges in unemployment related searches are notable in the regions surrounding the French and German capitals.

While there is no one-to-one relationship between all the indicators of a region, some trends do appear (9). The German regions of Mecklenburg-Vorpommern, Saarland and Bremen, for instance, consistently are among the regions with the highest relative intensity of searches related to recession, unemployment, unemployment benefits and short-time work schemes in Germany. It is noteworthy that these three regions also portrayed regional unemployment rates above the German average before the pandemic. For France, on the other hand, Corsica stands out with the highest relative increase in terms of unemployment searches and second highest increase in unemployment benefit queries. For Italy, the regions of Trentino-South Tyrol, Umbria and Friuli-Venezia Giulia stand out.

Finally, the data show clear spikes in queries for specific wage compensation schemes, such as the Cassa Integrazione Guadagni (CIG) in Italy, Kurzarbietergeld in Germany and the ERTEs (*expedientes de regulación temporal de empleo*) in Spain. For example, the largest increases in relative search intensity of these terms are recorded in the highly tourism dependent Canary Islands. Moreover, for those Member States with short-time work schemes (STWs) in place before the pandemic, the increases in searches are substantially larger than those observed during the 2008 crisis. Nevertheless, the introduction or extension of STWs does not seem to have eased economic sentiment relative to countries without such schemes; although there is suggestive evidence that during the 2008 crisis countries with STWs in place had less unemployment-related concerns (10).

(8) The regional panel covers Germany at NUTS 1 level and Spain, France and Italy at NUTS 2 level.

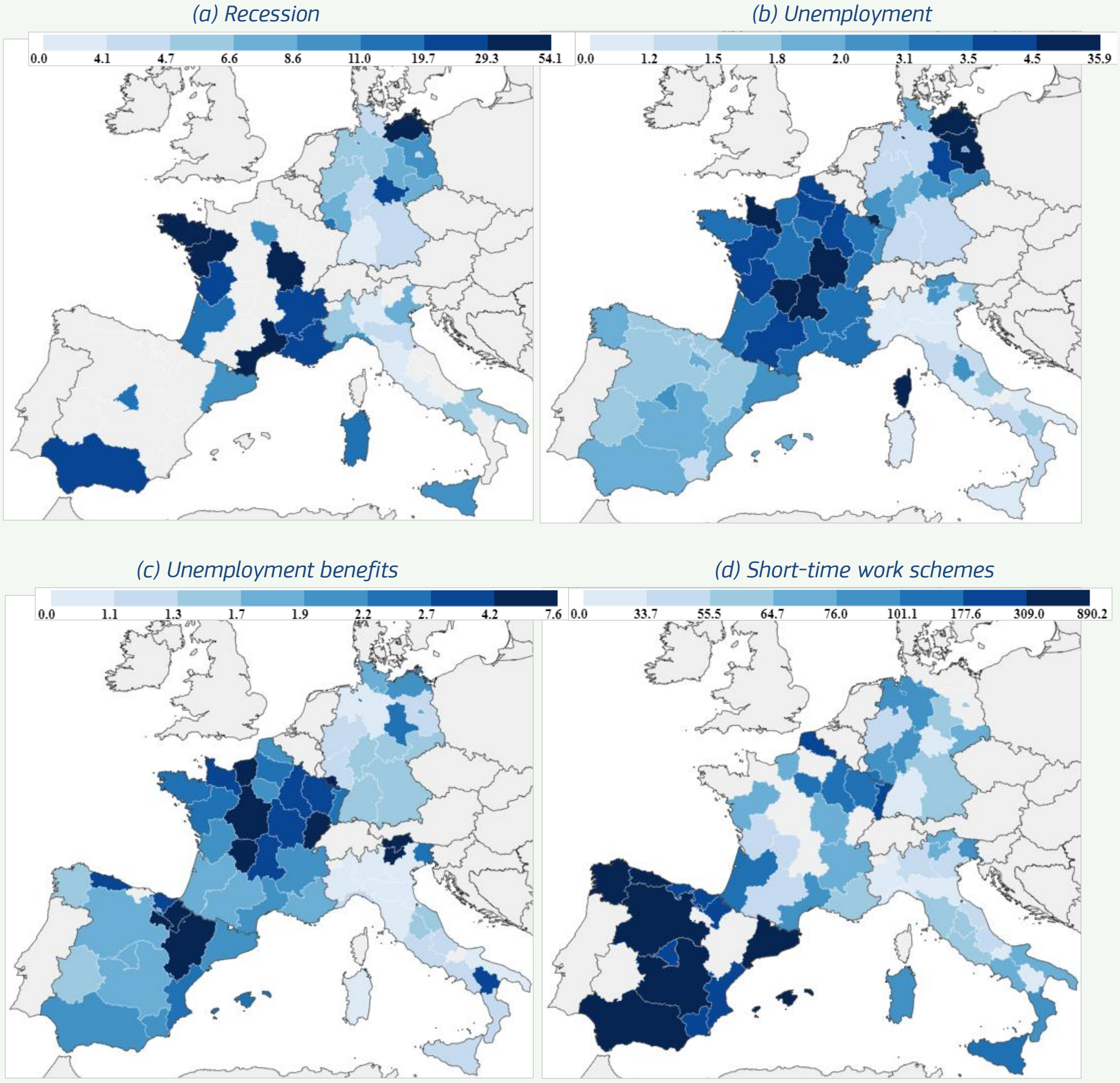
(9) The relative differences in intensity of the health crisis do not manage explain all regional variation. For example, in Spain, while recession-related searches increased tenfold in the relatively hard hit Madrid and Catalonia during the first wave, even stronger concerns were recorded for Andalusia (less hit by the first wave of the health crisis).

(10) van der Wielen and Barrios (2021).

(Continued on the next page)

Box (continued)

Figure 3: Regional post-COVID search intensity relative to the intensity before the COVID-19 outbreak



Note: The figure reports the search intensity in the two months following the outbreak of the pandemic relative to the mean search intensity before the COVID-19 outbreak (normalized to 1). The regional panel covers Germany at NUTS 1 level and Spain, France and Italy at NUTS 2 level. Regions are grouped into different colours by quantiles. The Italian regions of Bolzano and Trentino are pooled due to data limitations. Regions with insufficient observations are excluded.

Source: European Commission's Joint Research Center

References

Fetzer, T., Hensel, L., Hermle, J., and Roth, C. (2020). Coronavirus perceptions and economic anxiety. *The Review of Economics and Statistics*, forthcoming, https://doi.org/10.1162/rest_a_00946.

Nowzohour, L., and Stracca, L. (2020). More than a feeling: Confidence, uncertainty, and macroeconomic fluctuations. *Journal of Economic Surveys*, 34(4), 691–726.

van der Wielen, W. and Barrios, S. (2021). Economic sentiment during the COVID pandemic: Evidence from search behaviour in the EU, *Journal of Economics and Business*, forthcoming, https://doi.org/10.1016/j.jeconbus.2020.105970.

The RHOMOLO model simulates the impact of COVID-19 at regional level. The simulation takes into account the various lockdown measures implemented by the Member States, which are factored in the European Economy Forecast.

The spatial and sectoral configuration of the model allows assessment of the territorial impact of the crisis. The initial focus is on the EU-wide impact. *Figure 3.8* reports the country-level results, where 2020 GDP is reported as percentage change from 2019. The country-level results fall close to the national GDP growth figures for 2020 as reported in the Spring 2021 European Economic Forecast. They show an increasing intensity of the impact going from North to South. The added value of RHOMOLO lies in its regional dimension. As *Figure 3.9* shows, the different initial endowments and economic characteristics of the regions lead a heterogeneous response to the negative shocks designed to mimic the effects of the COVID-19 crisis.

There is considerable within-country variation in terms of GDP impact of the COVID-19 shocks. The uneven effects are particularly evident in countries such as Spain, Italy, France, and Finland, where the map shows a broad range of colours, representing the different magnitudes of the impact (*Figure 3.9*).

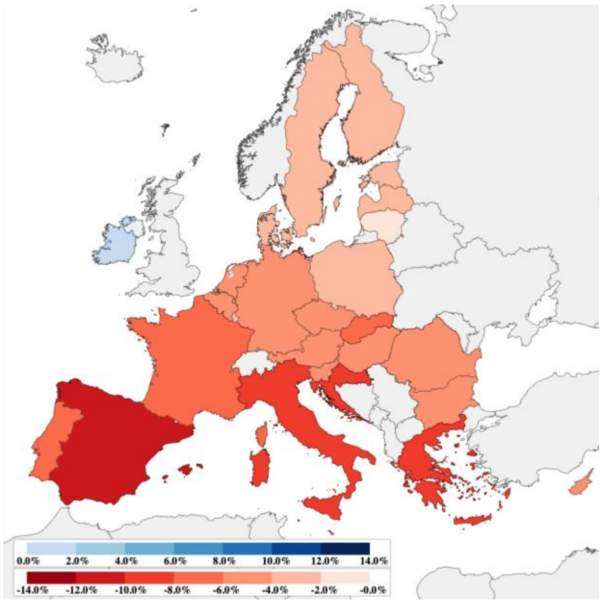
The simulated impact of the pandemic on regional GDP is on average (unweighted) -5.66%, with a standard deviation of 2.53. At the same time, the model estimates that employment declines by -5.02% (which is higher that the one predicted by the Spring 2021 European Economic Forecast), with a standard deviation of 2.62, implying a reasonable variation in results across the EU. Looking at the employment impact, it is important to keep in mind that no employment support policies such as short-term work schemes have been explicitly modelled. In other words, compared to real outcome, employment would have fallen far more without the public intervention.

Across most of the EU, the policy reaction alleviated the adverse effects of the crisis.

Figure 3.8

Following COVID-19 shocks, between-countries differences in GDP impact are significant

GDP impact at national level in 2020



Source: European Commission's Joint Research Centre

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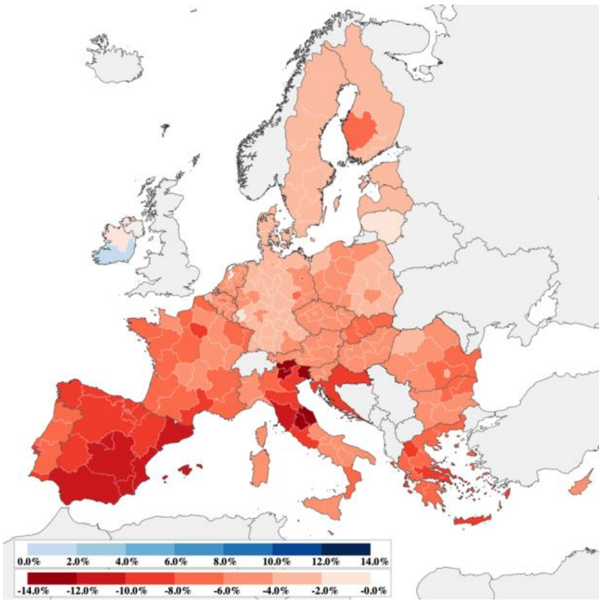
Figure 3.9

Within-country variation in terms of GDP impact of the COVID-19 shocks is considerable.

GDP impact at regional NUTS 2 level in 2020



Source: European Commission's Joint Research Centre

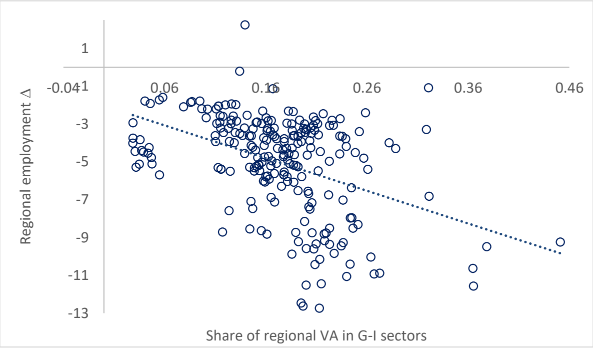
Click here to download figure.

As expected, GDP losses are highly correlated to declines in employment. In order to further explore the impact of the current crisis on employment, the results of the model provide insights on what drives GDP and employment losses related to the COVID-19 crisis. *Chart 3.4* plots the changes in regional employment (on the vertical axis) against the VA share in sectors G-I (Wholesale and retail trade, transportation, and accommodation).

Chart 3.4

Regions based on tourism-related services sectors had bigger employment losses

Correlation between changes in regional employment and share of VA in sectors G-I (2020)



Source: European Commission's Joint Research Centre

Click here to download chart.

This correlation shows that the larger the regional share of VA in service sectors providing accommodation and physical retail, the bigger the loss in employment. This exercise investigates the economic impact of the COVID-19-related lockdown measures (national averages), where the territorial effects vary in terms of magnitude due to the specific characteristics of the various regional economies of the EU. The combination of national adverse shocks and the specific characteristics of the various regional economies of the EU results in wide regional heterogeneity in the GDP impact of the crisis. For instance, regions where jobs and VA are largely concentrated in tourism-related services sectors will experience larger job disruptions. Moreover, regional trade integration and sector specialisation may be conducive to substantial divergent effects of apparently similar neighbouring regions. The results show that the COVID-19 crisis exerts uneven effects across EU regions. This has important implications for the EU policymakers designing recovery plans and measures, notably to support the economies that were hit hard by the economic shocks related to the COVID-19 pandemic and the resulting lockdown measures.

3.3. Determinants of regional vulnerability to the COVID-19 shock

The analysis investigates the role of structural characteristics of (NUTS 2) regions and how these relate to the impact of shocks on regional economies and job markets. The analysis looks beyond the general dependence on retail and tourism, which became evident during the Covid-19 crisis. The EU's NUTS 2 regions are clustered around 26 variables describing the regions' structural characteristics (see *Table 3.2*), which have been reduced to six major **structural (principal) components** (factors). The aim of this analysis is to identify the core structural characteristics of a region, which make on the one hand the economy more or less vulnerable to the major adverse shock that occurred in 2020 and 2021 and on the other hand the labour market more or less resilient with respect to a shock (of a given magnitude).

Table 3.2 ([219]) shows the respective correlations between the factors and the original variables, also called 'factor loadings' ([220]). On this basis, the six factors can be characterised as follows:

Higher incomes through good (labour) earnings: this factor is positively correlated with regional GDP per capita, earnings, and household income. Additionally, in regions scoring high on this factor have many well-qualified people work in fast-growing health and care sectors and/or as (well-paid) scientists and other highly-skilled professionals.

Highly-[well] performing industrial labour markets: regions scoring high on this factor exhibit high employment rates and low unemployment. NEET ([221]) rates tend to be lower and the significance of manufacturing is higher in these regions.

Centres of economic output with large labour markets: this factor is linked to the levels of regional GDP and employment. These variables are included to control for the size of a region's economy and its labour market.

Human capital driving investment and growth: regions scoring high on this factor tend to have more workers in innovative technology- and knowledge-intensive sectors, favouring economic growth.

Weak[er] education outcomes: the factor is negatively correlated with the share of post-secondary and highly educated people, while the number of school-dropouts is higher.

Dependence on tourism: the economies of regions scoring high on this factor feature high reliance on the tourism sector, as measured by nights spent in tourist accommodations.

([219]) The factor extraction makes use of these correlations and is done so as to maximise the correlation of a factor with certain original variables while minimising the correlation with other variables.

([220]) Factor Loadings below 0.25 are suppressed.

([221]) NEET: Neither in Employment or in Education or Training.

Box 3.3: RHOMOLO model

The simulations are carried out using RHOMOLO, a numerical-spatial general equilibrium model based on regional account data and a set of estimated bilateral trade flows and intermediate shipments that are consistent with national accounts. The model covers EU NUTS 2 regions disaggregating all economies into 10 NACE Rev.2 sectors ([1]).

Following standard practice in macroeconomic modelling, a scenario is built to mimic the effects of the COVID-19 crisis by introducing multiple adverse shocks at the same time ([2]). Initially, thanks to the availability of country-specific information, all the shocks introduced in the model have been calibrated to reflect specific national economic conditions in terms of GDP changes as depicted by the latest available macroeconomic data for 2020. In particular, the same shock is applied to all regions of a country. The model framework assumes that the macroeconomic transmission channels associated with the COVID-19 pandemic are both of demand and supply nature, as summarised in Table 1.

Table 1 - Scenario shocks in RHOMOLO in 2020 (EU average)

Labour supply shock
1.9% reduction in workforce
Demand shocks
The risk premium increases by 200 bps (uncertainty shock)
Reduction of private consumption in the following sectors: G-I (9.4%); and R-U (-5.7%)
Reduction of exports to the rest of the world (-9.5%)

([1]) For additional details on this simulation exercise, see the TERRITORIAL DEVELOPMENT INSIGHTS SERIES - JRC125536, July 2021 (European Commission's JRC).

([2]) One important difference with the previous RHOMOLO analysis on the COVID-19 crisis (Conte et al., 2020) lies in the asymmetric and country-specific nature of the shocks.

Table 3.2
Factor analysis: The principal components (factors) explaining regional structural characteristics
Six factors extracted from 26 original variables related to regional economy, labour market structure, skills & education, dependence on tourism, transport; 2019 or last available year – factor loadings

Original variables	Six rotated components						Variance explained by factors (*)
	Higher incomes through good (labour) earnings	**Highly-[well] performing industrial labour markets**	**Centres of economic output with large labour markets**	**Human capital driving investment and growth**	**Weaker education outcomes**	**Dependence on tourism**	
nominal GDP per capita	0.31						82%
wage level (labour compensation per employee)	0.37						89%
household income	0.34						92%
employment : NACE M and N (professionals, scientific etc)	0.27						79%
employment: NACE O to Q (administration, health & care	0.32						73%
average hours of work in main job	-0.30						74%
participation in LLL	0.31						67%
employment rate by sex, age		0.38					84%
unemployment rates by sex, age		-0.44					85%
NEET rates		-0.34					81%
ratio employees, Manufacturing/total		0.39					84%
nominal GDP (abs.)			0.61				92%
employment (abs.)			0.66				92%
real growth rates of Value Added				0.61			70%
employment in technology and knowledge-intensive sectors				0.48			77%
gross fixed capital formation				0.27			42%
tertiary education				0.28	-0.34		82%
share medium education		0.36			-0.27		77%
early school leavers		-0.31			0.43		75%
victims in road accidents							73%
transport: Density of lorries (no. of lorries per EUR of GDP)							79%
nights spent at tourist accommod. Establish. – hotels						0.69	78%
capacity of collective tourist accommod.: Number of hotels						0.48	47%
car density per inhabitant						0.28	35%

Note: Factor loadings indicate the correlation between the extracted factor and the original variable. Factor loadings below 0.25 are suppressed.
(*) indicates the cross-regional differences in the original variables that can be explained by the six factors.

Source: Commission services based on Eurostat data (various sources).

In addition, the following two factors, provided by the RHOMOLO-model, are used to describe how the economy (GDP) and labour market (employment) would be affected by the COVID-19 crisis in 2020-2021:

Resilience to the COVID-19 shock (shock-resilience dimension): the average change of GDP during 2020 and 2021 as projected by the RHOMOLO model.

Labour market elasticity to the COVID-19 shock (labour-market performance dimension): the average GDP change, relative to the average change of employment during 2020 and 2021 as projected by RHOMOLO.

The correlations among all those factors shed a light on the regional determinants of the decline in economic activities during the crisis and the vulnerability of labour markets.

Labour markets that were performing well before the crisis are linked with lower risk of substantial economic decline. Each dot in the *Charts* represents one of the 240 NUTS 2 regions. The colour/shape of the dot signals the cluster to which each region has been assigned (see *Table 3.3* and Annex 3.2).

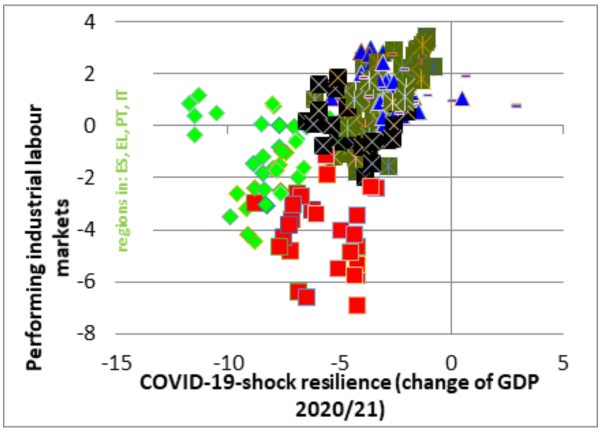
Table 3.3
The six clusters of regions

	Cluster	Typology	Characteristics
	Southern 1	Structurally weak regions	Least performing labour markets, low availability of human capital, high labour market elasticity to adverse shocks
	Southern 2	Regions sectorally vulnerable to shocks	Lowest shock-resilience, high dependence on tourism
	Transition 1	Shock-resilient transition regions	Better shock resilience, performing labour market
	Transition 2	Low income transition regions	Lowest earnings/incomes, smaller regions
	Established	High income regions	High earnings/incomes, better shock-resilience
	Metropolitan	Highest income, lowest vulnerability	Highest earnings/incomes, high dependence on tourism, performing labour markets, larger regions, best availability of human capital, high knowledge-intensive growth, lowest incidence of poor educational outcomes

Note: There is no link between the two clusters labelled as “Transition” and the official definition of “regions in transition” adopted by the EU.
Source: Commission services based on Eurostat data (various sources)

Chart 3.5 plots the factor scores on the shock resilience dimension against the “well performing industrial labour markets” factor. There is an evident positive link between the two. The cluster represented by the red squares (‘Southern 2’) is characterised by particularly high structural unemployment before the COVID-19 crisis. These regions tend to exhibit both low resilience to the shock and weak labour-market performance.

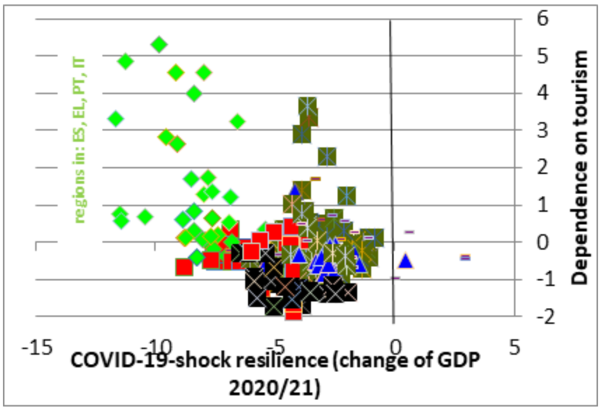
Chart 3.5
Economic shocks tend to be less profound in regions with structurally healthy labour markets
Performing labour markets and GDP resilience



Source: Commission services based on Eurostat data (various sources)
Click here to download chart.

Strong dependence on tourism increases exposure to this particular crisis. Green dots in *Chart 3.6* represent regions of the Southern cluster in Spain, Greece, Portugal and Italy, where the tourism sector plays a more dominant role than elsewhere.

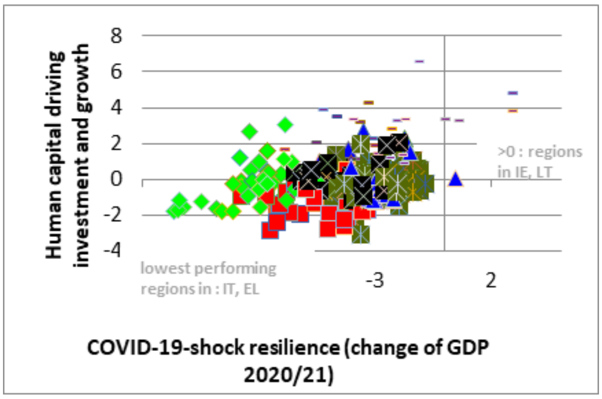
Chart 3.6
Structural dependence on the tourism sector makes for high vulnerability to the COVID-19 shock
Tourism and GDP resilience



Source: Commission services based on Eurostat data (various sources)
Click here to download chart.

Resilience against the COVID-19-induced GDP decline is higher in innovative regions with larger shares of well-qualified workers. High human capital strengthens a region’s innovative potential, enabling workers to engage in knowledge-intensive activities. Such regions tend to be more resistant to economic downturns (*Chart 3.7*).

Chart 3.7
Low-growth, low-human-capital regions tend to be more vulnerable to the COVID-19 shock
Human capital and GDP resilience



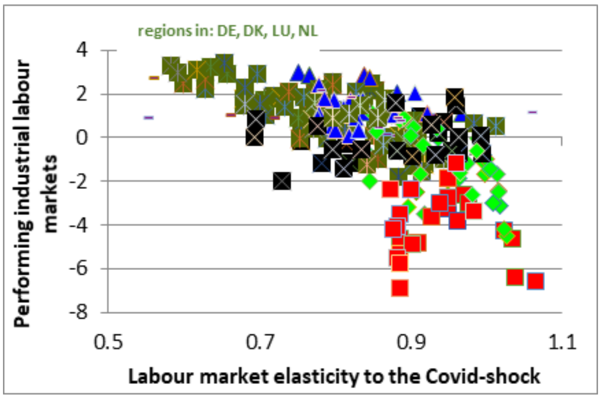
Source: Commission services based on Eurostat data (various sources)
Click here to download chart.

Well performing labour markets are better protected against the economic downturn. *Chart 3.8* shows a clear negative link between well-performing regional labour markets and regional GDP contraction (as simulated through the RHOMOLO model). In well performing regions in the centre of the EU, employment is relatively high with a significantly lower employment elasticity of the (negative) GDP change. That is, any given GDP change would lead to a lower reduction of employment in those regions. This is also due to the fact that the Member States where such regions tend to be located have comparably generous Short-Time Work Schemes in place. However, significant within-country variability across regions indicates that structural region-specific characteristics play a decisive role.

Chart 3.8

Structurally healthy regional labour markets are better protected against the COVID-19 shock

Performing labour markets and labour market resilience



Source: Commission services based on Eurostat data (various sources)

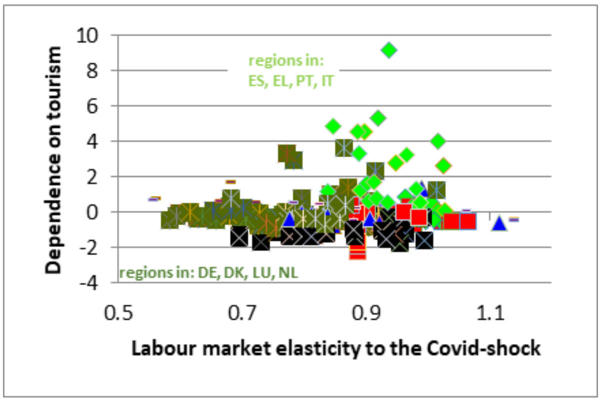
Click here to download chart.

Structural dependence on tourism increases the labour market reaction to the economic shock. The high dependence of the Southern European cluster (light green diamonds) on the tourism sector renders these regions more vulnerable to shocks. In addition, labour markets can be less well protected against the shock of a given magnitude (Chart 5).

Chart 3.9

Strong dependence on tourism reduces the effectiveness of labour-market shock absorbers

Tourism and labour market resilience



Source: Commission services based on Eurostat data (various sources)

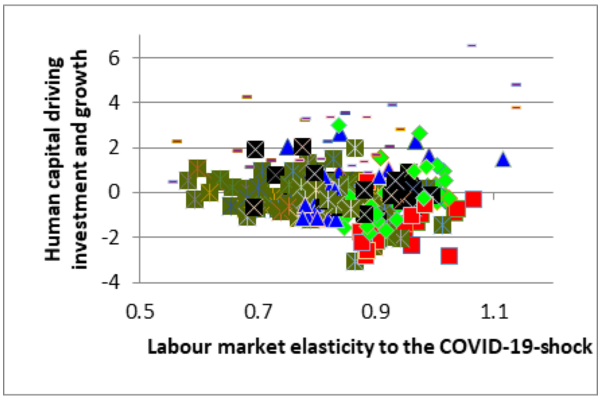
Click here to download chart.

The link between (pre-crisis) growth and a region's capacity to absorb economic shocks on the labour market is less clear. This finding reflects the fact that a number of Southern and Eastern European regions with high economic growth rates (typically reflecting innovative economies with highly-qualified workforces) were not able to safeguard their labour markets from the impact of the COVID-19-crisis.

Chart 3.10

No clear link between human capital and the impact of the shock on the labour market

Human capital and labour market resilience



Source: Commission services based on Eurostat data (various sources)

Click here to download chart.

3.4. The regional resilience and its drivers

Resilience is a concept, derived from biology, referring to the recovery capacity and adaptation properties of a system. It can be defined as the resource or capability of a system or entity to cope with complex contingencies due to internal and/or external shocks. In other words, it is the capacity to react under conditions of stress and change ([222]). From a more social perspective, the European Commission defines resilience as the ability to absorb shocks without harming sustainable societal well-being ([223]). From an operational point of view, it is possible to see the reaction of each region to the COVID-19 crisis, for example in terms of GDP change, as an indicator of its resilience ([224]). The use of GDP change to measure the resilience is a common practice in the literature of applied economics and extensively used, for example, in the assessment of the regional resilience following the 2008 crisis ([225]).

In this light, RHOMOLO simulated data (GDP) are used as proxy for the response to shocks and to measure the resilience of the regions. Then, an econometric model analyses the main drivers and factors behind these dynamics as the result of regional features and human capital-endowments, total factors productivity (ESDE 2019), quality of local institutions, and economic structure. RHOMOLO simulates regional GDP for 2020 in terms of percentage change from 2019. These estimations represent the proxy for the regional resilience and are used as dependent variable (Res) in our econometric model:

$$Res_r = \beta_0 + \beta_1 TFP_r + \beta_2 HC_r + \beta_3 QoG_r + \beta_4 gdp_r + \beta_5 KSI_r + \beta_6 Pop_r + e_r$$

([222]) Limnios et al. (2014).

([223]) Manca, Benczur and Giovannini, 2017 (European Commission's Joint Research Centre).

([224]) It is also correct to remark that the size of initial exogenous shock was not the same for all the regions.

([225]) Among others, see Annoni, de Dominicis (2019); and Neysan Khabirpour (2019).

where the subscript *r* stands for region, TFP is the total factor productivity, HC is the quality of human capital (226), R&D is the intensity of expenditure in research and development, QoG (227) is the quality of government as proxy for the quality of institutions (228). All the explicative variables are at pre-COVID time (229) and, representing structural conditions, are used in the form of a three-year average (230).

Productivity (TFP), the quality of human capital, R&D and the quality of local institutions are drivers contributing to reducing the impact of negative shocks, as shown in *Chart 3.11*. Notably, using standardised coefficients, it demonstrates that the impact of the quality of human capital is the highest. Those results suggest that:

- There is a strongly significant and positive link between the quality of human capital and regional resilience. Highly educated workers face shocks better than less educated ones.

- High expenditures in R&D support regional resilience.

- Regional systems characterised by a high level of efficiency (TFP) provide a prompt reaction to a shock.

- High quality of local institutions ensures an effective reaction to the shocks and higher regional resilience.

- The industrial specialisation (KSI) in certain industries tends to increase the regional resilience.

(226) Human capital is calculated computing the number of the schooling years based on the level of formal education according to the International Standard Classification of Education (ISCED) system.

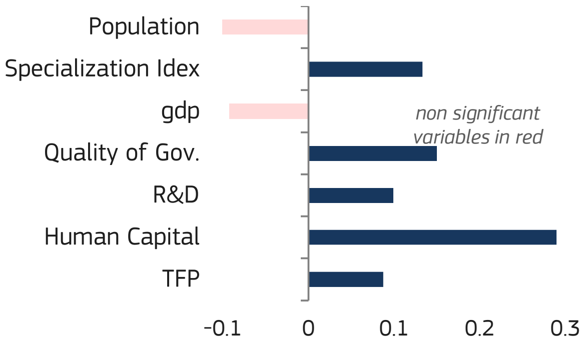
(227) QoG is a composite indicator calculated from survey data (using subjective information) has three main sub-components 1) absence of corruption; 2) the strength of 'the rule of law' (impartiality); and 3) government effectiveness, voice and accountability (quality of public services) as perceived by the respondents. For further details, see Charron, Dijkstra and Lapuente (2014); and Charron, Lapuente and Annoni (2019).

(228) The econometric specification also controls for the regional differences in terms of GDP per capita (gdp), sectoral composition of the economy (KSI: Krugman specialization index) and population (Pop).

(229) This also supports the assumption of exogeneity for the explicative variables with respect to the dependent variable.

(230) All data are from ESTAT with the exception of QoG (data source: European Quality of Government Index (EQI), 2017 edition, University of Gothenburg) and TFP, which is DG EMPL extension of the time series built by Cambridge Econometrics based on ESTAT data (see ESDE 2019).

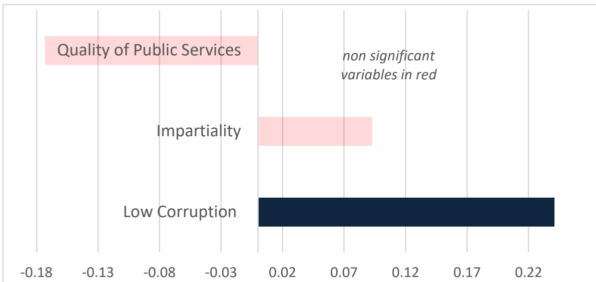
Chart 3.11
Human capital plays a key role
Drivers of regional resilience – standardized coefficients



Note: significance level 10%
Source: DG EMPL elaboration
Click here to download chart.

The disaggregation of Quality of Government into its three pillars highlights that low corruption in the administration contributes positively to regional resilience. The level of impartiality and the quality of public services appear to not be statistically significant in this analysis (*Chart 3.12*).

Chart 3.12
Low corruption in public services matters
The three pillars of Quality of Government– standardised coefficients



Note: significance level 10%
Source: DG EMPL elaboration
Click here to download chart.

Digitalisation also contributes positively to regional resilience. Introducing the degree of digitalisation (internet purchases abroad (231) and digital infrastructures (232)) into the model confirms the results of the basic model and highlights the strategic role played by digital infrastructures (*Chart 3.13*). One might expect that the higher the internet purchases in other countries (233), the lower the regional resilience, given that the former represents the propensity of the residents to buy outside their region. The digital infrastructure variable is the proportion of households with broadband access (H_broadband), in order to take into account both the internet coverage and its quality, which have a positive impact on regional resilience.

(231) The proportion, within each region, of internet users who have ordered goods or services from other EU countries during the last 12 months (nt_ord_EU).

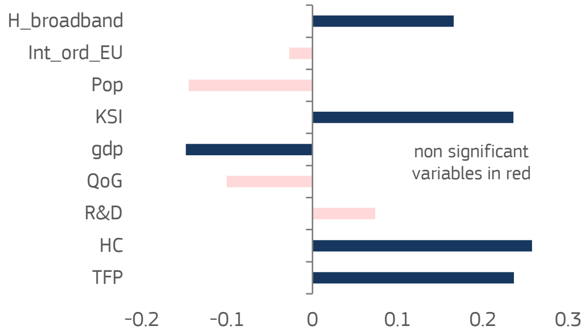
(232) The proportion of households using broadband infrastructures. (H_broadband).

(233) We have also to recognise that, for structural reasons, small countries have higher propensity to buy abroad than bigger ones.

Chart 3.13

Digital infrastructures support resilience

The extended model of regional resilience – standardised coefficients



Note: significance level 10%

Source: DG EMPL elaboration

Click here to download chart.

Given that the COVID-19 pandemic is a geographically localised phenomenon, it is useful to check for the presence of spatial effects. The econometric specification has been enriched including spatial effects for the dependent variable. In this way we account for the fact that each region is more exposed to spillovers coming from neighbouring regions. In fact, it seems reasonable to assume that a strong outbreak of the pandemic and a large economic impact in a region can affect nearby regions, because the economies are likely inter-linked. Estimations, presented in Annex 3.3, confirm both the previous conclusions and the spatial dimension of the economic impact.

3.5. Regions in digital and green transition

The impact and reaction of the regions to the COVID-19 crisis are further linked to the digital and green transitions. It seems clear that those processes present synergies and complementarities that should be exploited. At the same time the twin transition will play a strategic role to face present and future challenges, notably in terms of resilience, but not all the regions are at the same level and present different vulnerabilities.

3.5.1. The digital transition

Digitalisation is emerging as a key driver of future economic growth for EU countries and regions. The launch of the Skills Agenda in 2016 (234) with a focus on digital skills, the Digital Skills and Job Coalition, and the upcoming Digital Europe Programme indicate the importance attached to digital skills as a driver for creating, utilising and benefitting from digital technologies. Building on this, the 2020 European Skills Agenda (235) designs a five-year plan to strengthen sustainable competitiveness, ensure social fairness, realise the first principle of the European Pillar of Social Rights, and build resilience to crises. Furthermore, 20% of the Recovery and Resilience Facility allocations are earmarked to support the digital transition increasing productivity, developing the skills of workforce, enhancing the innovation and research and helping creating jobs.

The COVID-19 pandemic has had an impact on the speed of digitalisation, transforming the manner and location of work. Moreover, given the nature of COVID-19, the impact on industries is uneven and often persistent. These characteristics imply that the adverse labour market shock will differ among countries and, within countries, among regions. In this light, it is important to assess the digital skills of regional employment provided by the EU Labour Force Survey. The digital tasks within each occupation have been assessed in order to construct a digital index based on effective employment matching the European Digital Competence Framework (DigComp) (236), ESCO (237) and ISCO classifications (238).

An indication of the digital skills intensity in selected occupations is visible in *Table 3.4*, which shows the top five most digital skills-intensive occupations and five occupations requiring the least amount of digital skills.

(234) European Commission, 2016.

(235) https://ec.europa.eu/social/main.jsp?catId=1223

(236) See Vuorikari et al., 2016 and DigComp project (https://ec.europa.eu/jrc/en/digcomp).

(237) ESCO is the multilingual classification of European Skills, Competences, Qualifications and Occupations (https://ec.europa.eu/esco/portal/home).

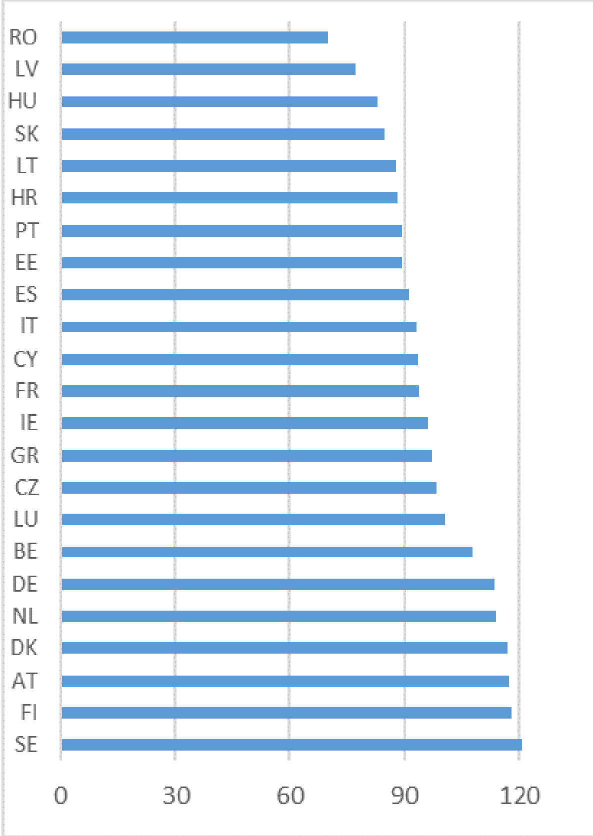
(238) The EU Labour Force Survey (EU-LFS) has been linked to the ESCO classification system ("European Skills, Competences, Qualifications and Occupations) by ISCO code at level of 3-digit. The European Digital Competence Framework (DigComp) is used to map the ESCO framework and then identify the digital skills within each ISCO occupation. See Annex 3.3 for further details on the assessed digital skills and the matching between DigComp and ESCO framework.

Table 3.4
Digital skills intensity for selected occupations at 3-digit ISCO level

Occupation at 3-digit ISCO level	Average skills intensity within occupation
Database and network professionals	2.2
Software and applications developers and analysts	1.8
Information and communications technology operations and user support technicians	1.4
Authors, journalists and linguists	1
Information and communications technology service managers	1
Locomotive engine drivers and related workers	0
Street vendors (excluding food)	0
Refuse workers	0
Mining and construction labourers	0
Domestic, hotel and office cleaners and helpers	0

Source: Barslund, 2021
Click here to download table.

Figure 3.10
Country level digital skills intensity (EU23 average = 100)



Source: Barslund, 2021
Click here to download figure.

Figure 3.10 **shows the ranking of countries according to the digital skills intensity of the labour market** ([239]). Average digital skills intensity in the labour market varies among EU countries. Sweden has the highest digital skills intensity at around 20 percent above the average level for the EU23 countries. Finland, Austria, Denmark, the Netherlands, and Germany also have substantially higher digital intensities than the EU average. Romania and Latvia have the lowest digitals skills intensive labour markets, both with less than 80 percent of the EU average. Among large countries, Italy, France and Spain are all just above 90 percent of the EU average. We can compare the ranking of digital skills intensity among EU countries with related rankings available as part of the European Commission's digital scoreboard ([240]). For individual digital skills the digital scoreboard has indicators for 'at least basic level of skills' and 'above basic level of skills'. Both indicators identify the same top six countries (among the countries covered by the digital intensity index), which are also shown by the digital skill intensity index. At the bottom end of the scale, Romania, Latvia and Hungary also have among the lowest scores on the two digital scoreboard indicators ([241]).

Figure 3.11 shows a weak convergence of digital skills-intensity **changes across countries.** Countries to the right of the vertical line (crossing at 100) presented in 2011 a digital skills intensity above average. On the vertical line there is the change in digital skills intensity measured in percentage points of EU23 average in 2011. Countries above the horizontal line have increased their digital intensities, constituting all except Ireland. The EU23 average is also indicated and has increased by around 6 percentage points from 2011-2018.

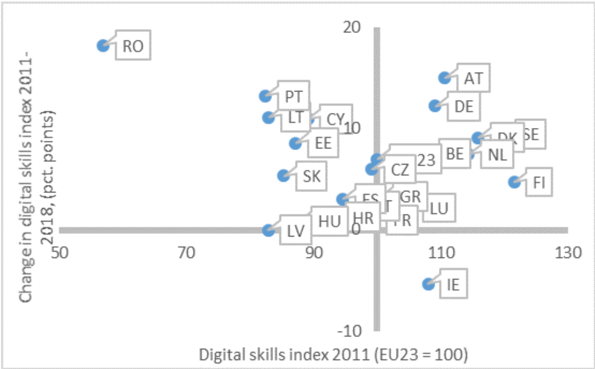
Countries with an already elevated level of digital intensity in 2011 – Sweden, Denmark, the Netherlands – experienced an above-average increase in digital intensity, Finland being the exception. Austria and Germany have become substantially more digital skills-intensive. Increases have been moderate for those countries in the middle of the distribution in 2011, in particular for Spain, Italy and France. Countries initially at the bottom of the distribution have tended towards having high growth in digital skills intensity – examples are Romania, Portugal, Lithuania, and Cyprus.

A clear downward sloping trend would have suggested that countries with a worse starting point would have higher increases in their digital intensity. However, it seems that the development is more U-shaped, and a comparison of the coefficient of variation also reveals little movement. For example, countries ranked first and last in improvement over time in 2011 are

([239]) Due to the lack of data at level 3-digit ISCO code, the index is not available for Bulgaria, Malta, Poland, and Slovenia
([240]) https://digital-agenda-data.eu/
([241]) European Commission, 2020b.

Romania (low score in 2011) or Austria and Germany (high score in 2011).

Figure 3.11
There are weak convergence in digital skills-intensity across countries
Change in the digital skills index in EU Member States, 2011-2018. (EU23)



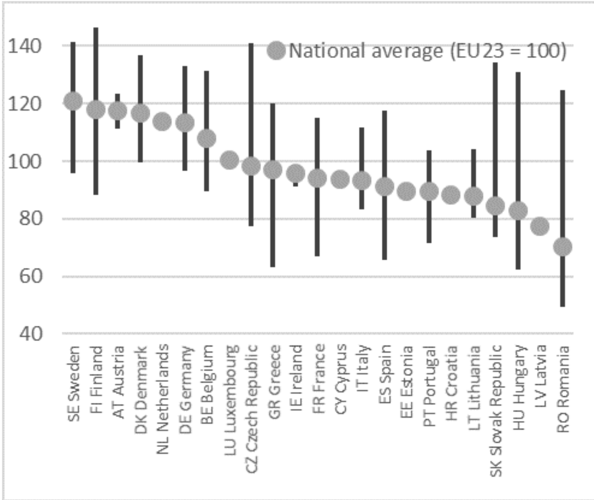
Source: Barslund, 2021
Click here to download figure.

The EU-LFS survey allows the computation of the digital skills intensity index by region, which represents an important complement to the set of indicators available at regional level.

There is significant variation within countries with many regions ([242])**,** as shown in *Figure 3.12*, both among countries with the highest and lowest national average scores. Within each country, with more than four NUTS 2 regions, there are regions with digital skill intensity above and below the EU23 average. In fact, Slovakia presents a standard deviation of 26.62, followed by Romania (23.54), Czechia and Finland (around 20 for both).

([242]) Netherlands, Germany and Austria are classified at NUTS 1 level because the lack of available information in the EU-LFS survey.

Figure 3.12
Within-country variability in digital skills index is relevant
Variability in digital skills intensity among NUTS 2 regions, 2018



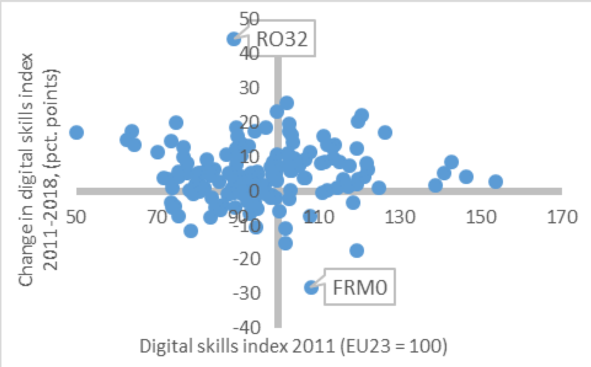
Note: The figure shows minimum and maximum digital skills intensities in the labour market at NUTS 2 regional level, and the national average for EU23 countries. NUTS 2 level information is missing for the Netherlands. Cyprus, Estonia, Luxemburg, and Latvia only have one NUTS 2 level area. For Germany and Austria, regional digital skills intensity refers to the NUTS 1 level (no information is available on NUTS 2).

Source: Barslund, 2021
Click here to download figure.

The intensity of digital skills is correlated with GDP per capita by region. Areas with the highest intensity of digital skills usually have the highest GDP per capita and are often located in regions around capital cities. This is the case in Sweden, Finland, Denmark and Germany (NUTS 1) – countries with a high average national digital skills intensity – but also in Romania, Hungary and Slovakia. One exception is Belgium, where the area around Brussels has a skills intensity of around the national average.

Unlike at country level, there is no sign of convergence among regions. In fact, the analysis of changes in the digital index from 2011 at regional level (*Figure 3.13*) shows that regions are rather closely clustered around the middle of the chart but that there are also outliers at both ends, as similarly observed in *Figure 3.12*. The estimated trend-line (not shown) is almost vertical. Only the four regions with the lowest digital skills intensity in 2011 (most leftward points) report an above-average increase.

Figure 3.13
There is no sign of convergence in digital skills index among regions
Change in the digital skills index across NUTS 2 regions, 2011-2018



Source: Barslund, 2021
Click here to download figure.

3.5.2. Climate change and green transition

The green transition is closely linked to regional features and vulnerabilities, notably in relation to climate change risks, as well as mitigation and adaptation needs. The interaction between social and climate dimensions comprises notably the direct health impacts of extreme climate events (including heatwaves, floods, and other extreme weather effects and natural disasters). It further includes labour market impacts of changing industrial structures in response to climate hazards, as well as potential job creation and destruction effects of climate change-induced infrastructure investment. The location-specific data sources used in this section include data on climate hazards (extreme temperatures, storms, wildfires, floods), with a focus on heatwaves, as well as insurance claims associated with climate-related damage, social indicators, and sectoral patterns.

These complex interlinkages of climate and socio-economic challenges, as well as the urgencies to address them, are at the centre of the European Green Deal. Previous ESDE reports assessed in more detail notably the employment, skills and social impacts of climate change. Based on the previous Peseta III studies, the 2019 ESDE edition ([243]) highlighted in particular the significant economic and social costs of inaction on environmental degradation and climate change. It also showed that there was widespread awareness among European citizens of the responsibility and urgency to act, despite concerns regarding the costs and distributional impacts that the transition may entail ([244]). The report concluded that inaction is not an option and that, for the EU's climate and energy strategy to succeed, social concerns and impacts need to be taken into account from the outset and, where needed, compensatory measures need to be part of the reforms.

Heatwaves are among the climate-related hazards that have considerably intensified in the past few decades. According to the PESETA ([245]) IV Technical report on heat and cold extremes in the EU ([246]), about 10 million Europeans are currently exposed to heatwaves each year. Health hazards associated with heatwaves are particularly sharp among the elderly and those with pre-existing medical conditions. Besides the direct health effects, heatwaves cause losses in labour productivity in a wide range of industries and occupations, especially in those which require outdoor physical activities, such as in the construction, tourism, agriculture, and fisheries sectors.

Heatwave-related challenges are not uniformly distributed across regions. Using data from the PESETA IV technical report aggregated at the NUTS 2 region-level, *Figure 3.14* presents the annual average share of the population exposed to heatwaves between 1981 and 2010. This share is particularly high in the South-Western and Eastern regions of Europe. Within regions, cities can form heat islands, leading to an even more elevated heat exposure to residents. Moreover, inhabitants of poorer neighbourhoods, that may lack parks and similar amenities, are at a particularly high risk.

The share of the population directly exposed to heatwaves is projected to grow more than tenfold. The PESETA IV Technical report examined three warming scenarios for global warming: 1.5°C, 2°C, and 3°C of increase in average temperature. The three scenarios correspond to an average increase in the share of the population exposed to heatwaves by 23, 40, and 67 percentage points. That means that even under the most optimistic, lowest warming scenario, the population share exposed to heatwaves is projected to grow more than tenfold, i.e. from about 10 million to 100 million individuals. In terms of annual fatalities, against the 3,000 lives lost annually at present, Europe may lose 30,000 to 100,000 people to heatwaves each year.

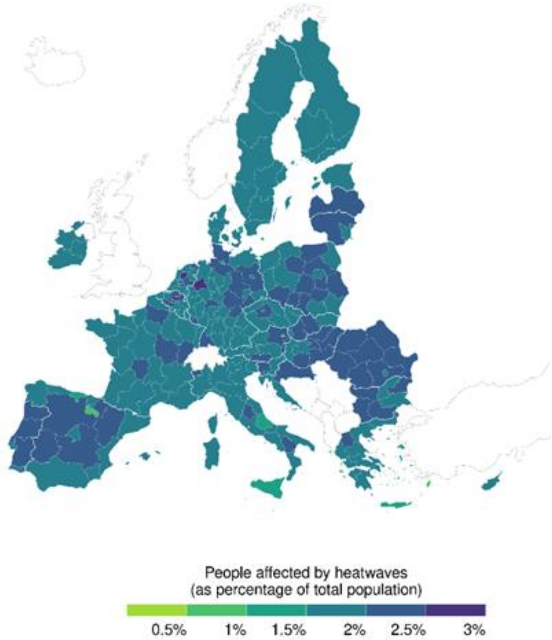
([243]) "Sustainable growth for all: choices for the future of Social Europe"; Employment and Social Developments in Europe (2019) review (http://ec.europa.eu/social/esde2019).

([244]) Recent studies show that environmental awareness has even increased because of the COVID-19 pandemic (e.g. Eliana Andréa Severo, Julio Cesar Ferro De Guimarães, Mateus Luan Dellarmelin: Impact of the COVID-19 pandemic on environmental awareness, sustainable consumption and social responsibility: Evidence from generations in Brazil and Portugal, Journal of Cleaner Production 286, 124947, 2021.

([245]) The PESETA project (European Commission's Joint Research Centre) aims to better understand the effects of climate change on Europe, for a number of climate change impact sectors, and how these effects could be avoided with mitigation and adaptation policies (https://ec.europa.eu/jrc/en/peseta-iv).

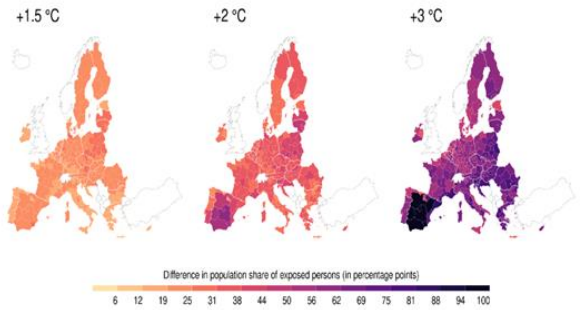
([246]) Naumann G. et al. (2020): Global warming and human impacts of heat and cold extremes in the EU. JRC PESETA IV project – Task 11 (https://ec.europa.eu/jrc/sites/jrcsh/files/pesetaiv_task_11_heat-cold_extremes_final_report.pdf).

Figure 3.14
South-Western and Eastern regions of Europe are more exposed to heatwaves
Share of population exposed to heatwaves between 1981 and 2010 (annual average)



Source: DG EMPL calculations based on data from the PESETA IV project.
Click here to download figure.

Figure 3.15
Poorer regions suffer bigger losses
Share of the regional population exposed to heatwaves in three different scenarios (Δ percentage point)



Source: DG EMPL calculations based on data from the PESETA IV project.
Click here to download figure.

Poorer regions with higher exposure are set to suffer bigger losses given their socio-economic vulnerabilities and the lack of resources needed for adaptation measures. *Figure 3.15* shows the percentage point differences in the share of the regional population exposed to heatwaves between the baseline scenario (no further increase in the average temperature) and the three warming scenarios ([247]). The maps point out that some of the regions that are predicted to experience the most dynamic growth in heatwave exposure are located notably in Spain, Romania, Hungary, Lithuania, and Latvia, which are also among those regions that already suffer from the highest exposure. Moreover, regression estimates based on NUTS 2 data have shown that on average one percent lower regional GDP per capita is associated with up to 0.1 percentage point higher share of exposed population. This shows the presence of an unfavourable, self-reinforcing relationship between the socio-economic and climate vulnerabilities, which needs to be taken into account in the design and implementation of both mitigation and adaptation policies.

The new European Climate Adaptation Strategy, published in February 2021, recognises such climate-social linkages. Notably, it calls for a climate resilience that is just and fair, "so that the benefits of climate adaptation are widely and equitably shared". It highlights a need for adaptation measures that help individuals adapt to changing climatic conditions through reskilling and requalification programmes, and for the protection of workers against weather hazards. It also recalls the distributional specificities of climate change.

The new Climate Adaptation Strategy sets out how the EU and its regions can adapt to the unavoidable impacts of climate change and become climate resilient by 2050 ([248]). Indeed, halting all greenhouse gas emissions would still not prevent the climate impacts that are already occurring, or that are projected to occur even in the best case scenarios. To that end, the new Strategy calls to mainstream climate resilience considerations in all policies and suggests 14 areas of actions that complement the increased ambitions and unmatched efforts on the mitigation side, since the launch of the European Green Deal in December 2019.

Key measures taken under the Green Deal on the mitigation side include the adoption of a first European Climate Law. This unique law, proposed in March 2020 and politically agreed in May 2021, establishes binding EU-level targets of net domestic emission reductions of at least 55% by 2030 and climate neutrality by 2050, as well as the objective to strive for net negative emissions beyond 2050.

A dedicated legislative package, the so-called "Fit for 55" package planned for adoption on 14 July 2021, aims to put the Climate Law into practice. Its focus is on aligning existing EU climate and energy legislation with the more ambitious climate and energy targets for 2030, increasing the stringency of regulation, extending the scope of carbon or energy pricing, and suggesting new legislation

([247]) The original Technical report takes into account projected population growth. However, as noted in that document, population dynamics have a minor effect on risk developments related to extreme temperatures; this exercise therefore considers static population levels.

([248]) http://ec.europa.eu/clima/policies/adaptation where needed, such as addressing potentially adverse risks of carbon leakage.

Climate action covering both mitigation and adaptation is also at the centre of the EU's recovery plan. The Recovery and Resilience Facility will support Member States in their economic recovery and longer-term resilience. The National Recovery and Resilience Plans are assessed and monitored in view of their effective support of investments and reforms that promote just transitions and improve climate resilience across the entire EU. At least 37% of the budgetary allocations of the plans should be directed to climate action, covering both mitigation and adaptation. In addition, the plans must not support measures that do significant harm to the environment (based on the 'do no significant harm' principle), including to the objective of climate change adaptation and mitigation.

In parallel, additional funding for climate policies and targeted support to vulnerable and carbon intensive regions is provided. The Just Transition Mechanism worth at least EUR 60 billion aims to alleviate the socio-economic impact of the green transition by notably investing in skills and new infrastructure, helping citizens to re-skill and upskill, facilitating their access to clean energy, whilst providing investment and technical assistance to local businesses. This is further supported by Invest EU, which builds on a budgetary guarantee of EUR 26.2 billion to leverage EUR 372 billion in private and public investments, with a target of at least 30% for climate objectives (to fulfil the commitment of the European Council to achieve a climate mainstreaming target of 30% for both the multiannual financial framework and Next Generation EU).

Further actions have been taken to stimulate private investments in support of climate mitigation and adaptation. The so-called EU Taxonomy Climate Delegated Act ([249]) adopted on 4 June 2021 spells out technical screening criteria for determining the conditions under which an economic activity qualifies as substantially contributing to climate change mitigation and adaptation without doing significantly harm to other environmental objectives.

Benefitting from the measures already adopted, the regional heterogeneity in exposure to heatwaves calls for targeted investment as well as technological and organisational measures to mitigate the losses. Climate adaptation and mitigation constitutes action to prepare for and adjust to the effects of climate change, implemented at the Union, Member State, regional or local levels, or in private companies and households. It includes investment in new structures and appliances, or better-insulated buildings and air-conditioning systems against temperature extremes. Organisational measures are also part of the adaptation toolkit, for example changing working patterns that help exposed workers avoid the hottest periods of the day. Innovative technological solutions, such as wearable machines that protect from heat or alleviate physical exertion are among the adaptation responses of the future.

4. Future scenarios and the impact of Covid-19 in the short run

The pandemic directly affects the economic recovery of the national and regional economies. The combination of Trade-SCAN ([250]) and RHOMOLO models helps assess the territorial impact of the crisis, dependent on the evolution of the pandemic and the scenarios implemented by the epidemiological models, which are based on different assumptions regarding the number of days of lockdown and the length and severity of the pandemic (see *Box 3.4* for details). Trade-SCAN ([251]) is a JRC ([252]) multi-country input-output model calibrated to official statistics, whereas RHOMOLO allows for the regionalisation of the results. In this way, it is possible to estimate how much GDP and employment would be gained (saved) in 2021 if half of the lockdown and restriction measures implemented in 2020 were removed. This counterfactual analysis has also been applied assuming alternative scenarios of lockdowns in the different macro areas (euro area, EU, etc.), resulting in two different scenarios:

1) The EU halves its lockdown and restriction measures in 2021, i.e. resulting from a better epidemiological scenario, while the rest of the world remains at the same levels as in 2020. We further break down the results assuming only the euro area or only the non-euro area countries halve their sanitary measures, keeping the rest of the world at the same levels as in 2020.

2) The same levels of lockdown and restriction measures are maintained in the EU in 2021, while the rest of the world reduces its sanitary restriction levels by half.

Results ([253]) show that if, in 2021, the EU halved its lockdown and restriction measures of 2020, the EU GDP would increase by 3.2% (*Figure 3.16***) from -6.2% in 2020.** Ireland would turn out to be

([249]) The first of a series of delegated acts, defining the technical screening criteria for the objectives listed in the EU Taxonomy Regulation of June 2020 ((EU) 2020/852).

([250]) https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/trade-scan-v2-user-friendly-tool-global-value-chain-analysis

([251]) Trade-Scan results are provided by Jose Manuel Rueda Cantuche and Giovanni Mandras (European Commission's Joint Research Centre).

([252]) European Commission's Joint Research Centre.

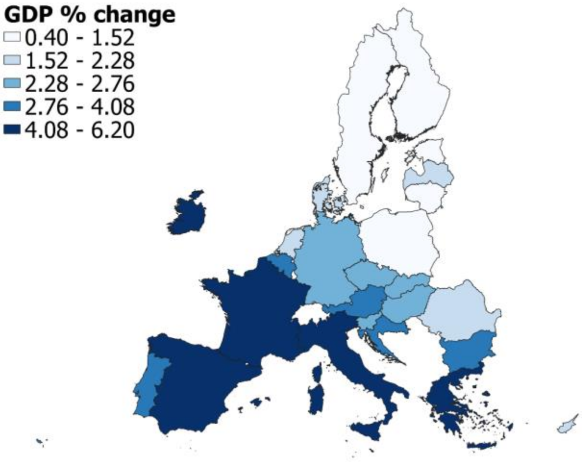
([253]) See Annex 3.5 for all the results.

the country benefitting most in the EU with an estimated GDP increase of 6.2% followed by Spain (4.8%), France (4.5%), Italy (4.4%), Greece and Malta (4.1%), and Portugal and Croatia (4%).

Figure 3.16

By halving the restrictions, the impact on GDP in 2021 would be significant for EU

Trade-Scan estimation – 2021 GDP impact under Scenario 1



Source: European Commission's Joint Research Centre

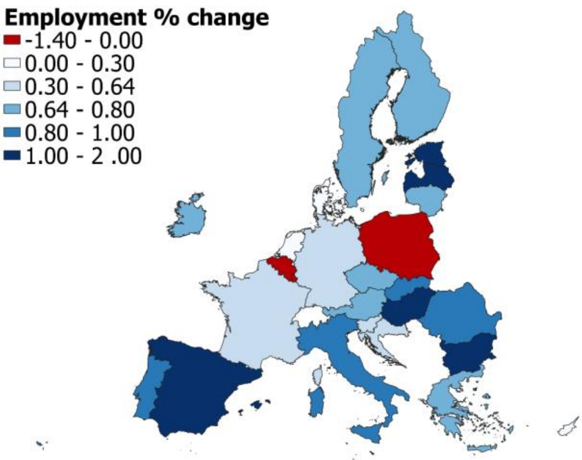
Click here to download figure.

In terms of employment, the same Scenario 1 would save around 1.6 million jobs, which represents 0.7% of the EU total employment (*Figure 3.17***)**. In particular, Spain would reduce job losses by around 400,000, which is equivalent to roughly 2% of its total employment, followed by Bulgaria (1.5%), Estonia (1.4%), Latvia (1.2%), Hungary (1.1%), Italy and Slovakia (1%).

Figure 3.17

By halving the restrictions, EU would save 1.6 million jobs

Trade-Scan estimation – 2021 employment impact under Scenario 1



Source: European Commission's Joint Research Centre

Click here to download figure.

At sectoral level, trade services, arts, entertainment and recreation activities, business services, transport and storage sectors, accommodation and food services, and private households with employed persons would accumulate more than half of the GDP and employment gains, both in the EU and in euro area. The size of such gains from the baseline (2020) also depends on the sectoral composition of each economy. On the other hand, sectors such as the wood and cork manufacturing industry, basic metals, chemicals and pharmaceutical products as well as electricity production are rather inelastic and would have a limited reduction of around 25% of the fall in GDP.

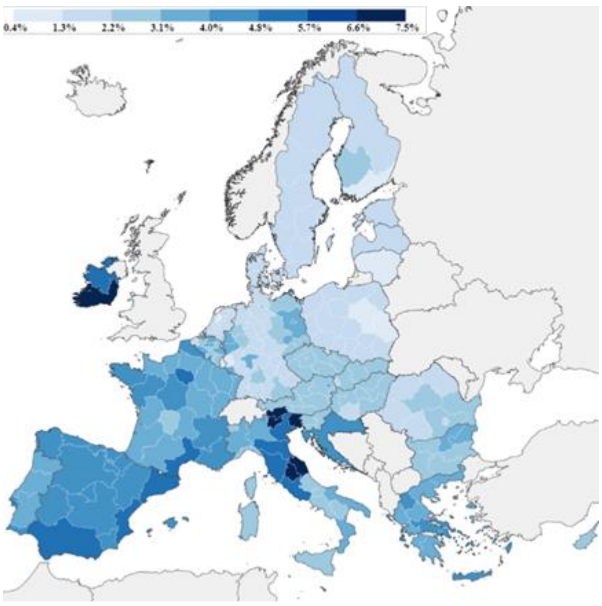
In the scenario, in which the rest of the world reduced restrictions, while the EU maintained them at 2020 levels, Ireland would be the country experiencing the greatest fall in GDP and in employment, followed by Bulgaria. Overall, in the EU, the GDP would fall by an additional -0.3% while maintaining the same drop in jobs. With an average additional drop of -2.2% in terms of persons employed, wholesale and retail trade, accommodation and food services, and transport services would be the most affected sectors.

Regionalised GDP impacts across all regions in the EU show a notable within-country variation under Scenario 1. The EU regions' GDP saved due to lower restrictions vary from 0.4% to 7.5% with an average of 2.95% and a standard deviation of 1.4 (*Figure 3.18*). The higher within-country differences are found mostly in western EU countries (Ireland, Italy, Spain and France). South and eastern Ireland together with the Italian north-east border and central regions are those benefitting more from better epidemiological scenarios in the EU, displaying gains above 6.6%. Northern and eastern EU regions are those with the lowest gains and a more homogeneous response.

Figure 3.18

Impact on EU regions GDP in 2021 shows notable within-country variation

2021 impact on EU regions GDP - RHOMOLO estimation under Trade-Scan Scenario 1



Source: European Commission's Joint Research Centre

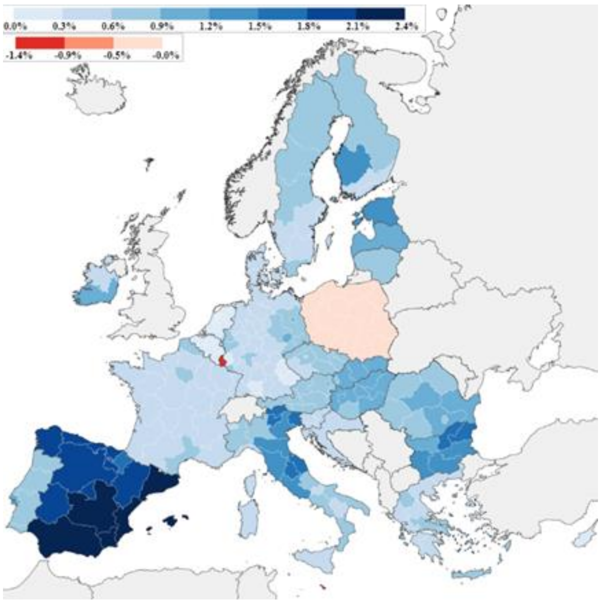
Click here to download figure.

Looking at the regionalised impacts on employment under the same Scenario 1, the results confirm a heterogeneous regional response, due to the characteristics of each economic regional structure. The job losses increase/reduction range from -1.4% to 2.4%. Spanish regions show higher gains with values above 1.8%, followed, with values above 1%, by the centre and north-eastern Italian regions, Bulgarian and Hungarian regions. Interestingly, the lowest gains are found in the core-central EU regions with almost all the regions showing values lower than 1%. Interestingly, no regions in Poland show positive values but, instead, a slight (-0.1%) decrease in employment (*Figure 3.19*).

Figure 3.19

The impact on regional employment is heterogeneous

2021 impact on EU regions employment - RHOMOLO estimation under Trade-Scan Scenario 1



Source: European Commission's Joint Research Centre

Click here to download figure.

One of the main conclusions of the analysis is that efforts by the EU to improve the epidemiological scenarios in 2021 in order to reduce the restrictions and lockdowns are worthwhile. GDP and employment would gain significantly, and would certainly pay off the extra costs that governments would incur in its implementation.

Moreover, as expected, the regionalisation of the impacts across all EU regions, has shown both in the case of GDP and employment that countries do not behave as homogeneous economic blocs, underpinning the importance of considering the economic characteristics of each region in order to implement the most effective measures.

Box 3.4: A combination of models to assess future scenarios at national and regional level

The procedure for the estimation of the socio-economic effects at regional level of the different scenarios of lockdown measures can be illustrated by the five steps sketched in Figure 20 ([1]).

1. The starting point is the number of days as a percentage of a quarter (i.e. 3 months) that lockdown measures are implemented in a certain region, depending on the estimated evolution of the pandemic.
2. Since the economic structure is not homogeneous across Member States, a country average is estimated using the share of regional value added in a given country. As a result, a high number of days with lockdown measures in regions with high GDP would weigh more than the same number of days in less developed regions. The previous step produces a country-specific GDP-adjusted measure of the average number of days as a percentage of a quarter (3 months) that lockdown measures are implemented. Should these measures be taken during the full three-month period, the expected initial shocks or estimated national demand declines by sector and by quarter would be fully applied for each country. If the lockdown measures were in place only half of the quarter, the expected initial shocks would be halved instead.

Figure 1 - Linking health and economic models

Source: European Commission's Joint Research Centre

Click here to download chart.

3. Country-specific sectoral initial shocks are of utmost importance and should be based on available estimates from Eurostat statistics, other sector-specific information and the main sectoral features of the lockdown measures (e.g. closure of restaurants, hotels, etc.).
4. The fourth step is the use of multi-country input-output analysis and the OECD global input-output tables to account for the socio-economic (GDP and employment) direct and indirect effects of the initial sectoral shocks across other sectors and other countries in the EU and non-EU countries. The Trade-SCAN model is used to carry out such analysis (Roman et al., 2020; Arto et al., 2019). This model is calibrated to the official GDP published by Eurostat and the OECD for all quarters of 2020.
5. The last step is the regionalisation of the national effects derived from the Trade-SCAN model through the RHOMOLO model (Mandras et al., 2019), which provides an array of different impacts across all regions in the EU for the different epidemiological scenarios.

([1]) De Groeve, T., A. Annunziato, L. Galbusera, G. Giannopoulos, S. Iacus, M. Vespe, J.M. Rueda Cantuche, A. Conte, B. Sudre, H. Johnson, Scenarios and tools for locally targeted COVID-19 Non Pharmaceutical Intervention Measures, Publications Office of the European Union, Luxemburg, 2020, JRC 122800 (Chapter 8).

5. Conclusions

The chapter focuses on sub-national territorial dimensions exploring the challenges and opportunities related to the COVID-19 crisis.

Regional disparities and rural-urban cleavages posed challenges even before the COVID-19 pandemic. Income inequality varies substantially at regional level and inequality indices tend to be the highest in capital regions. Metropolitan regions present higher median incomes, although with large variations within countries. An inclusive recovery from a territorial perspective needs to address these long-standing patterns.

The uneven geographic impact of the COVID-19 crisis has implied often a greater variation within countries than between them. The rise in unemployment in 2020 in the EU was slightly higher in urban than in rural areas. However, preliminary evidence for the EU26, without Germany, suggests that non-teleworkable occupations have recorded larger reductions of employed in rural areas.. This pattern was determined also by the degree of social interaction required by different occupations but it needs further examination.

According to the results of the RHOMOLO model, the regional impact of the COVID-19 on GDP is large, with a considerable variation across the EU, although the Mediterranean regions were the most affected. The impact of the crisis tends to increase from Northern to Southern Europe. The results also suggest that the higher the share of employment in services with physical interaction, such as accommodation and physical retail, the larger the loss in employment.

Teleworkable occupations have coped better with the pandemic and are best placed to face the challenges of the future. The distribution of teleworkable occupations strongly depends on digital broadband infrastructures and the degree of urbanisation. When considering non-teleworkable occupations, however, a stronger decrease is found in urban centres.

Specific territorial conditions significantly affected the impact of the COVID-19 crisis and prospects for recovery. Territorial differences such as inequality, digital skills, and local endowments are persistent and determine the capacity of regions to overcome the crisis.

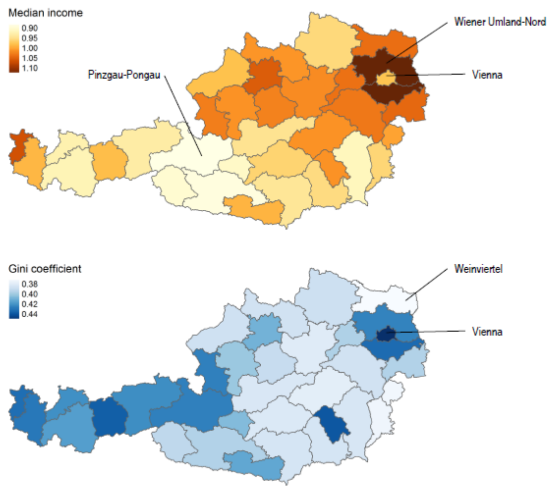
The intensity of digital skills significantly varies across regions and is correlated with regional GDP per capita. Regional differences in digital skills are persistent and have played a role on the crisis' impact; overcoming them would raise the capacity of recovery. Strengthening the intensity of digital skills and notably promoting the teleworkability of occupations will help face the challenges of the future.

Econometric analysis of the performance of regions helped identify the drivers of differential regional resilience, notably in the light of the COVID-19 crisis. Econometric findings show that high regional productivity (TFP), high quality of human capital, high expenditures on Research & Development and a high quality of local institutions help reduce the impact of negative shocks such as the COVID crisis. Further specifications of the model suggest that low corruption in administration and good digital infrastructures contributes positively to regional resilience.

Simulation results show that the phasing out of lockdowns and restriction measures in 2021 are expected to have a significant positive impact on GDP. All regions would benefit both in terms of GDP and employment, although to varying extents. This provides another incentive for quickly rolling out vaccinations.

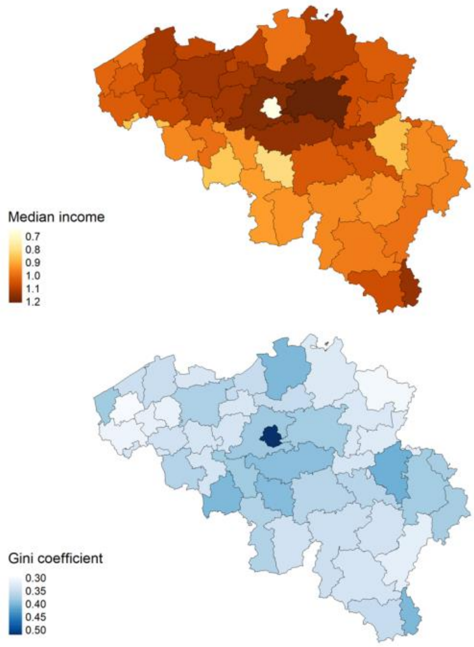
Annex 1: Median income and income inequality in some EU Member States

Figure A1.1
Regional map of income levels (top) and inequality (bottom) in Austria



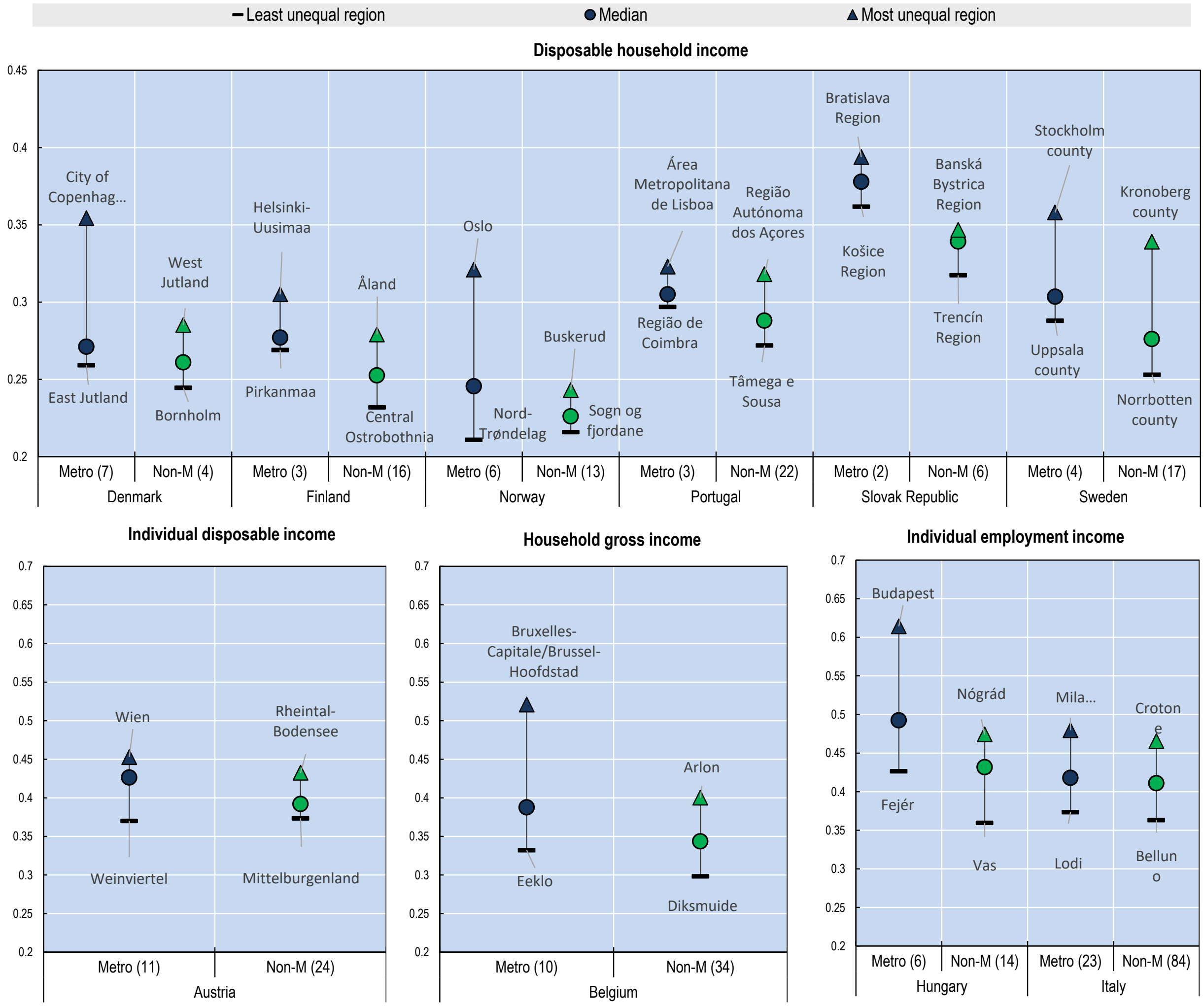
Note: Income concept: individual disposable income
Source: OECD calculations based on administrative income data
Click here to download figure.

Figure A1.2
Regional map of income levels (top) and inequality (bottom) in Belgium



Note: Income concept: household gross income
Source: OECD calculations based on administrative income data
Click here to download figure.

Chart A1.1
Metropolitan regions are more unequal than non-metropolitan regions
Gini coefficients by degree of urbanisation, regional incomes, small (TL3 NUTS 3) regions, 2018/19 or latest year



Note: OECD calculations using statistics drawn from national tax record data

Source: Number of TL3 regions by degree of urbanisation listed in brackets behind the country name. TL3 regions are classified as metropolitan if more than half of their population lives in a Functional Urban Area of at least 250 000 inhabitants and as non-metropolitan otherwise

Click here to download chart.

Annex 2: Result of the cluster analysis: assignment of NUTS-2 regions to six regional clusters

Table A2.1
The six regional clusters

Southern 1	Southern 2	Transition 1	Transition 2	Established		Metropolitan
Voreio Aigaio (EL)	Bruxelles/Brussel (BE)	Yugozapaden (BG)	Severozapaden (BG)	Burgenland (AT) (AT)	Leipzig (DE)	Wien (AT)
Anatoliki Makedonia (EL)	Attiki (EL)	Kypros (CY)	Severen tsentralen (BG)	Niederösterreich (AT)	Sachsen-Anhalt (DE)	Prov. Vlaams-Brabant (BE)
Kentriki Makedonia (EL)	Notio Aigaio (EL)	Stredni Cechy (CZ)	Severoiztochen (BG)	Kärnten (AT)	Schleswig-Holstein (DE)	Prov. Brabant wallon (BE)
Dytiki Makedonia (EL)	Kriti (EL)	Jihozápad (CZ)	Yugoiztochen (BG)	Steiermark (AT)	Thüringen (DE)	Praha (CZ)
Ipeiros (EL)	Ionia Nisia (EL)	Severovýchod (CZ)	Yuzhen tsentralen (BG)	Oberösterreich (AT)	Sjælland (DK)	Oberbayern (DE)
Thessalia (EL)	Galicia (ES)	Jihovýchod (CZ)	Severozápad (CZ)	Salzburg (AT)	Syddanmark (DK)	Berlin (DE)
Dytiki Ellada (EL)	Principado de Asturias (ES)	Strední Morava (CZ)	Kontinentalna Hrvatska (HR)	Tirol (AT)	Midtjylland (DK)	Hamburg (DE)
Sterea Ellada (EL)	Cantabria (ES)	Moravskoslezsko (CZ)	Közép-Dunántúl (HU)	Vorarlberg (AT)	Nordjylland (DK)	Darmstadt (DE)
Peloponnisos (EL)	País Vasco (ES)	Eesti (EE)	Nyugat-Dunántúl (HU)	Prov. Antwerpen (BE)	Länsi-Suomi (FI)	Hovedstaden (DK)
Extremadura (ES)	Comunidad Foral de Navarra (ES	Pest (HU)	Dél-Dunántúl (HU)	Prov. Limburg (BE) (BE)	Etelä-Suomi (FI)	Helsinki-Uusimaa (FI)
Ciudad de Ceuta (ES)	La Rioja (ES)	Vidurio ir vakaru Lietuvos (LT)	Észak-Magyarország (HU)	Prov. Oost-Vlaanderen (BE)	Pohjois- ja Itä-Suomi (FI)	Île de France (FR)
Ciudad de Melilla (ES)	Aragón (ES)	Latvija (LV)	Észak-Alföld (HU)	Prov. West-Vlaanderen (BE)	Åland (FI)	Midi-Pyrénées (FR)
Nord-Pas-de-Calais (FR)	Comunidad de Madrid (ES)	Malopolskie (PL)	Dél-Alföld (HU)	Prov. Hainaut (BE)	Centre - Val de Loire (FR)	Rhône-Alpes (FR)
Guadeloupe (FR)	Castilla y León (ES)	Slaskie (PL)	Abruzzo (IT)	Prov. Liège (BE)	Bourgogne (FR)	Budapest (HU)
Martinique (FR)	Castilla-la Mancha (ES)	Wielkopolskie (PL)	Norte (PT)	Prov. Luxembourg (BE) (BE)	Franche-Comté (FR)	Northern and Western (IE)
Guyane (FR)	Cataluña (ES)	Zachodniopomorskie (PL)	Centro (PT) (PT)	Prov. Namur (BE)	Basse-Normandie (FR)	Southern (IE)
La Réunion (FR)	Comunitat Valenciana (ES)	Lubuskie (PL)	Nord-Vest (RO)	Stuttgart (DE)	Haute-Normandie (FR)	Eastern and Midland (IE)
Mayotte (FR)	Illes Balears (ES)	Dolnoslaskie (PL)	Centru (RO)	Karlsruhe (DE)	Picardie (FR)	Sostines regionas (LT)
Molise (IT)	Andalucía (ES)	Opolskie (PL)	Nord-Est (IT)	Freiburg (DE)	Alsace (FR)	Luxembourg (LU)
Campania (IT)	Región de Murcia (ES)	Kujawsko-Pomorskie (PL)	Sud-Est (RO)	Tübingen (DE)	Champagne-Ardenne (FR)	Utrecht (NL)
Puglia (IT)	Canarias (ES)	Warminsko-Mazurskie (PL)	Sud - Muntenia (RO)	Niederbayern (DE)	Lorraine (FR)	Noord-Holland (NL)
Basilicata (IT)	Languedoc-Roussillon (FR)	Pomorskie (PL)	Sud-Vest Oltenia (RO)	Oberpfalz (DE)	Pays-de-la-Loire (FR)	Zuid-Holland (NL)
Calabria (IT)	Jadranska Hrvatska (HR)	Lódzkie (PL)	Vest (RO)	Oberfranken (DE)	Bretagne (FR)	Warszawski stoleczny (PL)
Sicilia (IT)	Lombardia (IT)	Swietokrzyskie (PL)	Západné Slovensko (SK)	Mittelfranken (DE)	Aquitaine (FR)	Bucuresti - Ilfov (RO)
Sardegna (IT)	Bolzano/Bozen (IT)	Lubelskie (PL)	Stredné Slovensko (SK)	Unterfranken (DE)	Limousin (FR)	Stockholm (SE)
Alentejo (PT)	Trento (IT)	Podkarpackie (PL)	Východné Slovensko (SK)	Schwaben (DE)	Poitou-Charentes (FR)	Östra Mellansverige (SE)
Açores (PT)	Veneto (IT)	Podlaskie (PL)		Brandenburg (DE)	Auvergne (FR)	Sydsverige (SE)
	Friuli-Venezia Giulia (IT)	Mazowiecki regionalny (PL)		Bremen (DE)	Prov.-Alpes-Côte d'Azur (FR)	Västsverige (SE)
	Emilia-Romagna (IT)	Vzhodna Slovenija (SI)		Gießen (DE)	Corse (FR)	Bratislavský kraj (SK)
	Toscana (IT)			Kassel (DE)	Piemonte (IT)	
	Umbria (IT)			Meckb.-Vorpommern (DE)	Valle d'Aosta	
	Marche (IT)			Braunschweig (DE)	Liguria (IT)	
	Lazio (IT)			Hannover (DE)	Groningen (NL)	
	Malta (MT)			Lüneburg (DE)	Friesland (NL) (NL)	
	Algarve (PT)			Weser-Ems (DE)	Drenthe (NL)	
	Área Metrop. de Lisboa (PT)			Düsseldorf (DE)	Overijssel (NL)	
	Madeira (PT)			Köln (DE)	Gelderland (NL)	
				Münster (DE)	Flevoland (NL)	
				Detmold (DE)	Zeeland (NL)	
				Arnsberg (DE)	Noord-Brabant (NL)	
				Koblenz (DE)	Limburg (NL) (NL)	
				Trier (DE)	Småland med öarna (SE)	
				Rheinhessen-Pfalz (DE)	Norra Mellansverige (SE)	
				Dresden (DE)	Mellersta Norrland (SE)	
				Chemnitz (DE)	Övre Norrland (SE)	
					Zahodna Slovenija (SI)	

Note: The assignment of capital regions and bigger agglomerations may be distorted due to commuting workers.

Source: Commission services based on Eurostat data (various sources)

Click here to download table.

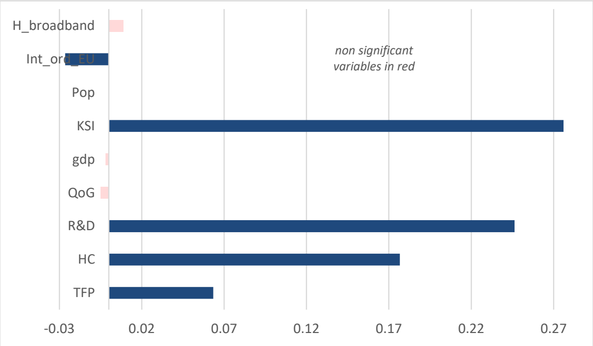
Annex 3: The spatial dimension of the regional resilience

The spatial autoregressive model (SAR), taking into accounts the spatial dependence of the shocks, broadly confirms the results of the other models and highlights the importance of the territorial linkages.

Chart A3.1

The spatial model confirms the main results

Spatial autoregressive model (SAR) for regional resilience (GDP shock)



Source: DG EMPL elaboraton

Click here to download chart.

Annex 4: Digital skills: mapping between DigComp and ESCO framework

Firstly, ISCO codes is linked to the ESCO framework. Then the DigComp framework is used to map to the ESCO framework, such that digital skills can be identified in the list of skills accompanying each ESCO code. *Figure A4.1* provides an example of the mapping between DigComp and ESCO framework.

Figure A4.1
Mapping between DigComp and ESCO framework

Table 5: The mapping of the competence areas of DigComp and an ESCO example

DigComp	ESCO transversal ICT skills
Information and data literacy	Digital data-processing
Communication and collaboration	Digital communication
Digital content creation	Content-creation with ICT software
Safety	ICT Safety
Problem solving	Problem-solving with ICT tools and hardware

Source: Vuorikari et al. (2016)
Click here to download figure.

In this way, each ISCO code to be associated (via ESCO and DigComp) with a (large) number of digital skills, essential to work in at least one occupation covered by the relevant ISCO code. Under the headings of the DigComp framework there are 21 broader skills (*Table A4.1*).

Table A4.1
Broader digital skills categories in the DigComp Framework

DigComp Category	Skills in the DigComp framework
1.1	browsing, searching, and filtering digital data
1.2	evaluate data, information, and digital content
1.3	manage data, information, and digital content
2.1	Interact through digital technologies
2.2	share through digital technologies / using digital tools for collaboration and productivity
2.3	Engage in citizenship through digital technologies
2.4	Collaborate through digital technologies
2.5	use online conventions of netiquette
2.6	Manage digital identity
3.1	Develop digital content
3.2	integrate and re-elaborate digital content
3.3	copyright and licenses related to digital content --- not used
3.4	Computer programming
4.1	protecting ICT devices
4.2	Protect personal data and privacy
4.3	protect health and well-being while using digital technologies
4.4	protect the environment from the impact of the digital technologies
5.1	solve technical problems
5.2	Identify needs and technological responses
5.3	creatively use digital technologies
5.4	Identify digital competence gaps

Source: Barslund, 2021
Click here to download table.

Annex 5: Trade-Scan simulation results

Table A5.1

GDP and employment gains over the baseline (2020) under different paces of lockdown restrictions in the EU, euro area or rest of the world

	GDP					Employment				
	Baseline	Euro area	Non euro area	EU	RoW	Baseline	Euro area	Non euro area	EU	RoW
EU	**-6.10%**	**3.00%**	**0.20%**	**3.20%**	**-0.30%**	**-1.50%**	**0.70%**	**0.10%**	**0.80%**	**0.00%**
Euro area	**-6.60%**	**3.40%**	**0.00%**	**3.40%**	**-0.40%**	**-1.60%**	**0.80%**	**0.00%**	**0.80%**	**0.00%**
Austria	-6.60%	3.00%	0.20%	3.20%	0.10%	-1.70%	0.80%	0.00%	0.80%	0.00%
Belgium	-6.30%	3.10%	0.10%	3.20%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Bulgaria	-4.20%	0.40%	2.40%	2.80%	-0.70%	-2.30%	0.20%	1.30%	1.50%	-0.30%
Croatia	-8.00%	1.60%	2.40%	4.00%	0.00%	-1.20%	0.30%	0.30%	0.60%	0.00%
Cyprus	-5.10%	2.10%	0.10%	2.20%	0.30%	-0.60%	0.30%	0.00%	0.30%	0.00%
Czech Rep.	-5.60%	0.50%	2.20%	2.70%	0.00%	-1.50%	0.10%	0.60%	0.70%	0.00%
Denmark	-2.70%	0.20%	1.40%	1.60%	-0.20%	-0.70%	0.00%	0.30%	0.30%	0.00%
Estonia	-2.90%	1.20%	0.20%	1.40%	0.00%	-2.70%	1.30%	0.10%	1.40%	0.00%
Finland	-2.80%	1.50%	0.00%	1.50%	-0.10%	-1.50%	0.80%	0.00%	0.80%	0.00%
France	-8.10%	4.60%	-0.10%	4.50%	-0.40%	-1.10%	0.60%	0.00%	0.60%	0.00%
Germany	-4.90%	2.50%	0.00%	2.50%	-0.10%	-1.10%	0.60%	0.00%	0.60%	0.00%
Greece	-8.20%	4.00%	0.10%	4.10%	0.00%	-1.30%	0.70%	0.00%	0.70%	0.00%
Hungary	-5.00%	0.40%	2.00%	2.40%	0.00%	-2.20%	0.20%	0.90%	1.10%	0.00%
Ireland	3.40%	4.10%	2.10%	6.20%	-7.90%	-1.50%	0.80%	0.00%	0.80%	-0.10%
Italy	-8.90%	4.40%	0.00%	4.40%	0.00%	-2.10%	1.00%	0.00%	1.00%	0.00%
Latvia	-3.60%	1.50%	0.20%	1.70%	0.10%	-2.30%	1.10%	0.10%	1.20%	0.00%
Lithuania	-0.80%	0.40%	0.00%	0.40%	0.00%	-1.50%	0.70%	0.00%	0.70%	0.00%
Luxembour	-1.30%	0.70%	0.00%	0.70%	0.00%	2.00%	-1.00%	0.00%	-1.00%	0.00%
Malta	-7.00%	4.30%	-0.20%	4.10%	-0.60%	2.60%	-1.40%	0.00%	-1.40%	0.00%
Netherlands	-3.70%	1.90%	0.00%	1.90%	-0.10%	-0.60%	0.30%	0.00%	0.30%	0.00%
Poland	-2.70%	0.30%	1.10%	1.40%	-0.10%	0.10%	0.00%	-0.10%	-0.10%	0.00%
Portugal	-7.60%	4.00%	0.00%	4.00%	-0.20%	-1.70%	0.90%	0.00%	0.90%	0.00%
Romania	-3.90%	1.30%	0.80%	2.10%	-0.20%	-1.80%	0.20%	0.70%	0.90%	0.00%
Slovakia	-5.20%	1.80%	0.90%	2.70%	-0.10%	-1.90%	0.90%	0.10%	1.00%	0.00%
Slovenia	-5.50%	2.40%	0.20%	2.60%	0.10%	-1.00%	0.40%	0.00%	0.40%	0.00%
Spain	-10.80%	4.70%	0.10%	4.80%	0.60%	-4.20%	2.00%	0.00%	2.00%	0.00%
Sweden	-2.80%	0.20%	1.30%	1.50%	0.00%	-1.30%	0.10%	0.60%	0.70%	0.00%

Source: European Commission's Joint Research Centre

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