



Employment and Social Developments in Europe

Addressing labour shortages and
skills gaps in the EU

2023

Annual review

Employment and Social Developments in Europe 2023

European Commission

Directorate-General for Employment, Social Affairs and Inclusion

Directorate F

Manuscript completed in July 2023

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The report has benefited from comments and suggestions received from many colleagues in various Directorate-Generals of the European Commission, including Alfonso Arpaia and Anais Gradinger. It also benefited from conscientious editing by Gráinne Murphy, as well as from diligent clerical support from Evita Grzibovska.

For the data presented in this report, the cut-off date for the extraction was 2 June 2023 (14 June 2023 for EU-SILC data, and 27 June 2023 for the EU Labour Force Survey 2022 ad-hoc module on skills) unless otherwise specified. Calculations on microdata collected through LFS were made using the User Database (UDB) that Eurostat made available on 30/11/2022.

Comments on the publication are welcome and should be sent to the email address EMPL-F4-UNIT@ec.europa.eu

Manuscript completed in June 2023

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Print ISBN 978-92-68-05540-3 ISSN 1977-270X doi: 10.2767/513321 KE-BD-23-002-EN-C

PDF ISBN 978-92-68-05541-0 ISSN 2315-2540 doi: 10.2767/089698 KE-BD-23-002-EN-N

Foreword



In 2022, the EU labour markets exhibited remarkable resilience despite a number of major tests, including Russia's war of aggression against Ukraine, high inflation, and an economic slowdown. We witnessed record-breaking employment levels, with the highest number of people employed and the lowest unemployment rates ever recorded. This resilience serves as a testament to the strength of our labour markets and our social market economy.

However, we must also acknowledge and address the enduring challenges. These include lower labour market participation among individuals with lower educational attainment, migrants, individuals from minority racial or ethnic backgrounds, women, persons with disabilities, as well as individuals at the beginning or end of working age. Additionally, higher inflation has eroded households' purchasing power, leading to increased severe material and social deprivation and energy poverty in 2022.

Considering these challenges and in line with the European Year of Skills, the 2023 edition of the Employment and Social Developments in Europe report provides insights into persistent labour shortages and skills gaps in the EU. It looks at occupations and sectors that are expected to continue to face labour shortages, such as those linked to construction, healthcare, science, technology (especially information and communication technologies, ICT), engineering, and mathematics. This trend is likely to increase as the population ages and the green and digital transitions progress. It also analyses the contributing factors to these persistent labour shortages which vary across occupations. For instance, shortages in STEM jobs often result from an insufficient supply of workers with highly specialised skills. In lower-skilled and manual occupations, such as long-term care work, poor working conditions and challenges in retaining workers play a more significant role.

To alleviate labour shortages, it is essential to promote the labour market participation of underrepresented groups. Measures aimed at reducing gender segregation will also be instrumental, as persistent labour shortages tend to concentrate in either female-dominated jobs (e.g., nurses or cleaners) or male-dominated jobs (e.g., ICT specialists).

Recognizing that addressing labour shortages is crucial for supporting economic growth and enhancing the EU's innovative capacities, the report analyses several potential solutions. It emphasises the effectiveness of upskilling and reskilling initiatives, as well as policies to improve the alignment of labour supply and demand. The report also highlights the positive effects of enhancing work incentives, reforming tax and benefit systems, and improving working conditions. Furthermore, attracting workers from non-EU countries can help mitigate shortages.

It is important to note that we have already established numerous policies under the European Skills Agenda, providing a solid foundation to address labour shortages. For instance, the Pact for Skills has facilitated the establishment of 18 partnerships in key industrial sectors, each identifying skills gaps and committing to upskilling and reskilling workers. Already this has led to 2 million benefitting from training, with €160 million invested by Pact members so far. The EU Directive on adequate minimum wages, coupled with strengthened collective bargaining, will contribute to improved pay conditions and make certain professions more appealing to workers. Recommendations on effective active support to employment, social economy framework conditions, and a fair transition toward climate neutrality provide guidance for managing the digital and green transitions. Finally, we are committed to fully implementing the European Pillar of Social Rights and meeting the 2030 EU headline targets on employment, skills, and poverty reduction.

I encourage you to join the discussion and actively participate in designing effective and innovative actions to enhance Europe's competitiveness, inclusivity, sustainability, and resilience.

A handwritten signature in blue ink, which appears to read 'N. Schmit'. The signature is stylized and fluid.

Nicolas Schmit

Commissioner, Jobs and Social Rights

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Executive Summary

ADDRESSING LABOUR SHORTAGES AND SKILLS GAPS IN THE EU

MAIN ECONOMIC, LABOUR MARKET AND SOCIAL DEVELOPMENTS

The EU economy performed relatively well in 2022, despite Russia's war of aggression against Ukraine prompting skyrocketing energy prices, supply chain disruptions, and related increases in the cost of living. The EU economy grew by 3.5% in real terms, exceeding previous expectations. After strong Gross Domestic Product (GDP) growth in the first half of 2022, economic expansion then slowed, with a smaller-than-projected contraction in the final quarter. Energy prices stabilised towards the end of the year, which, combined with a predicted decrease in 2023, improved the economic outlook for 2023 and 2024. Significant risks remain, notably linked to rapidly rising prices for food and services, potential new increases in gas prices, and tight labour markets.

Inflationary pressures started in 2021 and reached 9.2% in 2022, with spikes in energy, food, and transport prices. This is challenging for lower-income and, to a lesser extent, middle-income households, for which these necessity items account for a substantial share of overall consumption. Due to the drop in wholesale gas prices, inflation stabilised towards the end of the year and is projected to fall to 6.7% in 2023 and 3.1% in 2024.

Overall, the EU labour market has remained remarkably resilient. The number of people employed rose by 2.0% in 2022 and reached new record levels (213.7 million people). The record employment rate of 74.6% is an important step towards the 2030 Porto target of 78.0% employment for the population aged 20-64. The rise in employment was primarily driven by an increase in the number of permanent and full-time workers. Furthermore the employment rate of recent graduates recorded a sharp increase (2.8 percentage points (pp)). At the same time, the EU unemployment rate receded to 6.2%, the lowest ever recorded. Youth unemployment declined by 2.2 pp from 16.7% in 2021 to 14.5% in 2022, but remains a major challenge.

Nevertheless, significant challenges persist: the gender employment gap remains stable but high at 10.7 pp; people with lower educational attainment have higher unemployment rates, lower employment, and lower participation in adult learning activities; unemployment among young people remained more than two-and-a-half times higher than the rest of the population; and 11.7% of young people across the EU were neither in education, employment or training (NEET) in 2022, despite major shortages in the labour market.

While high by historical standards, nominal wage growth remains far below inflation, leading to a contraction in real gross disposable household income (GDHI) growth, and posing challenges particularly for those at the lower end of the income scale. In the second half of 2022, real GDHI growth per capita (quarterly, year-on-year) was negative for the first time in approximately two years, driven by a decrease in the compensation of employees and self-employed workers. Faced with economic pressures, more than one-quarter of lower-income households reported financial distress in December 2022, up from 23.3% in the previous year. Financial distress also increased for households in the second and third income quartiles in the same time period, but to a somewhat lesser extent. Pressures on households' purchasing power, coupled with surges in energy prices, led to increases the number of people unable to keep their home warm, from 6.9% in 2021 to 9.3% in 2022.

In a challenging context, the at-risk-of poverty (AROP) rate and income inequality in the EU remained broadly constant in 2022. The AROP rate and income inequality – measured by the ratio of total income received by the 20% of the population with the highest income compared to that received by the 20% of the population with the lowest income – decreased slightly in 2022 (2021 incomes), with Eurostat’s flash estimates predicting stability (2022 incomes). After reaching unprecedented levels in 2021, the poverty reducing impact of social transfers remained elevated in 2022 (2021 incomes), reducing AROP by more than one third. However, the AROP indicator measures low income relative to the rest of the population and as such does not capture declines in real household incomes and loss of purchasing power resulting from inflationary pressures. Rather, this is better reflected in the increased share of the population living in severe material and social deprivation (SMSD) rate in 2022 (6.7%, compared to 6.3% in 2021), as well as the decrease in GDHI in the second half of the year.

People with lower levels of education are at higher risk of poverty or social exclusion than the overall population (34.5% compared to 21.6% in 2022).

Education and training remain key to addressing poverty and social exclusion. People with higher levels of education are at lower risk of poverty or social exclusion: in 2022, 10.5% of those with tertiary education were at risk, compared to 19.8% of those with medium-level qualifications and 34.5% of those with lower education. For in-work poverty, these shares were 4.1%, 8.7% and 18.4%, respectively.

LABOUR SHORTAGES AND CHANGING SKILLS NEEDS IN THE EU

Labour shortages occur when the demand for workers qualified in a particular area of the labour market exceeds the supply of those workers. This can arise due to cyclical but also a number of structural reasons, such as a declining or inactive labour force, skills gaps and skills mismatches (including in the context of the twin transition), working conditions, and labour mobility and migration. In Q1 2023, labour shortages were reported as a factor limiting production by 28% of employers in manufacturing and 31% in both services and construction in the EU, ranging from below 10% in Cyprus and Spain to over 50% in Poland, Malta and Slovenia.

With the employment rate at an all-time high of 74.6%, the job vacancy rate rose to 2.9% in 2022, compared to 1.3% in 2012.

Labour shortages rebounded sharply in 2022 as the economy and labour market recovered from the COVID-19 pandemic, coming back in line with previous occupational and sectoral patterns. The job vacancy rate rose to 2.9%, the highest rate ever recorded, with labour shortage indicators showing increasing tightness in the labour market. While part of these developments reflects a cyclical upturn in the economy

following the substantial dip during the COVID-19 crisis, structural determinants remain crucial. Many of the current shortages (e.g. in science, technology, engineering and mathematics (STEM), including information and communications technology (ICT), construction, healthcare, hospitality) are long-standing and likely to have been further exacerbated by the green and digital transitions. Following demand interruptions during the COVID-19 crisis (except healthcare, which saw soaring demand during the pandemic), these shortages exceeded pre-pandemic levels by the end of 2021. For example, labour shortages in manufacturing and construction are now nearly three times the level observed 10 years ago, and have more than doubled in services.

While labour shortages can be a sign of a dynamic economy and give workers some leverage, they can have negative effects on companies and the wider economy. Shortages may increase the pressure on workers’ work-life balance and impact their economic prospects in the long term, but they may also lead to workers demanding higher wages, better working conditions, or additional skills development, as well as providing opportunities for marginal workers to enter or remain in the labour market. Alongside this, however, labour shortages may reduce the economic activity of companies and public institutions, lower their innovation capacity, or force them to reduce the quality and quantity of their products and services. If not addressed, countries with labour shortages may become less attractive for innovation and investment in research and development, weakening their competitiveness, hindering their transformation towards a more digitised economy, and delaying the green transition. Given the prevalence of negative effects of labour shortages, it is particularly important to understand their underlying structural drivers.

In light of the importance of skills for the EU economy and the 2023 European Year of Skills, this year’s Employment and Social Developments in Europe (ESDE) report focuses on persistent labour shortages and changing skills needs in the EU. It starts by identifying occupations and sectors facing persistent labour shortages over the last 10 years and then analyses their structural drivers: it considers the implications of evolving skills demands in the context of the green and digital transitions; it highlights certain labour market participation challenges, including demographic changes (notably ageing) and lower labour market participation among certain population groups, with a particular focus on women and migrant workers born outside the EU; it explores the structural barriers reducing the efficiency of matching labour supply and demand, with an emphasis on the role played by gender segregation; and it assesses the implications of certain working

conditions for labour shortages. Finally, it presents and estimates the likely impacts of selected policy measures to address labour shortages.

Persistent labour shortages are mainly found in healthcare, STEM (particularly ICT), construction, and some service occupations.

Persistent labour shortages are found in a diverse range of sectors and occupations across all skill levels. While there is no agreed methodology to identify labour shortages in the EU, combining different approaches provides a comprehensive view of the demand for labour at sectoral and occupational level. Persistent labour shortages are particularly prevalent in healthcare, STEM (notably ICT), construction, and

certain service occupations. While this list includes some relatively high-skilled occupations, it also includes middle-skilled and low-skilled occupations.

The importance of different structural drivers of labour shortages varies significantly by occupation and sector. Overall, employers' difficulties in finding people with the right skills are often linked to their inability to attract and retain workers (e.g., due to poor working conditions or human resource management (HRM) practices) rather than a lack of skills among job applicants. However, a limited supply of skilled workers poses challenges for persistent labour shortages in fields such as STEM or healthcare. In other occupations, especially those characterised by more manual skills and lower literacy, numeracy and digital skills requirements (e.g. cleaners, personal care workers), poor working conditions and challenges in attracting and retaining workers play a more significant role. Labour shortages in some occupations might be exacerbated by evolving skills and employment needs due to the green and digital transitions.

Looking ahead, shortages in both high and low skilled occupations are projected to increase considerably. STEM, ICT and healthcare professionals will be in particular demand. Future shortages will primarily be driven by employment growth in these occupations, followed by replacement needs as older cohorts retire. These may create significant bottlenecks given the educational credentials required.

Structural drivers of shortages

The green transition is projected to lead to employment growth in several sectors and occupations, where new vacancies may be difficult to fill. It is estimated that the green transition could lead to creation of between 1 and 2.5 million additional jobs by 2030. This includes jobs in some sectors and occupations already experiencing persistent labour shortages (e.g., transportation and storage sector, drivers, building and related trades, electrical and electronic trades), as well as those likely to face labour shortages in the future (e.g. net-zero technologies, water supply, sewerage, waste management and remediation activities, and certain science and engineering professions). Significant expansion needs, severe underrepresentation of female workers, and increasing demand for medium-skilled and high-skilled workers with specific qualifications in sectors key to the green transition, combined with high replacement needs for older workers in some relevant sectors, might exacerbate labour shortages.

One-third of ICT professionals' skills are digital, compared to less than one-tenth for most other occupations.

The digital transition contributes to persistent labour shortages among ICT professionals but does not seem to be a key driver of shortages in other occupations. ICT occupations are the most digitally intensive form of work in the EU, by a considerable margin. In this context, lower average digital intensity of work among women, older

people and those with lower levels of educational achievement is largely explained by the underrepresentation of these groups in ICT occupations. The demand for ICT work doubled between 2011 and 2021, with more than 9 million ICT specialists now working in the EU. This number is projected to expand sharply, making current labour shortages even more pressing. As yet, the impact of the recent advancement of artificial intelligence (AI) on the labour market and labour shortages remains unclear. Recent evidence indicates that AI is already transforming the nature of work and skills needs in certain sectors and occupations. It could have a positive impact on productivity, but also raises concerns about job loss, stability, and wages, as well as trust in employers to make the right decisions about its use.

Addressing labour shortages in specialist ICT positions will likely involve supporting more women to enter the field. With women accounting for only 17% of all employment in ICT occupations in the EU, measures tackling their underrepresentation offer important opportunities to attract new workers. Around one-quarter of women's underrepresentation traces back to gender segregation in ICT education. Exposure to broader stereotypes around ICT work contributes to gender divides in aspiration from an early age: at 15 years of age, around 1 in 10 boys expect to work in ICT, compared to just 1 in 100 girls. Certain aspects of employment in ICT are also known to limit women's participation, including reliance on full-time work patterns that are difficult to reconcile with care responsibilities, and biases in recruitment practices, remuneration, and promotion ladders.

The decreasing working-age population will likely drive up labour shortages in the coming decades.

This is because, once retired, people maintain the demand for products and services at a relatively high level, while the labour supply decreases due to the shrinking of the working-age population. Population ageing is a major challenge for the EU: in the 11 Member States analysed in detail, the share of the older population (aged 70+) is expected to increase gradually by 2030, then more sharply by 2050. In most Member States, these demographic trends are expected to weigh on capital and labour, and thus on GDP.

Lower labour market participation among women, lower-educated people, people with a migrant background (especially migrant women), older workers and young people is one of the factors underlying labour shortages.

Since 2004, women are, on average, about 12 pp less likely to participate in the labour market than men, a difference that increases by another 10 pp with motherhood. The participation probability of people aged 55–64 is about 28 pp lower than among under-55s, partly due to early retirement schemes. However, for both older workers and women, those participation gaps have decreased over time. Education plays a fundamental role in the rate of labour market participation: those attaining at most lower secondary education are about 23 pp less likely to participate in the labour market than those with tertiary education. People born outside the EU are 2 pp less likely to be employed than natives, primarily due to particularly low employment rates among migrant women. Finally, other groups, such as persons with disabilities or people with a minority racial or ethnic background, including Roma, remain underrepresented in the labour market.

Only 14% of occupations facing shortages are gender balanced, compared to around 25% of occupations in the EU labour market.

Gender segregation of the labour market contributes to shortages by reducing the efficiency of labour supply allocation.

Labour shortages are evident in occupations and sectors where men account for the majority of workers (e.g. STEM occupations, where men represent 80% of workers), as well as in some jobs where women comprise the majority of workers (e.g. healthcare occupations, where women represent 80% of workers).

Persistent gender segregation reduces the pool of people available to fill new vacancies, exacerbating difficulties in finding workers, especially in times of rising demand. Measures aimed at reducing gender segregation offer important opportunities to ensure that increased labour market participation of women alleviates labour shortages. Currently, women remain unlikely to progress into hard-to-fill vacancies in male-dominated occupations. At the same time, relying almost exclusively on women's work does not generate sufficient labour supply to satisfy the demand for specific services such as nursing, personal care, or cleaning. Improving working conditions and pay in these jobs is likely to play an important role in attracting additional workers.

While the extent of gender segregation in STEM and healthcare work depends on a range of factors, a substantial proportion can be traced to unequal participation of women and men in certain fields of education.

This is because STEM and healthcare workers tend to be highly educated in specialist fields of study, in which either women or men are severely underrepresented. For example, gender differences in workers' most recent field of study account for about half of the underrepresentation of women in STEM occupations. Addressing gender segregation in education thus provides an important opportunity to expand the future talent pool available to fill vacancies in STEM and healthcare jobs. Among other measures, this will require challenging the gender stereotypes that contribute to stereotypical subject choices by labelling certain jobs and fields of study as male or female domains. By exaggerating (or inventing) gender differences in early educational outcomes in these study fields, such stereotypes continue to shape children's long-term aspirations and self-confidence, irrespective of their talents and abilities.

Among people born outside the EU and working in occupations experiencing shortages, 9 out of 10 are employed in low-skilled occupations.

Migrant workers born outside the EU are more often employed in occupations facing persistent labour shortages.

Compared to native workers with the same characteristics, being a migrant is associated with a higher probability (8.7 pp) of working in shortage occupations, especially in lower-skilled ones. However, their lower participation rate in the labour market – particularly among migrant women – results in some untapped potential in tackling labour shortages. Migrant workers born outside the EU

are 3.1 pp more likely to have difficulties in finding permanent or full-time employment, despite indicating their willingness to work more hours, especially in occupations with persistent labour shortages. The high share of migrants reporting discrimination when in employment (8.6%, compared to 5.4% for the native population) also suggests inefficiencies in matching labour supply with relevant job opportunities. Further obstacles to migrants getting a (suitable) job are the lack of skills in the host country language(s), difficulties in recognising their formal qualifications obtained abroad, and care responsibilities. These factors may hinder the potential of migrants to mitigate future labour shortages.

Job strain was found to be substantially above the EU average (30%) for nurses (61%), carers (55%), drivers (44%), cooks and bartenders (43%), doctors (43%) and cleaners (36%).

More strenuous working conditions and lower pay might explain the persistence of labour shortages in some occupations and sectors. In terms of overall job quality, reported job strain is significantly higher than average for workers in the health, residential care, and transport sectors, especially among nurses, carers, and drivers. Around 75% of female-dominated occupations facing shortages report higher than average (30%) job strain. Workers in several shortage occupations with high job strain also report difficulties in making ends meet more often than

the EU average (26%). This includes cleaners (47%), cooks and bartenders (44%), and carers (43%). At the opposite end of the scale, computer programming and architectural and engineering activities stand out for their higher median hourly earnings, lower job strain and more frequent non-standard forms of employment than the EU average.

In some jobs with more difficult working conditions, health and safety at work risks may be an additional factor contributing to labour shortages. In five out of six shortage occupations experiencing significantly higher levels of job strain, the proportion of workers reporting that their health and safety at work is at risk is also higher than the EU average. The highest levels of health and safety at work risk are reported by nurses (69%), drivers (53%), doctors (51%) and carers (50%).

MEASURES TO ALLEVIATE PERSISTENT SHORTAGES

Several key policies and reform measures can alleviate persistent labour shortages in the EU. These include upskilling and reskilling, investing in adult learning, increasing financial incentives to work, alleviating the barriers to people entering the labour market, improving work and pay conditions and social protection coverage, and implementing policies to attract workers from abroad into jobs facing shortages. This report provides an in-depth analysis of selected topics linked to these measures, including the effects of vocational training programmes and measures to reduce skills mismatches, outcomes of several reforms of the tax and benefit system to improve work incentives, challenges to labour market participation posed by the cost and (geographical) availability of childcare, the impacts of targeted immigration policies, and the role of social partners.

The 2023 European Year of Skills emphasises the challenges underpinning labour and skill shortages in the EU. It contributes to a mindset where upskilling and reskilling throughout the working life is the norm for everyone. Proposed specifically to address skills and labour shortages, it will promote investment in skills, the labour market relevance of skills, good matching between individuals' aspirations and companies' needs, and good use of the skills of third-country nationals. It will also showcase skills development opportunities and activities across Europe.

The 2023 European Year of Skills builds on the broader policy framework set out in the European Skills Agenda. The Pact for Skills and the Blueprint Skills Alliances are important measures to foster the supply of skills to address labour shortages in health, STEM, and construction (among others). They also contribute to addressing the increasing demand for digital and green skills under the twin transition, alongside other EU initiatives, such as the Structured Dialogue on digital education and skills, the Recommendation on key enabling factors for successful digital education and training, the Recommendation on improving the provision of digital skills in education and training, the Recommendation on ensuring a fair transition towards climate neutrality, and the European Green Deal Industrial Plan. The Recommendations on individual learning accounts, micro-credentials, and vocational education and training will also support upskilling and reskilling. For example, more than half of the Member States are taking action towards developing individual learning account (ILA) schemes (already operational in France) to provide direct financial support to individuals for use in market-relevant training activities.

A vocational training programme in Lithuania increases the probability of employment across a range of population groups.

Upskilling and reskilling, together with improvements in matching labour supply and demand, can have positive employment effects and help to address persistent shortages. Modelling improvements in skills-matching at regional level shows positive macroeconomic effects for all regions covered, accompanied by positive spillovers into other regions.

One way to improve skills-matching at regional level could be to ensure that public employment service (PES) centres are geographically accessible to most people. While this is usually the case in city regions, it is less so in non-metropolitan regions, likely reflecting a combination of lower population density and less dense road networks in rural areas. Analysis of vocational training programmes in Lithuania and Finland found positive employment effects, particularly for some underrepresented groups in the labour market.

Targeted tax reforms impact participation in the labour market up to eight times more than broader income tax cuts.

Reforming tax and benefit systems can help alleviate labour shortages by improving work incentives. The impact of a personal income tax (PIT) cut, accounting for the interplay of taxes and benefits, depends on the specific details of the reform. In general, tax reforms targeting low-income earners have a significantly greater impact on people's labour supply than across-the-board PIT cuts: targeted measures

can have an impact eight times greater than an across-the-board PIT cut and as such promote active inclusion as also highlighted in the 2023 Council Recommendation on adequate minimum income. Moving towards individual taxation could also generate a significant increase in aggregate participation rates. The reform principally affects the labour supply of women, who are typically the secondary earner in the household.

Increasing participation in formal early childhood education and care (ECEC) could significantly improve the labour market activity of mothers in low-income households. Yet, accessible, affordable, and high-quality ECEC remains limited in a number of Member States. New data highlight that while net childcare costs (NCC) faced by parents have decreased considerably, formal childcare remains expensive in several Member States (e.g. in Ireland and Czechia, NCC account for more than one-third of women's median earnings). Access to childcare can also be constrained by long travel times to reach providers. Analysis of several Member States shows that childcare providers are frequently inaccessible by a short walk, but can usually be reached with a short drive. The geographic accessibility of childcare facilities tends to be much higher in urban settings, likely reflecting higher demand and/or population density. Overall, increasing childcare participation among children aged 0-2 living in households below median income to the Barcelona target of 45% would increase labour market participation of mothers by 5 pp in Italy, 10 pp in Hungary and 17 pp in Austria. This could be achieved at relatively low cost, with net budgetary effects ranging from 0.006% of GDP in Italy to 0.025% in Austria and 0.015% in Hungary.

In addition to skilling, activation, and tax reform measures, attracting some third-country nationals to the EU could help to address labour shortages. The European Commission's Skills and Talent package aims to increase the effectiveness of EU legal migration policy. Smooth integration of newly arrived workers into the labour market and society requires the provision of language courses and upskilling/reskilling opportunities. As part of the 2023 European Year of Skills, the Commission will also adopt initiatives on the recognition of qualifications and validation of skills attained abroad, as well as a proposal on an EU Talent Pool to facilitate matching between employers and migrants.

Social partners have an important role in tackling labour and skills shortages. They are key actors in providing tailored training, improving working conditions, collaborating with PES, and facilitating adult learning opportunities. This can help to address labour shortages, particularly by improving matching of labour supply and demand, as well as increasing the attractiveness and quality of jobs in certain occupations and sectors facing shortages.

Finally, some measures address other root causes of labour shortages. The Recommendations on effective active support to employment and on ensuring a fair transition towards climate neutrality provide broader policy guidance on managing labour market transitions. The Directive on Adequate Minimum Wages has the potential to improve pay conditions generally, particularly in some shortage occupations. The Recommendation on access to social protection for workers and self-employed has important implications for ensuring quality employment opportunities. The Strategic Framework on Health and Safety at Work 2021-2027 defines the key priorities and actions for improving workers' health and safety at work. Lastly, the European Care Strategy and the Recommendation on early childhood education and care (Barcelona targets 2030) aim to improve the availability, adequacy, and quality of care, with a potential positive impact on the labour market participation of women.

All of these initiatives contribute to the headline 2030 targets of 78% employment rate, at least 60% of adults attending training every year, and a reduction of people at risk of poverty or social exclusion by at least 15 million, as outlined in the European Pillar of Social Rights Action Plan. These aims are underpinned by significant funding at EU level, including through the Recovery and Resilience Facility (RRF) and the European Social Fund Plus (ESF+). Member States' Recovery and Resilience Plans (RRPs) endorsed by the European Commission and the Council show that some 20% of social expenditure is dedicated to employment and skills. The ESF+ provides almost EUR 99.3 billion to support EU employment, social, education and skills policies, helping to address a number of structural drivers of labour shortages, such as skills shortages and working conditions. The European Regional Development Fund (ERDF) also provides support for education, training and skills with around EUR 8.2 billion in the 2021-2027 period.

Main employment and social developments

1. INTRODUCTION ⁽¹⁾

In 2022, the European Union (EU) economy and the labour market proved resilient to exceptional shocks. The Russian war of aggression against Ukraine caused immense destruction and precipitated a humanitarian crisis in Ukraine. ⁽²⁾ It also affected the EU economy significantly, with its impact on the energy market prompting prices for gas and electricity to skyrocket. This further increased inflation levels, which were already elevated following strong recovery from the impacts of the COVID-19 pandemic and supply chain bottlenecks in 2021. Inflation averaged 9.2% in 2022, with a record high of 11.5% in October. Nevertheless, in 2022 the EU economy grew by 3.5% – slowing in the second half of 2022 – with soaring energy prices and record high inflation felt by all businesses and households, especially the most vulnerable. That economic expansion was the result of growing employment, increased consumption, substantial fiscal support, and a further decrease in the household saving rate, with the reduction in savings also likely signalling increased financial pressure on households. ⁽³⁾

Despite difficult circumstances, labour markets continued to perform strongly. In 2022, the unemployment rate reached a record low of 6.2% in the EU and 6.8% in the euro area. The employment rate of people aged 20–64 rose by 1.5 percentage points (pp) to reach a record high of 74.6%. In the current economic environment, this highlights the resilience of labour markets and represents an important step towards the EU Porto target of 78.0% employment by 2030.

In the context of record high employment and low unemployment rates, the EU labour market remained tight, with high and persistent labour shortages. In 2022, labour market slack (i.e. all people who have an unmet need for employment, including unemployed and underemployed people) was 12.3% of the extended labour force aged 15–74, notably lower than before the COVID-19 pandemic (13.6% in 2019). In addition, the job vacancy rate spiked at a historically high 2.9%, as companies found it increasingly difficult to fill vacancies following the sustained economic growth during the pandemic recovery period.

Following increases in 2021, prices continued to rise substantially in 2022, especially for necessity items. Overall, more than 90% of the core items in the Harmonised Index of Consumer Prices (HICP) basket

⁽¹⁾ This chapter was written by Fabio De Franceschi, Gabor Katay and Nora Wukovits-Votzi.

⁽²⁾ The Russian war of aggression against Ukraine led to millions of Ukrainians fleeing to the EU and neighbouring countries, where they were welcomed and provided with humanitarian aid. Shortly after the Russian invasion of Ukraine in February 2022, the EU activated the Temporary Protection Directive (2001/55/EC), which grants asylum to refugees and enables immediate access to the labour market and education system.

⁽³⁾ (European Commission, 2023e).

recorded above-average price increases. ⁽⁴⁾ Prices rose for necessity items (including gas, electricity, food, and transport), disproportionately affecting lower-income households, for which these items make up a larger share of consumption. ⁽⁵⁾ In the context of price spikes, certain households are likely to have relied on savings to offset financial pressures, with the overall household saving rate decreasing in 2022, including as the result of an increase in consumption demand following the COVID-19 pandemic. Supported by the EU, all Member States implemented measures to contain the impact of price increases on lower-income and middle-income households, but energy poverty (i.e. the inability to keep one's home adequately warm) nevertheless increased to 9.3% in 2022, compared to 6.9% in 2021.

Despite the relatively high nominal wage growth and interventions at EU and national level, inflation continued to erode purchasing power in 2022. While high by historical standards, nominal wage growth remained far below inflation, leading to purchasing power declines and a negative impact on real household incomes. ⁽⁶⁾ While Gross Domestic Product (GDP) increased by 3.5% in 2022, in Q3 and Q4, the growth of real household incomes (as measured by gross disposable household income (GDHI)) ⁽⁷⁾ was negative for the first time in around two years. With consumer prices rising, reported financial distress increased to 15.8%, a level similar to the end of 2012, during the aftermath of the financial crisis. It was particularly high (27%) for lower-income households in December 2022, compared to the households in the top income quartile (7.4%).

In this challenging context, the overall share of those at-risk of poverty or social exclusion (AROPE rate) remained broadly stable in 2022. Broken down by its three sub-components, the at-risk-of poverty (AROP) rate ⁽⁸⁾ (2021 incomes) and the share of people living in quasi-jobless households (referring to the situation in 2021) decreased slightly compared to the previous year. Eurostat flash estimates (2022 incomes) indicate that the AROPE rate and income inequality remained stable at EU level. However, the proportion of the population living in severe material and social deprivation, which more directly reflects declines in the purchasing power of households, increased from 6.3% in 2021 to 6.7% in 2022.

The share of those at risk of poverty or social exclusion (whether in work or not) and those at risk of in-work poverty varied considerably across education levels, a trend that persists over time. In 2022, the AROPE rate was 34.5% for those with lower levels of education, substantially higher than the rate for those with medium (19.8%) and higher (10.5%) levels of education at EU level. ⁽⁹⁾ Those with lower education also faced higher risks of in-work poverty (18.4%) than those with medium (8.7%) and higher (4.1%) levels of education. With 2023 designated the European Year of Skills, this is a timely reminder of the importance of opportunities for upskilling and reskilling.

This chapter reviews the latest socioeconomic developments in the EU and its Member States, with a particular focus on labour shortages and skills. It starts by reviewing the macroeconomic outlook in the EU, as well as the main labour market indicators. It then turns to households' financial situations, poverty, and inequality outcomes, with a focus on differences by level of educational attainment.

2. MACROECONOMIC DEVELOPMENTS AND FORECAST

Global economic activity decelerated in 2022 compared to 2021. It stagnated in the first half of 2022, picked up in Q3, and slowed again at the end of the year. ⁽¹⁰⁾ This was primarily the result of disruptions in the supply chain and energy market caused by Russia's war of aggression against Ukraine, as well as geopolitical tensions between the United States (US) and China affecting international trade. These caused food and energy prices to skyrocket and hindered growth in both advanced and emerging economies. Ongoing COVID-19-related lockdowns in parts of China also exerted a negative influence on the global economy. Consequently, global GDP growth (excluding the EU) was estimated to reach 3.2% in 2022, compared to a 6.1% rise in 2021.

The EU economy expanded in 2022, but growth slowed in the second half of the year due to exceptionally adverse shocks. Real GDP rose by 3.5% in 2022, after growing by 5.4% in 2021. Developments

⁽⁴⁾ (European Commission, 2023f).

⁽⁵⁾ Analysis of microdata from the latest available wave of the Household Budget Survey (EU-HBS) from 2015 confirms that low-income households may spend up to 40% more of their total budget on food and energy than more affluent population segments (European Commission, 2022f).

⁽⁶⁾ (European Commission, 2023e).

⁽⁷⁾ GDHI is an aggregate measure approximating of households' overall living conditions by focusing on the income that households are able to spend. Unlike GDP, GDHI per capita is net of capital depreciation and disregards the income of foreign residents.

⁽⁸⁾ At risk of poverty is measured as earning less than 60% of the median equivalised income.

⁽⁹⁾ For those aged 18 and above.

⁽¹⁰⁾ (European Commission, 2023e).

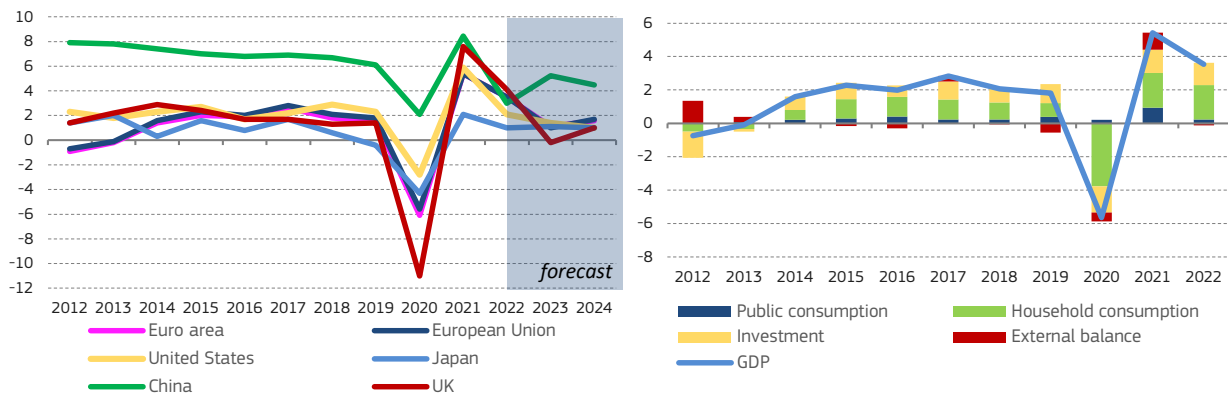
in the euro area were similar, with a rise of 3.5% in 2022. The economic activity in the EU was particularly strong in the first half of 2022 (+0.7% in both Q1 and Q2), slowing in the second half of the year, as the rise in energy prices, impacted by Russia's invasion of Ukraine, started to affect businesses and households (+0.4% in Q3, -0.1% in Q4). GDP growth in the US, Japan and China was lower than in the EU (+2.1%, +1.0%, and +3.0%, respectively) and higher in the United Kingdom (UK) (+4.1%) where recession was comparatively deeper in 2020 (Chart 1.1).

The rise in EU real GDP can primarily be attributed to household consumption and investment. In 2022, household consumption accounted for more than half of the GDP increase (+2.1 pp), with investment at +1.3 pp. The external sector was almost in balance (-0.1 pp contribution to GDP growth), while public consumption made only a modest contribution (+0.2 pp) (Chart 1.1).

Chart 1.1

Real GDP growth was higher in the EU than in other major economies in 2022, with household consumption and investment the main contributors

Left chart: GDP, volume (% change from previous year), global; Right chart: Contribution to GDP real growth, % change on previous year, EU



Note: Shaded area refers to European Commission (Directorate-General for Economic and Financial Affairs (DG ECFIN)) and International Monetary Fund (IMF) (for China) forecast.

Source: Eurostat [nama_10_gdp], DG ECFIN forecast, IMF World Economic Outlook (for China).

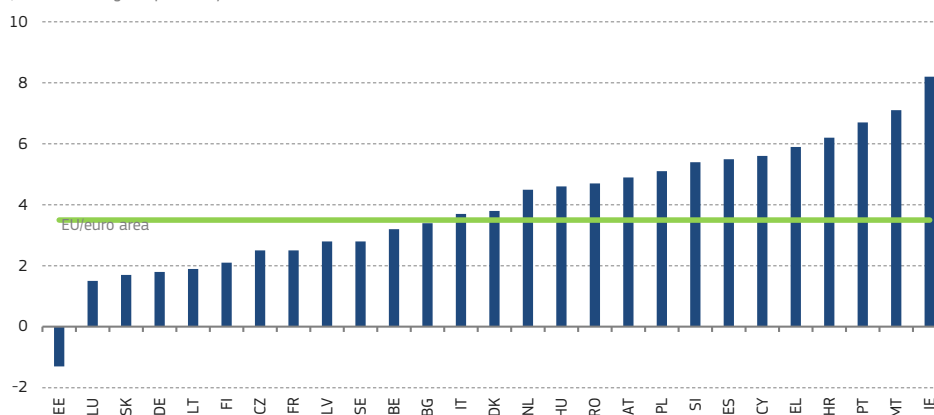
[Click here to download chart.](#)

In 2022, real GDP grew in almost all Member States, although with considerable differences between Member States. The increase was above 5.0% in one-third of countries, with notable growth in Ireland (+8.2%),⁽¹¹⁾ Malta (+7.1%), and Portugal (+6.7%). By contrast, growth declined in Estonia (-1.3%) and was significantly lower than the EU average in Luxembourg (+1.5%), Slovakia (+1.7%), and Germany (+1.8%) (Chart 1.2).

Chart 1.2

Real GDP growth in almost all Member States

Real GDP growth, EU, 2022 (% change on previous year)



Note: Ireland: modified domestic demand.

Source: Eurostat [nama_10_gdp].

[Click here to download chart.](#)

⁽¹¹⁾ Using modified domestic demand, which better reflects underlying domestic economic activity in Ireland (European Commission, 2023e).

Inflationary pressures that emerged during the economic recovery in 2021 were aggravated by Russia's invasion of Ukraine.

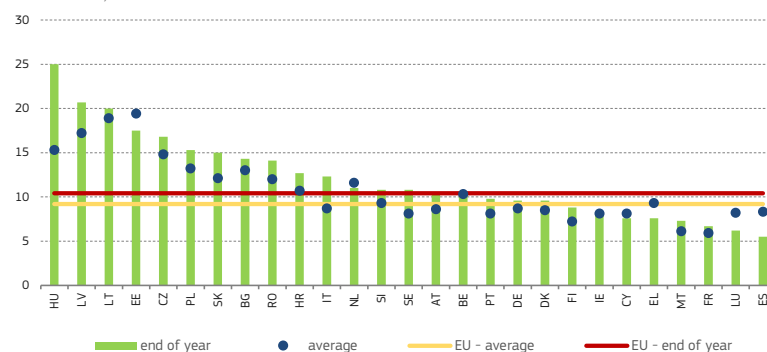
Inflation averaged 9.2% in the EU and 8.4% in the euro area, by far the highest recorded rates since the series began. ⁽¹²⁾ Inflation peaked at 11.5% in the EU in October 2022 (10.6% in the euro area) and decreased slightly by the end of the year, to 10.4% (9.2% in the euro area), due to lower energy inflation, while core inflation remained high. Overall, inflation remained far higher than at the end of 2021 (5.3% and 5.0%, respectively).

Year-end inflation was highest in Hungary (25.0%) and the Baltic countries (20.7% in Latvia, 20.0% in Lithuania, 17.5% in Estonia), due to their greater dependence on oil and gas imports from Russia. Spain (5.5%), Luxembourg (6.2%) and France (6.7%) had comparatively lower inflation rates (Chart 1.3).

Chart 1.3

Inflation was at historically high levels in several Member States

All-items HICP, 2022



Note: 'End of year' refers to December 2022.

Source: Eurostat [prc_hicp_aind ; prc_hicp_manr].

[Click here to download chart.](#)

Real GDP growth is expected to slow in 2023 amid continuing high inflation. That growth is predicted to be 1.0% in the EU and 1.1% in the euro area, followed by growth of 1.7% (EU) and 1.6% (euro area) in 2024. ⁽¹³⁾ During that time, inflation is projected to fall to 6.7% (2023) and 3.1% (2024) in the EU. This outlook reflects the fall of wholesale gas prices below pre-war levels and the availability of gas storage levels above recent seasonal averages, although with core inflation (including processed food and services) remaining high. Domestic demand could be fuelled by the current fall in energy prices but investment growth is projected to decelerate. The external sector should contribute positively to growth, mainly as a consequence of falling import prices, while the recent reopening of China's economy could boost external demand beyond current projections.

Nevertheless, there are risks to the economic outlook for the EU. High inflation remains a concern, as it could have negative repercussions for real wages and households' purchasing power. Nominal wage growth is not keeping pace with inflation, with a loss of workers' purchasing power (see section 4.1.) and increasing risks of poverty, especially for low-wage earners. ⁽¹⁴⁾ ⁽¹⁵⁾ Tight labour markets (see section 3.4.) and demands for pay rises could put strong pressure on wages and consumer prices generating perverse inflation-wage dynamics. Monetary policy could react to persistently high inflation by raising interest rates further, increasing financing costs for borrowers and slowing the economy, potentially affecting employment. Future developments in Russia's war of aggression against Ukraine could prompt new increases in gas prices, although the EU's continued diversification of supply sources has so far countered these pressures. Fragmentation of global trade represents another risk factor for the global economy, potentially affecting the EU.

In the longer term, demographic trends such as the reversal of population growth, steady increase in the old-age dependency ratio, ⁽¹⁶⁾ and the resulting negative consequences for the economy will bring additional challenges for the EU. After a long period of substantial growth, increases in the EU population slowed considerably over the past decade. More recently, several sudden events such as Brexit, the COVID-19 pandemic, and the Russian war of aggression against Ukraine accelerated or disrupted these longer-term developments. ⁽¹⁷⁾ The pandemic was responsible for 1.2 million additional deaths in 2020-2021, with a steeper decline for men. ⁽¹⁸⁾ In addition to excess mortality, it also caused a temporary decline in births (-14.1% in 24 EU countries during the first wave of COVID-19 compared to the average number of live births in January 2018 and 2019) ⁽¹⁹⁾ and led to a large drop in migration flows (almost 30% in 2020), as a result of lockdown

⁽¹²⁾ 2001 and 1997, respectively.

⁽¹³⁾ (European Commission, 2023e).

⁽¹⁴⁾ (European Commission, 2022g).

⁽¹⁵⁾ (European Commission, 2023f).

⁽¹⁶⁾ Ratio of people older than 64 to the working-age population.

⁽¹⁷⁾ In 2020, about 1.9 million people migrated to the EU from a country outside the EU, while about 956 000 people left the EU for a country outside the EU. In 2019, there were an estimated 2.7 million immigrants to the EU from non-EU countries, while about 1.2 million people left the EU for a country outside the EU.

⁽¹⁸⁾ (European Commission, 2023k). For more information, see the Eurostat 'Statistics Explained' articles on weekly death statistics and excess mortality (Eurostat, 2023d) and (Eurostat, 2023b).

⁽¹⁹⁾ (Pomar et al., 2022).

restrictions. ⁽²⁰⁾ ⁽²¹⁾ Some of these trends have since reversed, with birth rates recovering by the second half of 2021, to 1.53 live births per woman in the EU in 2021, and the fertility rate increasing in 21 Member States in 2021 compared to 2020. ⁽²²⁾ ⁽²³⁾ The UK withdrawal from the EU led to an almost 50% increase in EU citizens leaving the UK, compared to 2015. ⁽²⁴⁾ ⁽²⁵⁾ Finally, as of March 2023, about 3.9 million people had fled Ukraine and registered for temporary protection in the EU, representing the largest movement of displaced persons in Europe since the Balkan wars in the 1990s. ⁽²⁶⁾ Immigration into the EU from non-EU countries increased by almost 18% in 2021, compared to 2020. ⁽²⁷⁾

Population growth is expected to slow further in the coming years, before starting to decline in the longer term. The EU population is expected to increase slightly by 2030, from the current level of about 447 million people to around 453 million people. ⁽²⁸⁾ By 2100, the population is projected to decrease to about 419 million people, about 28 million people fewer than in 2022.

Consistently low levels of birth rates (1.53 births per woman in 2021) and extended longevity are expected to have a strong impact on the working-age population (15-64-year-olds) and the old-age dependency ratio ⁽²⁹⁾ in the EU. The working-age population is expected to shrink by 1.3% (3.7 million people) by 2030 compared to 2022 (285 million people), and by 9.9% (28.3 million people) by 2050. By 2100, the loss will exceed 20% (about 57 million people). Accordingly, the old-age dependency ratio is expected to increase from around 33% to 38% by 2030, and to 60% by 2100.

Some predominantly rural and less developed EU regions face an accelerated reduction in their working-age population. Combined with difficulties in attracting and/or retaining talent, this may impede these regions' capacity to build sustainable, competitive, and knowledge-based economies, and puts them at a higher risk of failing to catch up with more advanced regions. ⁽³⁰⁾

3. LABOUR MARKET DEVELOPMENTS

3.1. Employment trends

The labour market in the EU remained resilient, despite the difficulties faced by the economy in the second half of 2022. Growth in GDP was accompanied by an increase in total employment, by 2.0% in the EU and 2.3% in the euro area. As a result, 213.7 million people were employed in the EU in 2022, 166.1 million of whom were in the euro area. The numbers of people employed increased in all Member States. The strongest increases were recorded in Ireland (+6.6%), Malta (+6.3%) and Lithuania (+5.1%), with the lowest in Romania (+0.1%), Poland (+0.4%), Germany and Bulgaria (+1.3% for both).

The sectors that contributed most to employment growth in 2022 were trade, transport, accommodation and food service, and technical, administrative and support activities. In those two areas, the numbers employed grew by 1.5 million and 0.8 million, respectively. In relative terms, employment increased most in information and communication (+5.1%), a sign of the high demand for advanced skills in the labour market. It rose by 2.5% in construction and 1.1% in industry, and declined by 1.6% in agriculture. The number of self-employed people grew by only 0.6%, compared to 2.2% for employees.

In 2022, the number of total hours worked overtook the 2019 level and increased more than employment. Hours worked rose by 2.8% in the EU and 3.4% in the euro area. However, hours worked per person remained 1.2% and 1.7%, respectively, below 2019 levels (i.e. before the sharp drop in 2020 due to the

⁽²⁰⁾ For more information, see the Eurostat 'Statistics Explained' article on migration and migrant population statistics (Eurostat, 2023c).

⁽²¹⁾ (European Migration Network (EMN); OECD, 2021).

⁽²²⁾ (Pomar et al., 2022).

⁽²³⁾ Eurostat (2023e). According to Eurostat data, in 2021, most Member States saw a significant decrease in life expectancy overall, with life expectancy increasing in Belgium, Spain, France, Italy, Luxembourg, Malta, Portugal, Slovenia, Sweden compared to 2020. See Statistics Explained article on mortality and life expectancy statistics (Eurostat, 2023d).

⁽²⁴⁾ Based on data from 13 Member States.

⁽²⁵⁾ (European Commission, 2023k).

⁽²⁶⁾ (Eurostat, 2023a).

⁽²⁷⁾ (Eurostat, 2023c).

⁽²⁸⁾ EUROPOP2023 (baseline) population projections released by Eurostat on 30 March 2023.

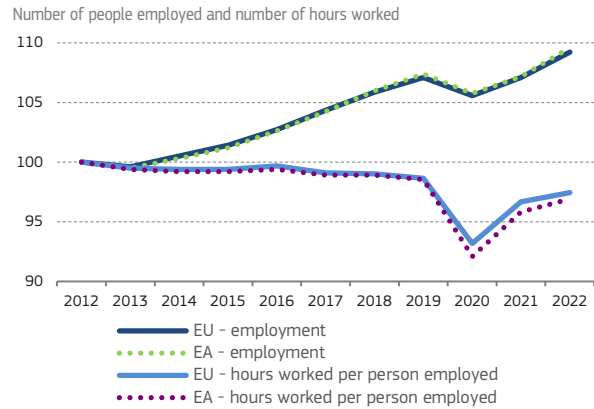
⁽²⁹⁾ This is defined as the ration between the population above retirement age and employed working-age population (aged 20-64 years).

⁽³⁰⁾ (European Commission, 2023c).

use of short-term work schemes during the COVID-19 crisis). Hours worked per person were already declining before 2020, at least partly due to the impact of automation (Chart 1.4).⁽³¹⁾

Employment growth in the EU is expected to remain solid but slow in the next two years as a consequence of the deceleration in economic growth. According to the latest European Commission forecast, employment should grow by 0.5% in the EU and by 0.6% in the euro area in 2023, while it should see an increase of 0.4% and 0.5%, respectively, in 2024, a slightly better performance than predicted for other advanced economies.⁽³²⁾ Employment rose in 2022 in the US (+3.7%) and the forecast is positive for 2023 (+1.0%), before an uptick of +0.1% in 2024. Employment is instead projected to stagnate in Japan and the UK (-0.1% and -0.2% in 2023, respectively, and -0.1% and +0.3% in 2024), after growth of +0.2% and +1.0%, respectively, in 2022 (Chart 1.5).

Chart 1.4
Number of hours worked per person employed increased but was still lower than in 2019
 Number of people employed and number of hours worked



Note: Index: 2012 = 100. EA = euro area.

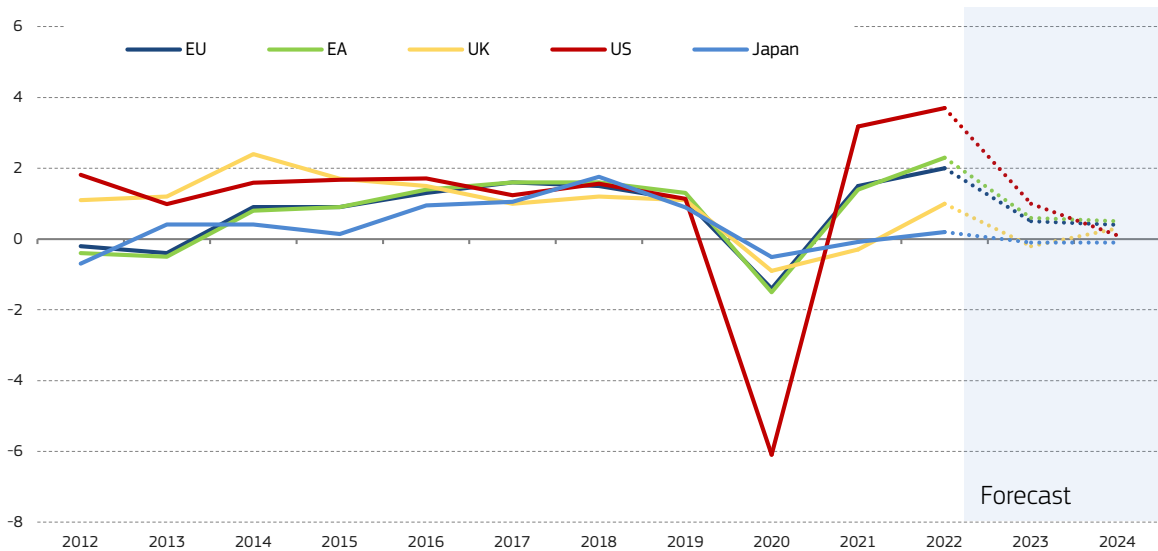
Source: Eurostat [nama_10_a10_e].

[Click here to download chart.](#)

Chart 1.5

Employment rose in all major economies in 2022 and is expected to remain resilient in the EU

Headcount employment (% change on previous year)



Note: European Commission (DG ECFIN) 2023 Spring forecast in the shaded area, and for UK (since 2020), US and Japan (since 2022).

Source: Eurostat [nama_10_pe, naida_10_pe], DG ECFIN forecast.

[Click here to download chart.](#)

⁽³¹⁾ (European Commission, 2021).

⁽³²⁾ See Chapter 2, Box 2.3 for longer term macroeconomic modelling of employment impacts of climate scenarios.

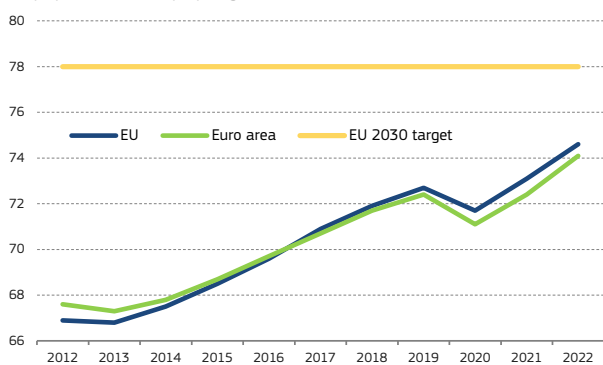
The employment rate for people aged 20-64 reached record levels in the EU in 2022.

It rose by 1.5 pp in the EU (74.6%) and by 1.7 pp in the euro area (74.1%) (Chart 1.6), but most of this increase occurred in the first half of the year. The highest rises were recorded in Greece (+3.7 pp), Ireland (+3.3 pp), and Estonia (+2.6 pp), while the employment rate grew least in Luxembourg (+0.7 pp) and France (+0.8 pp). The EU Porto target aims to achieve an employment rate of at least 78% in the EU by 2030, and six Member States (Denmark, Estonia, Ireland, the Netherlands, Slovakia, and Sweden) are already at or above their national target.

Chart 1.6

Employment rates reached historic levels in 2022

Employment rate (% of people aged 20-64)



Source: Eurostat [lfsi_emp_a].

[Click here to download chart.](#)

In 2022, the gender employment gap (the difference between the employment rate of women and men aged 20-64) declined slightly,

to 10.7 pp, 0.2 pp less than in 2021. The employment rate of women rose to 69.3%, while that of men grew to 80.0% for the first time. More progress is needed to meet the European Pillar of Social Rights action plan objective to halve the gender employment gap by 2030 compared to 2019.

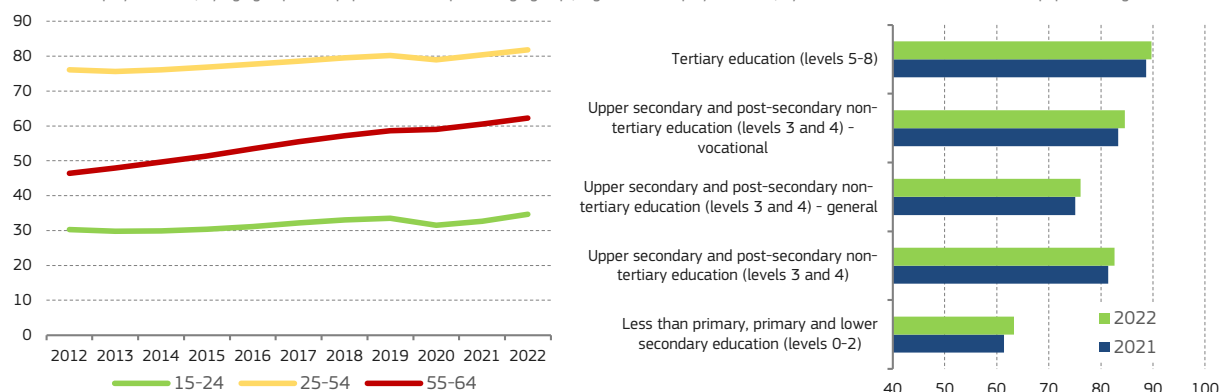
The employment rate rose for all age groups in 2022. Compared to 2021, it grew by 2.0 pp for workers aged 15-24 (young workers) (to 34.7%), by 1.4 pp for those aged 25-54 (core workers) (to 81.8%), and by 1.8 pp for those aged 55-64 (older workers) (to 62.3%) (Chart 1.7). This meant that the employment rate for younger workers surpassed pre-pandemic figures, at 1.2 pp higher in 2022 than in 2019. ⁽³³⁾ During the same period, the employment rate increased by 1.6 pp for core workers and by 3.7 pp for older workers, arguably as a result of demographic factors (more active cohorts have replaced previous ones) and pension reforms in several Member States. ⁽³⁴⁾ The gender employment gap was far wider for older workers (12.5 pp) than for either core workers (10.5 pp) or young workers (4.7 pp).

In 2022, the employment rate rose for people aged 25-54 across all educational levels. The increase was most notable among those with up to lower secondary education, ⁽³⁵⁾ at +1.9 pp (to 63.3%). Despite the implied reduction in the gap, rates remained highest for people with medium-level vocational education ⁽³⁶⁾ (84.6%, +1.3 pp) and for those with tertiary education (89.7%, +1 pp), who are typically more likely to have the skills required to obtain a job in the labour market.

Chart 1.7

Employment rates rose most among older workers between 2012 and 2022, and across all educational levels in 2022

Left chart: employment rate, by age group (% of population of respective age group); Right chart: employment rate, by educational attainment level (% of population aged 25-54)



Source: Eurostat [lfsi_emp_a, lfsa_ergaedn].

[Click here to download chart.](#)

⁽³³⁾ The growth of the employment rate for young people in 2022 was not linked to a deterioration of educational outcomes, as the rate of early leavers decreased (see section 3.3.) and tertiary educational attainment increased.

⁽³⁴⁾ (European Commission, 2019b)

⁽³⁵⁾ Includes people with less than primary, primary and lower secondary education.

⁽³⁶⁾ Medium level refers to upper secondary and post-secondary non-tertiary education. Vocational programmes aim to equip young people and adults with the knowledge, skills and competences required for particular occupations or for the labour market more broadly, and often contain components of work-based learning, including apprenticeships.

For recent graduates with at least upper secondary education, the employment rate recorded a sharp increase in 2022, rising by 2.8 pp compared to 2021, to 82.4%. Greece and Italy had the lowest rates (slightly above 65%), while the rate was above 90% in four Member States.⁽³⁷⁾ In 2022, the gap between men and women in the employment rate of recent graduates was 2.2 pp (81.3% for women, 83.5% for men). In 2022, 60.1% of recent vocational education and training (VET) graduates had benefited from work-based learning and 79.7% were in employment.

The rise in employment was primarily driven by an increase in permanent and full-time workers. The share of temporary employment among workers aged 15-64 in the EU collapsed in 2020 during the COVID-19 pandemic and did not revert to the same levels in 2021 and 2022: it reached 12.1% in 2022, stable compared to 2021 and still 1.1 pp below the 2019 rate. About 23.9 million people worked on a temporary contract in the EU in 2022, 1.7 million fewer than in 2019 (25.6 million). The impact of temporary employment on employment growth declined in the second half of 2021 and 2022 because non-permanent jobs lost during the pandemic were not recovered in some sectors (e.g. manufacturing, construction, accommodation and food, wholesale and retail) due to weak job creation.⁽³⁸⁾ In 2022, temporary work increased most among people with up to lower secondary education (460 000 more workers, to 6.4 million), but remained largely stable for people with higher educational levels (9.9 million people with upper secondary education, and 7.5 million people with tertiary education). The proportion of part-time workers aged 15-64 in the EU fell 0.1 pp in 2022, compared to 2021, to 17.6%, well below the 2019 rate (19.3%). There were almost three million fewer people working part-time in the EU in 2022 than in 2019 (34.7 million and 37.4 million, respectively).⁽³⁹⁾ More people working full-time could represent a sign of improved working conditions, which might in turn help to address labour shortages. The proportion of workers in temporary and part-time employment remained far higher among women (13.4% and 28.4%, respectively) than men (11.0% and 8.2%, respectively). The gender gap increased by 0.1 pp in temporary employment (to 2.4 pp) and decreased by 0.3 pp in part-time employment (to 20.2 pp). Chapter 2 discusses trends and developments in different forms of employment in greater detail, broken down by sectors and occupations with labour shortages.

There are strong differences in employment between the general population and vulnerable groups, such as people with disabilities and Roma. In 2022, the disability employment gap decreased by 1.7 pp from 2021, but remained very high, at 21.4%. According to a survey from the European Union Agency for Fundamental Rights (FRA), the rate of Roma people aged 20-64 in paid work is below the official employment rate for the general population in eight Member States analysed.⁽⁴⁰⁾ In 2021, the highest rates of employment for Roma were estimated in Hungary (62%, a gap of about 17 pp) and in Italy (61%, a gap of about 2 pp), with the lowest rates in Spain (25%, a gap of about 43 pp) and Portugal (31%, a gap of about 45 pp).

3.2. Unemployment rates

Continuing the momentum gained in the second half of 2021, unemployment remained at record low levels even when economic activity growth slowed in the second half of 2022. The unemployment rate (people aged 15-74) declined in both the EU and the euro area by 0.9 pp, to 6.2% and 6.8% respectively, in both cases the lowest rates ever recorded by Eurostat. The reduction was the same for men (-0.9 pp, to 5.9%) and for women (-0.9 pp, to 6.5%). The unemployment rate is expected to remain stable in 2023, at 6.2%, as a consequence of the continued labour market tightness due to skill shortages (Chart 1.8).⁽⁴¹⁾ In 2022, the unemployment rate declined faster but remained far higher for people with education up to lower secondary (12.2%, -1.6 pp from 2021) compared to those with upper secondary and post-secondary (non-tertiary) education (5.7%, -0.7 pp from 2021) or with tertiary education (3.7%, -0.8 pp from 2021).

⁽³⁷⁾ Netherlands, Germany, Luxembourg, Malta.

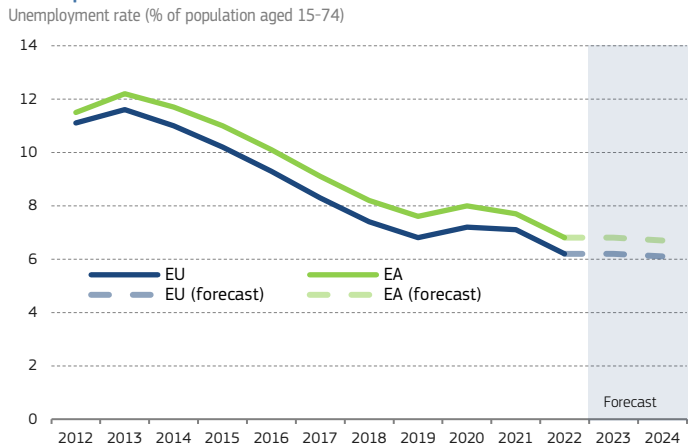
⁽³⁸⁾ (European Commission, 2022g).

⁽³⁹⁾ Involuntary part-time employment as percentage of total part-time employment declined in 2022 by 2.5 pp, to 20.8%.

⁽⁴⁰⁾ (European Union Agency for Fundamental Rights, 2022).

⁽⁴¹⁾ (European Commission, 2023e).

Chart 1.8
Unemployment rates reached record low levels in 2022 and are not expected to increase in 2023 and 2024



Note: European Commission (DG ECFIN) forecast in shaded area.

Source: Eurostat [une_rt_a], DG ECFIN 2023 spring forecast.

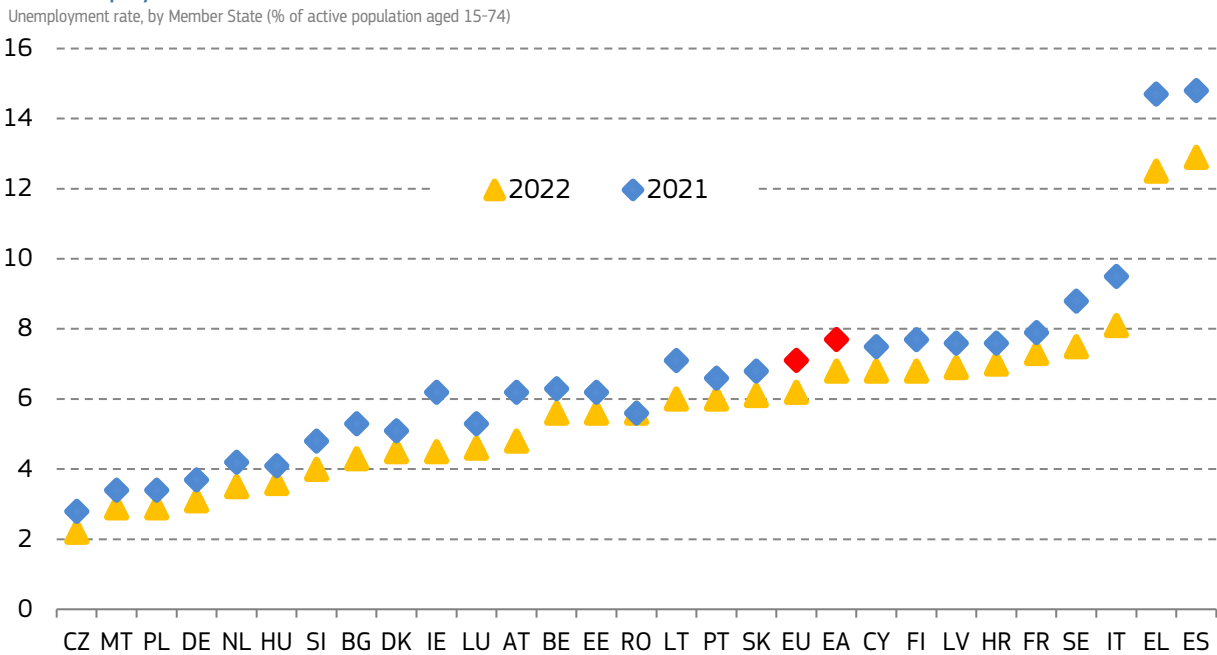
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Compared to 2021, the unemployment rate declined in almost all Member States. Romania was the exception, remaining stable, while the remainder experienced drops of at least 0.5 pp. Those falls were particularly prominent in Greece (-2.2 pp, to 12.5%), Spain (-1.9 pp, to 12.9%), and Ireland (-1.7 pp, to 4.5%) (Chart 1.9).

The youth unemployment rate declined in 2022. It averaged 14.5% in the EU (-2.2 pp) and 14.6% in the euro area (-2.3 pp). The most substantial annual declines were recorded in Italy (-6.0 pp, to 23.7%), Bulgaria (-5.1 pp to 10.7%) and Spain (-5.0 pp, to 29.8%), with the sharpest rises recorded in Estonia (+1.9 pp, to 18.6%) and Romania (+1.8 pp, to 22.8%). The unemployment rate was 2.7 times higher among young workers (aged 15-24) than the rest of population

(aged 25-74), a slightly higher proportion than in 2019 before the COVID-19 pandemic (when it was 2.6).

Chart 1.9
The unemployment rate declined in almost all Member States in 2022



Note: EU and euro area data points for 2022 in red.

Source: Eurostat [une_rt_a].

[Click here to download chart.](#)

The share of people aged 15-29 who were neither in employment nor in education and training (NEET) fell again in 2022. In the EU, that rate decreased by 1.4 pp (to 11.7%), compared to a decline of 0.8 pp in 2021. The NEET rate remained somewhat higher for women (13.0%) than for men (10.5%), increasing most in Slovenia (+1.2 pp) and Czechia (+0.5 pp), and falling most markedly in Italy (-4.1 pp), Bulgaria and Poland (-2.5 pp each). Romania is now the Member State with the highest NEET rate (19.8%), while the Netherlands has the lowest rate (4.2%). Despite the recent decline, the NEET rate is still elevated and needs to be reduced in order to avoid scarring effects among young people. The NEET rate for Roma people aged 16-24 in 2021 reached 71% in Spain and 59% in Romania, according to a survey of the European Union Fundamental Rights Agency⁽⁴²⁾ compared to official NEET rates (people aged 15-24) of 11.0% and 18.0%, respectively. Complementing the EU employment target for 2030, the European Pillar of Social Rights action plan sets as a goal to decrease the NEET

⁽⁴²⁾ (European Union Agency for Fundamental Rights, 2022).

rate to 9% by 2030, meaning that this progress has to be maintained in the coming years. The rate of early leavers⁽⁴³⁾ declined slightly in 2022, dropping by 0.2 pp to 9.6% (11.1% for men and 8.0% for women).

The long-term unemployment rate⁽⁴⁴⁾ fell in 2022. Having increased briefly during the onset of the COVID-19 pandemic, the long-term unemployment rate began to decline steadily from the second half of 2021, during the economic recovery, and that decline continued in 2022, when it fell to 2.4% in the EU (-0.4 pp) and 2.7% in the euro area (-0.5 pp). Long-term unemployment represented 38.5% of all unemployment, 0.7 pp lower than in 2021. Very long-term unemployment⁽⁴⁵⁾ dropped by 0.1 pp, at 1.4% in 2022, representing just under one-quarter (23.2%) of total unemployment.

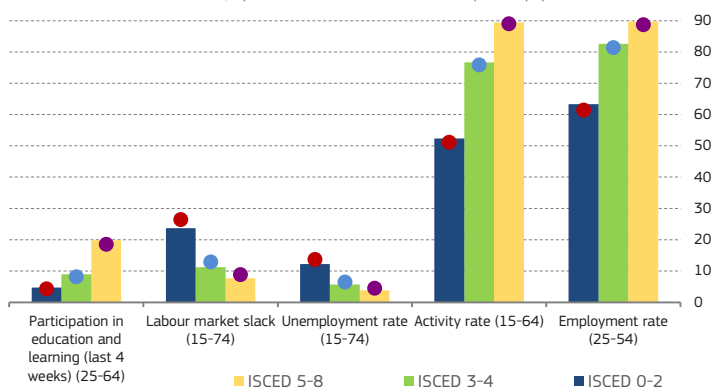
3.3. Labour market participation

Labour market participation increased strongly in 2022. Following a spike in 2021 during the recovery from the COVID-19 pandemic, the activity rate (people aged 15-64) in the EU increased by 0.9 pp, on average, to 74.5%, although it then stagnated in the second half of 2022. Despite increasing slightly more for women (+1 pp) than for men (+0.7 pp) the activity rate remained far lower for women overall (69.5% and 79.4%, respectively). The activity rate was highest for people with tertiary education (89.4%, +0.4 pp from 2021) and upper secondary vocational education (81.0%, +0.8 pp) and lowest for people with lower educational attainment (52.4%, +1.2 pp) (Chart 1.10). It was also lower for people born outside the EU (72.1%, +1.2 pp from 2021) than for natives (74.5%, +0.8 pp from the previous year).

Chart 1.10

People with lower educational attainment tend to be in a disadvantaged position in the labour market

Various labour market indicators, by educational attainment (% of respective population)



Note: International Standard Classification of Education (ISCED) 0-2: Less than primary, primary and lower secondary education; ISCED 3-4: Upper secondary and post-secondary non-tertiary education; ISCED 5-8: Tertiary education. 2022 data in bars, 2021 data in dots.

Source: Eurostat [lfsi_educ_a], [lfsa_argaed], [lfsa_urgaed], [lfsa_sup_edu], [trng_lfse_03]).

[Click here to download chart.](#)

secondary education (23.7%, -2.8 pp from 2021) than for people with tertiary education (7.7%, -1.2 pp) or upper secondary vocational education (9.6%, -1.6 pp).

3.4. Labour shortages

The job vacancy rate⁽⁴⁶⁾ spiked in 2022, as companies found it increasingly difficult to fill their vacancies in the wake of the COVID-19 pandemic. This labour shortage indicator rose steadily after the financial crisis, from 1.2% in 2012 to 2.2% in 2019. It declined briefly during the COVID-19 pandemic, to 1.7% in 2020, then spiked to 2.3% in 2021 and 2.9% in 2022 – the highest value ever recorded.⁽⁴⁷⁾ This substantial rise subsided in the second half of 2022, with the job vacancy rate stabilising at 2.9% in Q4. The highest rates were observed in the Netherlands (4.9%), Belgium, Austria (4.8% for both) and Czechia (4.7%), with the lowest in Romania, Bulgaria, and Spain (0.9% for all three) (Chart 1.11).⁽⁴⁸⁾ At sectoral level, the highest job vacancy rates were observed in the EU in administrative and support service activities (4.7%), accommodation and food service

⁽⁴³⁾ The indicator measures the share of the population aged 18 to 24 with at most lower secondary education who were not involved in any (formal or non-formal) education or training during the four weeks preceding the survey (EU Labour Force Survey (EU-LFS)).

⁽⁴⁴⁾ Long-term unemployment rate measures the share of active workers in unemployment for more than 12 months.

⁽⁴⁵⁾ Very long-term unemployment rate measures the share of active workers in unemployment for more than 24 months.

⁽⁴⁶⁾ The job vacancy rate measures the gap between the number of job vacancies and the sum of the vacancies and occupied posts.

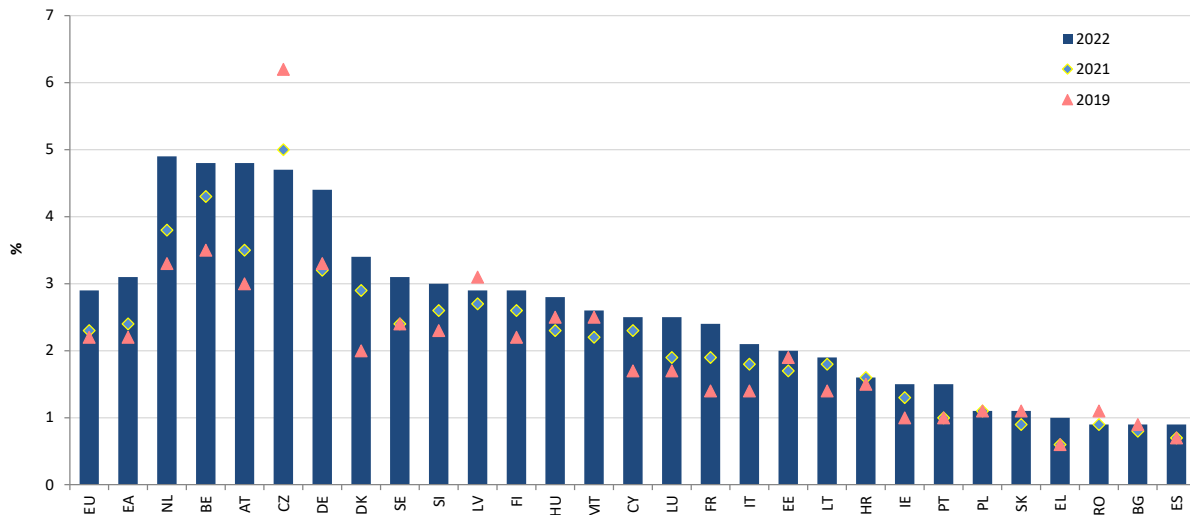
⁽⁴⁷⁾ Eurostat series for job vacancy statistics started in 2008.

⁽⁴⁸⁾ Provisional data for the Netherlands, Spain, and Bulgaria.

Chart 1.11

Job vacancies rose sharply in 2022

Job vacancy rates (% of vacancies and occupied posts)



Source: Eurostat [jvs_a_rate_r2].

[Click here to download chart.](#)

activities (4.2%), information and communication (4.1%), and construction (4.0%), with relatively lower rates for electricity, gas, steam and air conditioning supply (1.7%), financial and insurance activities (2.0%) and manufacturing (2.3%). Some of these sectors (e.g. construction) are central to the green and digital transitions, and alleviating the high number of job vacancies will help to remove bottlenecks and smooth this process (see Chapter 2).

The Beveridge curves⁽⁴⁹⁾ show labour shortages increasing in all sectors of the economy, together with a decline in unemployment. Using data on labour shortages from the European Commission's Business and Consumer Survey (BCS)⁽⁵⁰⁾ as a proxy for job vacancies, the Beveridge curves for the industry, services, and construction sectors display similar behaviour. From 2012 (after the financial crisis) to 2019, unemployment decreased consistently in a period of steady economic growth, while shortages increased steadily to very high levels. This rise stopped in 2020, as the economy was hit strongly by the COVID-19 pandemic, leaving companies facing major challenges and less able to hire new workers. At the same time, the increase in unemployment was limited by job retention measures, such as short-time work schemes. As the economy reopened in 2021, unemployment declined, labour shortages began to increase, and the curves returned to a similar position as in 2019. In 2022, labour shortages skyrocketed, while unemployment fell to historically low levels. The combination of a rise in vacancies and decline in unemployment suggests that the efficiency of labour market matching has not deteriorated in recent years.⁽⁵¹⁾ The increase in labour shortages in 2022 was pronounced in the services sector (+12.7 pp, to 31.2%), with the highest rates observed in the construction sector (32.8%, +7.2 pp from 2021) and a similarly high rate in industry (28.3%, +9.9 pp from 2021) (Chart 1.12).

High and persistent levels of labour shortages show underlying structural drivers. These long-term elements interact with cyclical factors – with lower unemployment the labour market becomes increasingly tight, and companies have more difficulties in finding people to hire.⁽⁵²⁾ Labour shortages and the underlying structural factors are discussed in depth in Chapters 2 and 3.

⁽⁴⁹⁾ Beveridge curves plot unemployment rates with job vacancy indicators to assess the efficiency of labour market matching (the process linking job vacancies to unemployed people).

⁽⁵⁰⁾ Measures the share of firms reporting that the availability of labour is a factor limiting production.

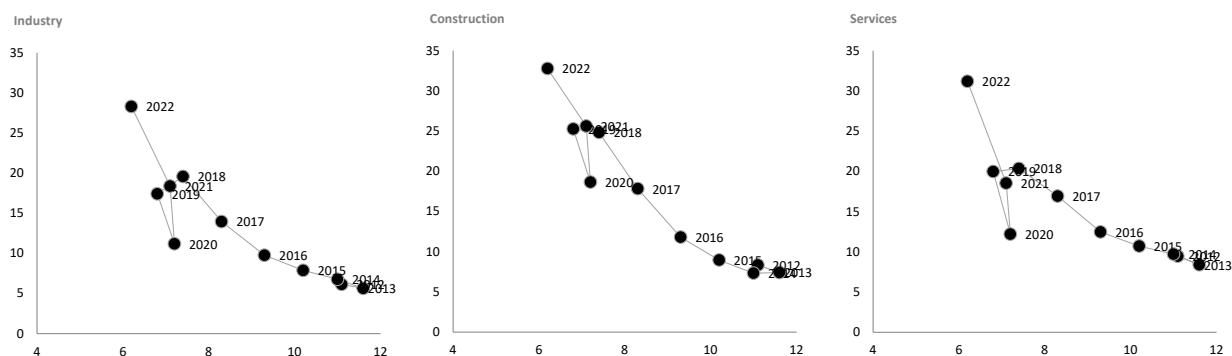
⁽⁵¹⁾ (European Commission, 2022g), pp. 84-85.

⁽⁵²⁾ (European Commission, 2022g).

Chart 1.12

Labour shortages skyrocketed across the whole economy in 2022

Beveridge curves (labour shortage indicators on Y axis and unemployment rates on X axis)



Note: Annual figures for the labour shortage indicators (Y axis) are calculated as annual averages of quarterly data (industry and services) or monthly data (construction).

Source: Eurostat [ei_bsin_q_r2 ; ei_bsbu_m_r2 ; ei_bsse_q_r2 ; une_rt_a].

[Click here to download chart.](#)

3.5. Adult learning and skills

The share of people aged 25-64 participating in education and training⁽⁵³⁾ was far higher for highly educated adults. In 2022, the percentage of people who engaged in learning activities after leaving initial education and training was 11.9% on average in the EU, 1.1 pp more than in 2021. However, the rate was 19.8% for people with tertiary education, 9.0% for those with upper secondary and post-secondary (non-tertiary) education, and only 4.7% for people with less than primary, primary, and lower secondary education. This hints at insufficient access to training for the people who may need it most. The share was also higher for women (12.9%) than for men (10.8%).

The higher the educational attainment of workers, the more likely they are to spend at least half of their working time on cognitive or communication tasks, or guiding other people.⁽⁵⁴⁾ Conversely, people with a low educational level are more likely to spend at least half of their working time on manual tasks that entail intense muscular power or that require finger dexterity. In 2022, the share of employed people aged 15-74 who used their skills at least half of the working time on different types of tasks ranged from 10.2% for calculation tasks to 42.3% for tasks requiring the use of digital skills⁽⁵⁵⁾. Percentages were significantly higher among women for the use of digital skills (46.4%, compared to 38.7% for men) and external communication (35.0%, compared to 24.8% for men), while they were much higher among men, in particular for hard physical work (32.1%, compared to 22.1% for women) (Chart 1.13).

Almost half of the employed people in the EU reported having large autonomy in either the order or the content of their job tasks. In 2022, the share of people reporting having large autonomy was 45.3% for people aged 15-74 (higher for men, at 46.5%, compared to 43.9% for women), older employed people (49.3% for people aged 55-64), and those with higher educational attainment (56.0%). On average, about half of employed people (51.8%) reported that they performed repetitive tasks at work to a large or very large extent, and 41.6% reported that their job tasks follow strict procedures to a large or very large extent. The repetitiveness of the tasks was much higher for employed people with a low level of educational attainment (64%) than for those with a high level (38.2%), and was also higher for women (54.8%) than for men (49.2%). However, there was little or no variation by sex or level of education regarding the obligation to follow strict procedures to a large or very large extent.

⁽⁵³⁾ In the previous four weeks.

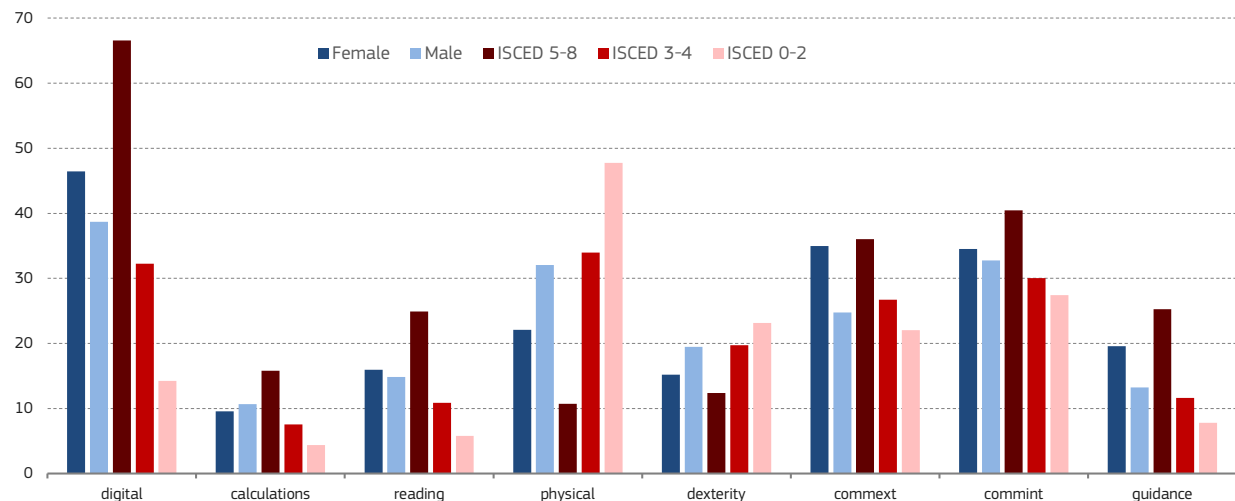
⁽⁵⁴⁾ Data in this and the following paragraph from the 2022 LFS ad hoc subject module on job skills. 'Cognitive' tasks include 'reading' and 'calculation' tasks, while 'communication' tasks include both 'internal' and 'external' communication.

⁽⁵⁵⁾ This data is a proxy of occupational digital skills. It shows the self-reported use of different digital devices in execution of tasks at work. It is to be noted that this measurement differs from the digital intensity index (Chapter 2), which provides for the digital intensity of occupations in terms of skills requirements. Therefore, differences in the findings based on both indicators are to be expected.

Chart 1.13

People with higher educational attainment display higher skill levels in most domains

People using skills 'at least half of the working time' in their main job, % of employed population aged 15-74, 2022



Note: ISCED 0-2: Less than primary, primary and lower secondary education; ISCED 3-4: Upper secondary and post-secondary non-tertiary education; ISCED 5-8: Tertiary education. Digital: working on a computer, tablet or smartphone (phone calls excluded); Reading: reading work-related manuals or technical documents (letters and emails without attached document excluded); Calculations: doing relatively complicated calculations, such as fractions or percentages (includes using a calculator or software); Physical: doing hard physical work, such as moving heavy objects, lifting people or working in painful or tiring positions; Dexterity: carrying out precise tasks with your fingers, such as surgery, drawing or repairing objects (typing or handwriting excluded); Commint: communicating verbally for work purposes with people from your business or organisation, such as colleagues and managers; Commext: communicating verbally for work purposes with people from outside your business or organisation, such as customers, suppliers, patients or pupils; Guidance: advising, training or teaching other people, such as customers, students or colleagues.

Source: EU-LFS 2022.

[Click here to download chart.](#)

4. SOCIAL SITUATION, POVERTY, AND INCOME DEVELOPMENTS

This section presents recent income trends and social developments in the EU, with a particular focus on the indicators included in the revised social scoreboard of the European Pillar of Social Rights action plan. It analyses the living conditions of EU households, including in the context of growing inflation and the recovery from the economic and social impacts of the COVID-19 pandemic. It also documents income trends for the overall population and looks at the multifaceted nature of poverty and social exclusion, with a focus on variations across different levels of educational attainment.

4.1. Income and consumption trends

Inflation spiked in 2022 and negatively affected households' purchasing power, although it decreased from record levels in the last quarter of the year. After two decades of low inflation, the COVID-19 pandemic, coupled with supply-chain bottlenecks, caused prices to rise in 2021. This trend was exacerbated by the Russian war of aggression against Ukraine in early 2022 and the resulting impact on energy and food markets. While nominal wage growth was high and picked up in Q4 2022, it remained far below inflation, leading to a fall in real wages. Inflationary pressures thus accentuated concerns about the purchasing power of lower-income households and low-wage earners,⁽⁵⁶⁾ who spend a higher share of their income on the elements that were among the primary drivers of inflation in 2022 (e.g. energy, food, transport).⁽⁵⁷⁾ At the same time, risks of wage-price spirals should be monitored⁽⁵⁸⁾.

Prices increased sharply for energy-related utilities, food, and transport in 2022, placing substantial financial pressure on lower-income households. Consumer price indices for energy-related and energy-intensive consumption items increased significantly (Chart 1.14). Electricity and gas prices increased steeply compared to the previous year, with gas prices surging by 55.2% on average in the EU. Prices peaked at 12.2% for food and 12.1% for transport. Consumer price indices for housing rentals also increased, albeit by a comparatively lower 1.9%, with large differences recorded across Member States.⁽⁵⁹⁾ Inflation pressures are expected to have had a particularly negative impact on lower-income households, given that the prices of

⁽⁵⁶⁾ Low wage earners are more likely to be affected because they spend a higher share of their income on energy and food, two of the elements driving high inflation. As a result, losses in purchasing power for low-wage earners have a larger effect on aggregate demand (European Commission, 2022g).

⁽⁵⁷⁾ (European Commission, 2022f).

⁽⁵⁸⁾ For further discussions see (European Commission, 2022g) (European Commission, 2023e).

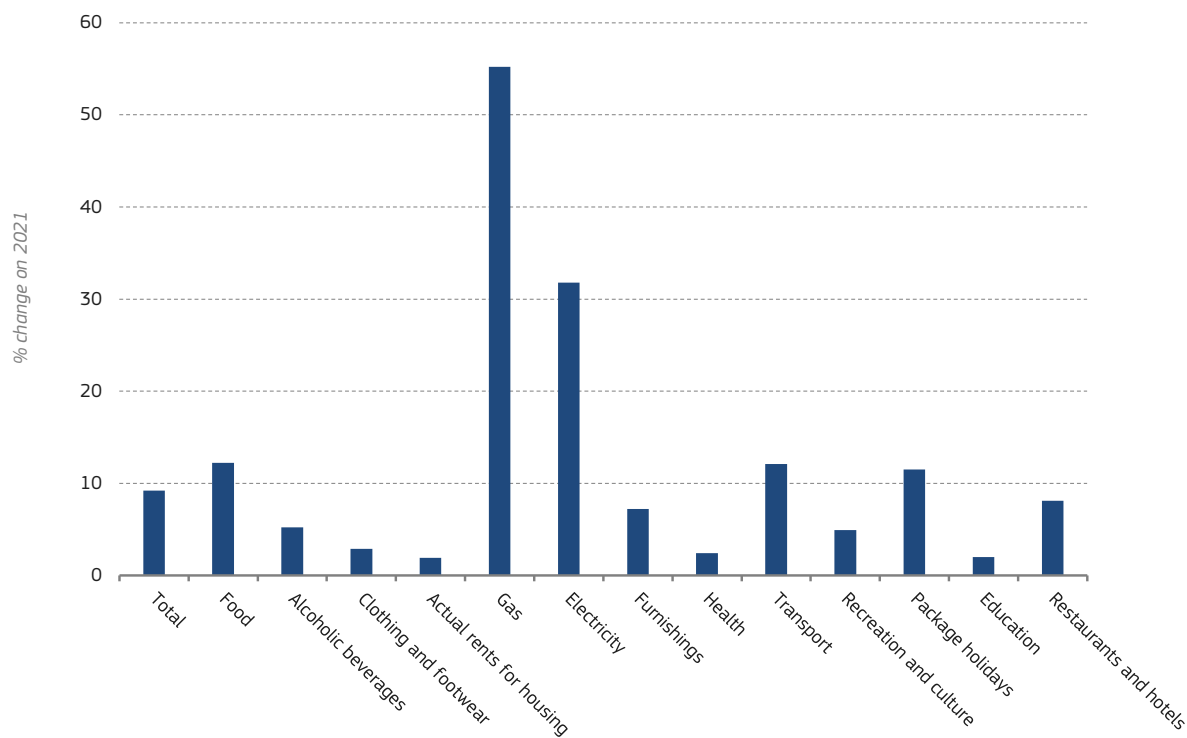
⁽⁵⁹⁾ Consumer price indices, compared to the previous year, for actual rentals for housing were particularly high in Estonia (22.1%), Slovenia (19%) and Lithuania (16.1%).

necessities predominant in the consumption basket rose substantially. Lower-income households are also typically less able to smooth their consumption by drawing on savings or additional borrowing.

Chart 1.14

Prices increased in 2022, particularly for energy-related consumption items

Price index of household final consumption expenditure (year-on-year change), by COICOP*, HICP annual data, EU



Note: Consumption items selected from the classification of individual consumption by purpose (COICOP); HICP gives comparable measures of inflation for the countries and country groups for which it is produced.

Source: Eurostat data [prc_hicp_aind].

[Click here to download chart.](#)

Recent price surges negatively affected the recovery of households' real income growth in 2022.

Previously, with the recovery from the impacts of the pandemic driven mainly by labour market income, growth of real GDHI per capita (quarterly, year-on-year) reached a remarkable 4.0% in Q2 2021 and a more moderate 1.1% in Q3 2021 (Chart 1.15). GDHI is an aggregate measure approximating households' overall living conditions by focusing on the income that households are able to spend.⁽⁶⁰⁾ However, real GDHI per capita growth was negative in Q3 2022, at -0.5%, and again in Q4, at -0.4%, driven by a negative year-on-year change in the weight of the real compensation of employees and the self-employed. This contraction in year-on-year real GDHI growth in Q3 2022 was the first since the onset of the COVID-19 pandemic in Q2 2020 and, before that, since Q2 2013. Overall, for the first time since 2013, annual adjusted gross disposable income of households per capita in real terms was also negative (-0.66%) in 2022, compared to the previous year.⁽⁶¹⁾

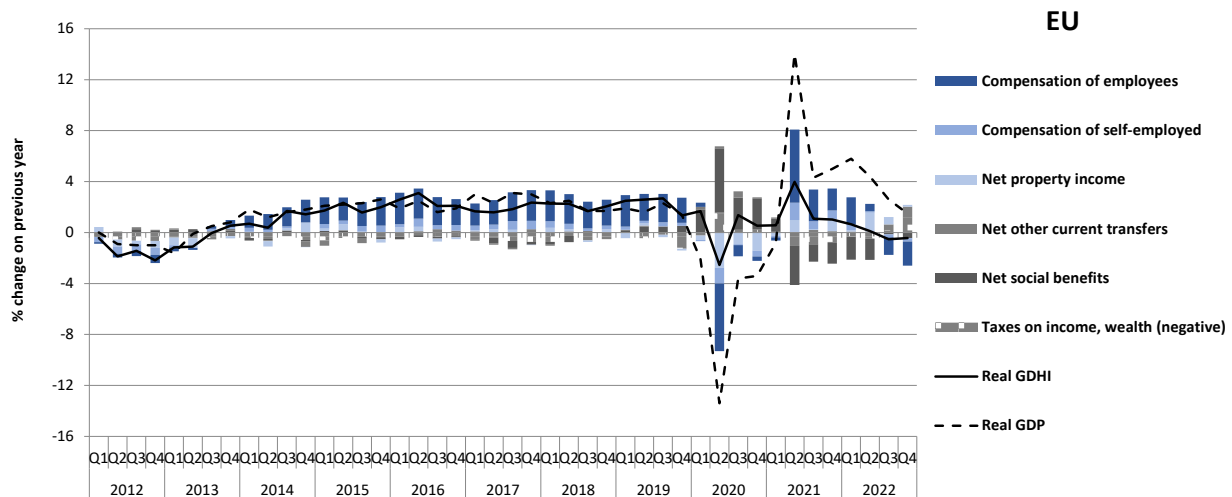
⁽⁶⁰⁾ Unlike GDP, GDHI per capita is net of capital depreciation and disregards the income of foreign residents.

⁽⁶¹⁾ [NASA_10_KI]. Key indicators, annual data. Adjusted real GDHI per capita (percentage change on previous period).

Chart 1.15

Real GDHI growth was negative in the EU in the second half of 2022

Real GDHI and real GDP (% change on previous year), and contribution of GDHI components (pp), 2012-2022, EU



Note: Nominal GDHI is converted into real GDHI by deflating it with the price index of household final consumption expenditure [prc_hicp_aind].

Source: Directorate-General for Employment, Social Affairs and Inclusion (DG EMPL) calculations based on Eurostat data, national accounts [nasq_10_nf_tr] and [namq_10_gdp], data non-seasonally adjusted.

[Click here to download chart.](#)

Taxes and transfers played a role in mitigating negative effects on households' real income growth in 2022. ⁽⁶²⁾ Faced with soaring energy prices, governments rolled out sizeable measures to protect households and corporations from the adverse impact of high energy prices in 2022, with the estimated net budgetary cost of energy support measures reaching 1.2% of GDP in the EU in 2022. ⁽⁶³⁾ Following the negative weight of taxes on real GDHI growth in general, including for much of 2021, in Q3 and Q4 2022 the year-on-year change in the weight of taxes was positive (as it was between Q2 2020 and Q1 2021), likely reflecting income and wealth tax relief measures. Additionally, the year-on-year change in the weight of net other current transfers on real GDHI growth was positive and particularly large in Q4 2022. In the context of previous exceptionally high net social benefit growth compensating for the loss in labour market income during the COVID-19 pandemic in the EU, the year-on-year change in the weight of net social benefits was negative for all quarters in 2022.

The further decrease in the household saving rate in 2022 reflects the recovery in demand for consumption items and could also suggest that households' budgets were squeezed. In 2022, the annual gross household saving rate in the EU fell to 12.9% from 16.5% in 2021 (having spiked in 2020), slightly above the rate recorded just before the COVID-19 pandemic and close to the long-term average (12.8%). ⁽⁶⁴⁾ ⁽⁶⁵⁾ With policy measures prompting an abrupt decline in contact-intensive consumption and income resilience leading to increased savings during the early stages of the pandemic, the saving rate decline in 2022 (that started in mid-2021) is the result of recovery in the demand for consumption items. In addition, it also likely reflects to some extent households' increased drawing on their savings to cope with inflation pressures. ⁽⁶⁶⁾ In the context of the COVID-19 recovery, household consumption shares increased by 2.6% in 2021. Following the easing of travel restrictions in many countries, the increases for holidays (+6.6%) and transport (+6.3), as well as for leisure items such as restaurants and hotels (+2.4%) and recreation and culture (+2.2%), were particularly marked in 2021 (Chart 1.16). Necessities also witnessed expenditure increases, particularly housing and related utilities (+3.1%). Expenditure on fundamental items such as health (+0.3%), clothing (+1.1%) and food (+1.5%) increased to a lesser extent.

⁽⁶²⁾ Market income sources are labour and capital income.

⁽⁶³⁾ (European Commission, 2023e). Energy support measures, which mainly consist of reductions in indirect taxes, subsidies on energy products or production, as well as price caps, are estimated according to the following criteria: (1) measures credibly announced and specified in sufficient detail; (2) strict and consistent definition of an energy measure; (3) measures with an impact on the government budget balance. (European Commission, 2022f) in Box 1.2.4 on fiscal policy measures to mitigate the impact of high energy prices noted energy measures by category, including income/targeted (20%) and income/untargeted (13.8%).

⁽⁶⁴⁾ Gross household saving rate, annual data [NASQ_10_KI]. Quarterly data indicate that the gross household saving rate (seasonally adjusted) increased in Q4 2022 to 12.6%.

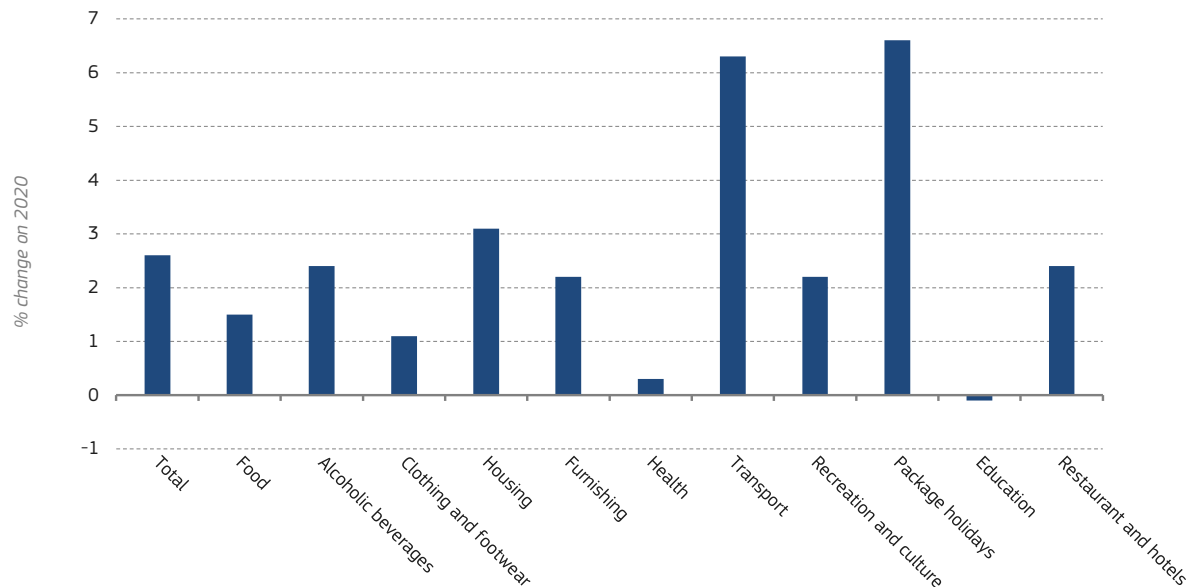
⁽⁶⁵⁾ (European Commission, 2023f).

⁽⁶⁶⁾ (European Central Bank, 2022).

Chart 1.16

Consumption expenditure was higher in 2021 than in 2020, particularly for transport and holidays

Final consumption expenditure of households (year-on-year change), by consumption purpose, 2021, EU



Note: Consumption items selected from COICOP; housing includes water, electricity, gas, and other fuel; furnishing includes household equipment and routine household maintenance.

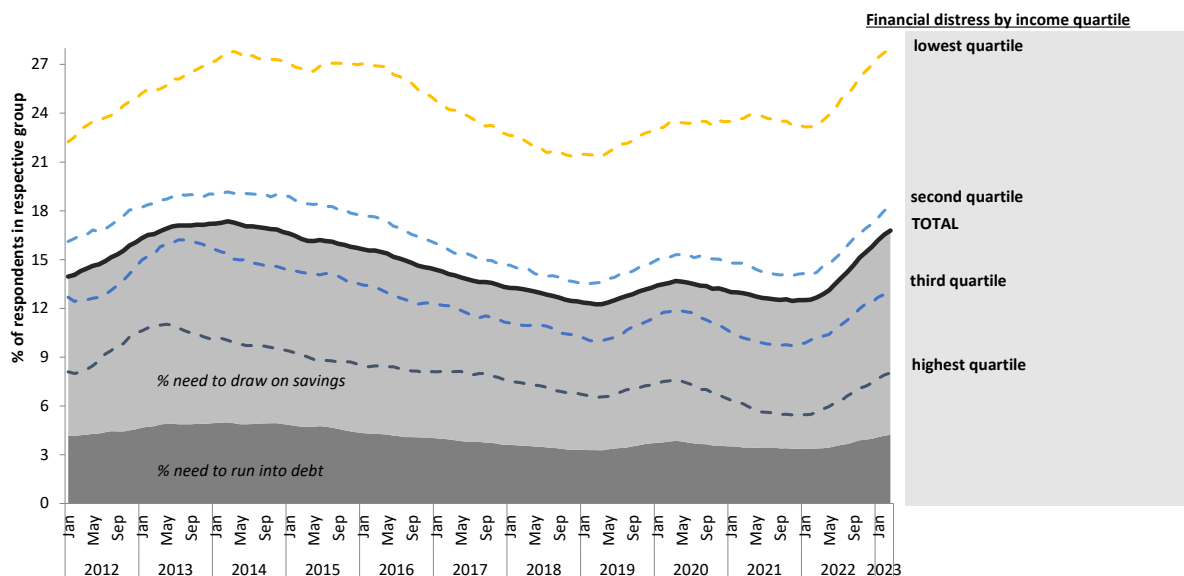
Source: Eurostat [NAMA_10_CO3_P3], values adjusted by price index (implicit deflator) in national currency.

[Click here to download chart.](#)

Chart 1.17

Reported financial distress increased in 2022 and was highest for low-income households

Reported financial distress by income quartile, 2012-2022, EU



Source: BCS, 12-month moving average (DG EMPL F.4 calculations).

[Click here to download chart.](#)

Inflation pressures in the economy have increased financial distress among households on lower incomes.

Overall, reported financial distress of households increased from 12.5% in December 2021 to 15.8% in December 2022 (Chart 1.17).⁽⁶⁷⁾ As one of its components, the share of adults reporting having to draw on savings to meet daily needs also rose, from 9.1% in December 2021 to 11.8% in December 2022. Broken down by incomes, in December 2022, 27% of lower-income households⁽⁶⁸⁾ reported financial distress (up from 23.3% in 2021), compared to 7.4% of households in the top income quartile (up from 5.5% in 2021). The levels of financial distress among lower-income households were similar to those recorded in the aftermath of the

⁽⁶⁷⁾ The financial distress indicator is based on the BCS and is composed of share of adults reporting the need to draw on savings and share of adults reporting the need to run into debt.

⁽⁶⁸⁾ Defined as those in the bottom income quartile.

financial crisis in December 2013. Financial distress also increased for households in the second income quartile (increasing from 14.1% to 17.2%) and third income quartile (increasing from 9.8% to 12.4%) from December 2021 to December 2022. The share of households reporting an inability to face unexpected financial expenses also increased in 2022, at 31.5%, compared to 30.2% in 2021. ⁽⁶⁹⁾ Similarly, the share of households reporting difficulties in making ends meet increased from 11.3% in 2021 to 12.2% in 2022, the same level recorded in 2020.

Surges in energy prices, coupled with pressures on households' purchasing power, had implications for energy poverty in 2022. Energy poverty increased by 2.4 pp in 2022, reaching 9.3% (compared to 6.9% in 2021). There were large variations across Member States, with energy poverty particularly high in Bulgaria (22.5%), Greece (18.7%), Lithuania and Portugal (both 17.5%). ⁽⁷⁰⁾ The share remained substantially higher for the population at-risk-of poverty, at 20.2%, more than double the EU average in 2022 (up from 16.4% in 2021). Before energy prices increased more steeply in early 2022, energy poverty had decreased at EU level, from 10.8% in 2013 to 6.9% in 2021. ⁽⁷¹⁾ ⁽⁷²⁾

4.2. Income inequality

In a challenging context, income inequality in the EU has remained broadly constant. Eurostat's flash estimates of the income quintile share ratio for the top and bottom quintiles (S80/S20) for income year 2022 show stability at EU level compared to 2021. ⁽⁷³⁾ As a measure of inequality of income distribution, the ratio of the total income received by the 20% of the population with the highest income (top quintile) to the total income of the 20% of the population with the lowest income (bottom quintile) decreased slightly, to 4.74 in 2022 (2021 incomes), compared to 4.99 in 2021 (2020 incomes) and 4.89 in 2020 (2019 incomes). ⁽⁷⁴⁾ Similarly, the ratio of total income received by the top quintile (20%) to total income of the 50% of the population (S80/S50) was 2.14 in 2022 (2021 incomes), down from 2.17 in 2021 (2020 incomes). ⁽⁷⁵⁾ The slight downward trend in 2022 (2021 incomes) and broad stability of income inequality during the COVID-19 outbreak also reflects the large-scale support measures put in place by Member States, with EU support, which mitigated negative effects. ⁽⁷⁶⁾ In view of more recent developments, including the energy crisis and related inflationary pressures, it is increasingly important to complement measures of income inequality with measures that better capture the impact of inflationary pressures on households (see section 4.1.). ⁽⁷⁷⁾

4.3. Risk of poverty and social exclusion

The AROPE rate remained relatively stable in 2022. The AROPE rate in the EU was 21.6% in 2022, similar to the two previous years (21.7% in 2021, 21.6% in 2020) (Chart 1.18). ⁽⁷⁸⁾ This stability also confirms the crucial role of social protection and social inclusion policies in ensuring socioeconomic resilience to shocks, including in the context of Russia's war of aggression against Ukraine. The AROPE rate was particularly high for young adults aged 18-24 years (26.5%) and for children (24.7%). ⁽⁷⁹⁾ The EU 2030 Porto target foresees lifting 15 million people out of poverty or social exclusion, including five million children (compared to the 2019 baseline of 92.2 million). With the AROPE rate remaining stable compared to 2021, an estimated 95.3 million EU citizens experienced poverty or social exclusion in 2022, 19.9 million of whom were children under 18 years old. This implies a slight decrease (279 000) on 2021, when 95.5 million people were considered at risk of poverty or social exclusion, 19.6 million of whom were children. ⁽⁸⁰⁾ In line with the trend in previous years, the share of people at risk of poverty or social exclusion in 2022 was slightly higher for women (22.7%) than for men

⁽⁶⁹⁾ [ILC_MDES04].

⁽⁷⁰⁾ [ILC_MDES01]. Data for Cyprus were provisional at the time of extraction, at 19.2%.

⁽⁷¹⁾ 2013 is the first available year. Data for Germany, Ireland, France, and Luxembourg have a break in series in 2020; Luxembourg and Portugal have a break in series in 2021.

⁽⁷²⁾ There is no single official indicator of energy poverty for the EU. The inability to keep adequately warm is one indicator that feeds into the AROPE indicator through the SMSD.

⁽⁷³⁾ Indicators focusing on incomes have limitations in capturing declines in the purchasing power of households due to an increase of the cost of living rather than a decrease in incomes.

⁽⁷⁴⁾ [ILC_DI11].

⁽⁷⁵⁾ [ILC_DI11D]. Income quintile share ratio S80/S50 for disposable income was 2.16 in 2020 (with a break in series), 2.17 in 2021, and 2.14 in 2022 at EU level.

⁽⁷⁶⁾ Taxes and benefits significantly reduce market income inequality (European Commission, 2022e).

⁽⁷⁷⁾ (European Commission, 2022b).

⁽⁷⁸⁾ AROPE rate corresponds to the sum of persons who are either at risk of poverty (2021 incomes), or severely materially and socially deprived (2022) or living in a household with a very low work intensity (2021). People are included only once, even if they are in more than one of these situations. [ILC_PEPS01N].

⁽⁷⁹⁾ Children are defined as less than 18 years old.

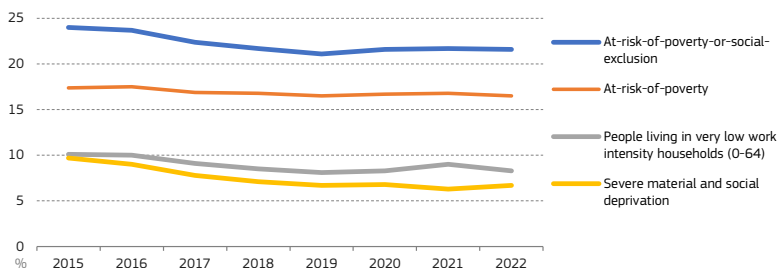
⁽⁸⁰⁾ [ILC_PEPS01N]. To note, previously part of the difference in levels reflected the change in data collection methods in Germany between 2019 and 2020, which affected the EU average, but not the direction of change, from 2020 to 2021.

(20.4%). People with a disability are also at a higher risk of poverty or social exclusion (28.9%), compared to people with no such limitations (18.3%).⁽⁸¹⁾

Chart 1.18

Risk of poverty or social exclusion continued to decline until 2019 and has remained stable in 2022, as compared to the previous year.

At risk of poverty or social exclusion rate (AROPE), at risk of poverty rate (AROP), severe material and social deprivation rate (SMSD) (% of population), very low work intensity households (% of population aged 0-64), EU, 2015-2022.



Note: The year refers to the EU-SILC survey year; income measured is from the previous year. AROPE, AROP: income from the previous year, SMSD: current year. VLWI: status in the past year. Values for AROP between 2015-2018 are estimated. For AROPE and AROP there is a break in time series in 2020.

Source: Eurostat, EU SILC [ILC_PEPS01] [ILC_LI02] [TEPSR_LM430] [TEPSR_LM420].

[Click here to download chart.](#)

inflation crisis, it is important to continuously monitor the evolution of household incomes in real terms, with real GDHI negatively impacted in 2022 (see section 4.1.). Additional Eurostat flash estimates deflating the estimated changes on incomes (using HICP) in 2022 also show the negative impact of the rising cost of living.⁽⁸⁴⁾

The proportion of the population living in severe material and social deprivation increased from 6.3% in 2021 to 6.7% in 2022.⁽⁸⁵⁾ This reflects declines in the purchasing power of households and contrasts with the downward trend of previous years. Over the longer term, the number of people living in severe material and social deprivation decreased to 28.7 million people in 2022, from 40.9 million people in 2015 at EU level.⁽⁸⁶⁾ Additionally, the share of people living in quasi-jobless households decreased slightly in 2022 (reference year 2021) to 8.3%, compared to 9% in 2021 (reference year 2020), following an earlier increase in the context of the onset of the COVID-19 pandemic.⁽⁸⁷⁾

The AROPE rate shows considerable variability across educational attainment levels.⁽⁸⁸⁾ Education and training are important for accessing employment opportunities and for achieving higher earnings. For those with lower levels of education, the AROPE rate was 34.5% in 2022 at EU level, substantially higher than the rate among people with medium (19.8%) and higher (10.5%) levels of education. This trend persists across countries and over time, with those with lower education levels consistently at higher risk of poverty or social exclusion. The difference between those with lower levels of education and those with higher levels of education is particularly pronounced (more than 30 pp) in Bulgaria, Romania, and Latvia (Chart 1.19). However, the share of

⁽⁸¹⁾ [ILC_PEE501N]. For a population aged 16+, for persons with some or severe level of activity limitation, compared to those with none.

⁽⁸²⁾ AROPE's three components are: at-risk-of poverty, total population (AROP O+), severe material and social deprivation, total population (SMSD O+) and share of people living in households with very low work intensity (quasi-jobless households), age 0-64 (VLWI 0-64).

⁽⁸³⁾ [TESSI010] The share of persons with an equivalised disposable income below the risk-of-poverty threshold, which is set at 60% of the national median equivalised disposable income (after social transfers).

⁽⁸⁴⁾ Eurostat flash estimates use the HICP to deflate the estimated changes in income deciles. Deflated values HICP measures the change over time in the prices of consumer goods and services as an average across all households.

⁽⁸⁵⁾ Official SMSD data available for 2022 incomes.

⁽⁸⁶⁾ [ILC_MDSD11] SMSD rate is the proportion of the population experiencing an enforced lack of at least seven of 13 deprivation items. Items at *household level*: i) Capacity to face unexpected expenses; ii) Capacity to afford paying for one week annual holiday away from home; iii) Capacity to be confronted with payment arrears (on mortgage or rental payments, utility bills, hire purchase instalments or other loan payments); iv) Capacity to afford a meal with meat, chicken, fish or vegetarian equivalent every second day; v) Ability to keep home adequately; vi) Having access to a car/van for personal use; vii) Replacing worn-out furniture. Items at *individual level*: viii) Having internet connection; ix) Replacing worn-out clothes with new ones; x) Having two pairs of properly fitting shoes (including a pair of all-weather shoes); xi) Spending a small amount of money each week on themselves; xii) Having regular leisure activities; xiii) Getting together with friends/family for a drink/meal at least once a month.

⁽⁸⁷⁾ [ILC_LVHL11N]. Persons living in household with very low work intensity, by age and sex (0-64 years).

⁽⁸⁸⁾ [ILC_PEPS04N] For those aged 18 and over. Lower levels of education are classified as less than primary, primary, and lower secondary education (ISCED levels 0-2). Medium levels of education are classified as upper secondary and post-secondary non-tertiary education (ISCED levels 3 and 4). Higher levels of education are classified as tertiary education (ISCED levels 5-8).

Box 1.1: Data on indicators of income inequality and poverty: some caveats

The indicators on economic strain, income inequality and poverty (see sections 4.1, 4.2, and 4.3) present new evidence on general trends in recent years compared to previous European Commission publications, based on EU-SILC 2022 data and Eurostat flash estimates.

Indicators should be interpreted with caution, in the context of rising consumer prices presenting new economic and social challenges across the EU. While measuring the inflation effects on living costs and purchasing power is comparatively straightforward, assessing the subsequent consequences on poverty and social exclusion is more complex.

The AROP rate is based on a relative threshold of 60% of the national median (equivalised) income after social transfers, and thus does not capture purchasing power considerations. By focusing on low income in comparison with other residents (i.e. relative risk of poverty), it does not automatically capture the effect of rising prices on households, as it does not take into account living costs and consumption. On the other hand, one of the three components of the AROPE rate, SMSD, is responsive to losses in households' purchasing power, as it distinguishes between individuals who cannot afford a certain good, service, or social activity. ⁽¹⁾

Several indicators of inequality and risk of poverty are the result of model simulations and should be interpreted with caution. Official statistics (i.e. not based on simulations) are necessarily published with a delay. In fact, for any given reference year t , data are released at $t+1$ (e.g. for EU SILC 2022, the release was in June 2023), while these indicators refer to the latest available completed year ($t-1$, i.e. 2021 for EU SILC 2022).

In the absence of recent official statistics on distributional indicators, due to the necessary time lag for their production after data collection, sources of a more experimental nature were used in the analysis.

This includes the following simulations:

- Eurostat flash estimates:
 - Income quintile share ratio S80/S20 referring to 2022 income year for disposable income (income share of the top 20% compared to the bottom 20%).
 - AROP rate referring to 2022 income year.

Flash estimates are produced by Eurostat to have early indicative results for use in the EU's policy agenda. These simulations imply the use of models that allow the estimation of the entire distribution and capture the complex interaction between labour market developments, the effects of economic and monetary policies and the implementation of social reforms.

In order to monitor the evolution of the disposable income in real terms, Eurostat flash estimates also used the HICP to deflate the estimated changes in income deciles for 2022 compared to the previous year, with those deflated values measuring the change over time in the prices of consumer goods and services as an average across all households.

⁽¹⁾ (Menyhert, 2022)

persons at risk of poverty or social exclusion has been decreasing across persons with different levels of education since 2015. ⁽⁸⁹⁾

Social transfers play an important role in reducing poverty. The AROPE rate did not experience a more substantial increase, including during the COVID-19 pandemic, partly due to the mitigating impact of social protection systems and measures taken by the Member States, with EU support. In 2022 (2021 incomes), social transfers reduced poverty by 35.3% on average in the EU. Overall, the impact of social transfers on poverty reduction remained broadly stable since 2015, but rose to unprecedented levels in 2021 (2020 incomes) (37.1%) and remained elevated in 2022 (2021 incomes). ⁽⁹⁰⁾

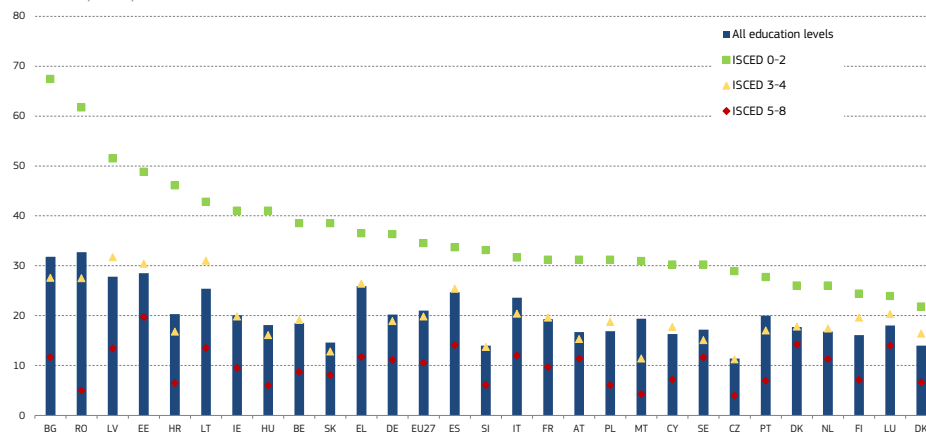
⁽⁸⁹⁾ Data available from 2015 onwards, broken down by ISCED levels. The largest decrease in pp between 2015-2022 is observed for those households with upper secondary and post-secondary non-tertiary education (ISCED levels 3 and 4).

⁽⁹⁰⁾ [TESPM050].

Chart 1.19

Higher AROPE rate for people with lower levels of education, across all countries

AROPE rate, by level of education, 2022, EU



Note: Provisional data for France, Cyprus, and Luxembourg.

Source: Eurostat, EU-SILC [ilc_peps04n].

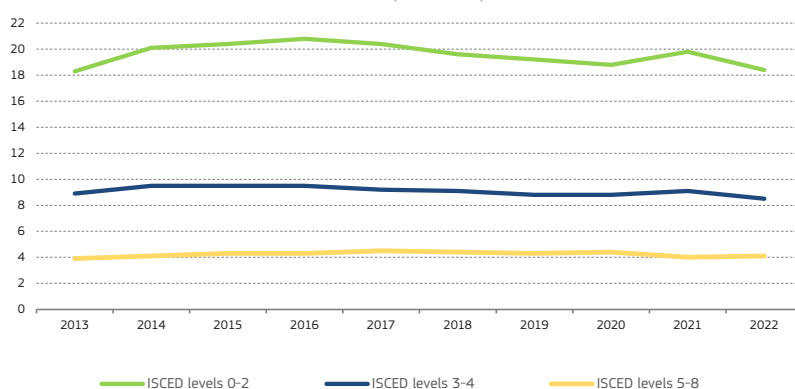
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Continuing a general trend, people with lower education levels face higher risks of in-work poverty, highlighting the importance of education and skills development. While in-work poverty remained broadly stable in 2020 (8.8%) and 2021 (8.9%), following a decline between 2016 and 2020, it decreased further to 8.5% in 2022 (2021 incomes).⁽⁹¹⁾ Yet, in-work poverty risks were persistently higher for those with lower levels of education, at 18.4% in 2022, compared to those with medium (8.7%) and higher (4.1%) levels of education.⁽⁹²⁾ While in-work AROP rates have remained broadly stable for those with higher levels of education, the risks for those with lower levels of education overall decreased slightly between 2016 and 2020 (Chart 1.20).

Chart 1.20

Higher in-work AROP rates for those with lower levels of education

Differences in in-work AROP rates across educational levels, 2013-2022, EU



Note: Values estimated from 2013-2019, with a break in time series in 2020.

Source: Eurostat, EU-SILC [ILC_IW04].

[Click here to download chart.](#)

Those employed part-time and on temporary contracts face higher levels of in-work poverty. In 2022 (2021 incomes), those working part-time experienced higher levels of in-work poverty (13.5%) than those working full-time (7.1%).⁽⁹³⁾ Similarly, the AROP rate was higher for those in temporary employment than those on permanent contracts, at 12.2% and 5.2% respectively.⁽⁹⁴⁾ In-work poverty was also significantly higher among non-EU born (19.4%), than native (7.5%) workers.⁽⁹⁵⁾

5. CONCLUSIONS

Overall, the EU economy and labour market remained resilient in 2022, with labour shortages constituting a key challenge. In a difficult geopolitical and economic climate, the EU economy expanded, while record levels of high employment and low unemployment resulted in continued tightness of the labour market, with persistent and high labour shortages. Chapters 2 and 3 will look more closely at the sectors and occupations facing labour shortages, focusing on their drivers and the policies that could be used to alleviate them.

⁽⁹¹⁾ [ILC_IW01]. 18-64 years.

⁽⁹²⁾ [ILC_IW04].

⁽⁹³⁾ [ILC_IW07].

⁽⁹⁴⁾ [ILC_IW05].

⁽⁹⁵⁾ [ILC_IW15]. For those aged 18 years or over.

Despite facing serious challenges, the EU economy expanded in 2022. The Russian war of aggression against Ukraine inflicted immense human suffering. It also exacerbated existing rises in inflation following the COVID-19 pandemic, with a spike in energy prices, particularly for gas and electricity, driving record levels of inflation. The EU economy grew overall, although progress slowed in the second half of the year. Stabilising energy prices meant that recession was avoided and the economic outlook improved for 2023 and 2024. Nevertheless, significant risks persist, as core inflation remains stubbornly high, geopolitical tensions have not subsided, and the global economy is only slowly returning to sustained growth.

The EU labour market performed strongly, with labour shortages remaining high. In 2022, the number of people employed reached new record levels and the unemployment rate was the lowest ever recorded. As job vacancy rates spiked, high and persistent labour shortages remain a major issue, given their potential to hinder future employment growth, especially in sectors linked to the green and digital transitions. Differences in the employment situations of people with lower educational attainment, persons with disabilities and other vulnerable groups such as Roma also represent a challenge in fully integrating all workers into the labour market.

After decades of low inflation, inflationary pressures present new social challenges by eroding households' real incomes. Record inflation leading to losses in real incomes placed increased financial pressure on households in 2022, particularly those on lower incomes. In the context of increases in inflation surpassing nominal wage growth and negatively impacting households' purchasing power, real GDHI growth per capita was negative in the second half of 2022 and the share of households experiencing severe material and social deprivation increased.

In light of stark rises in consumer prices, financial distress has increased, particularly among lower-income households. Prices surges were considerable in 2022, including for gas, electricity, food, and transport, putting substantial pressure on the finances of lower-income households, for whom these necessity items make up a larger share of their consumption expenditure. Given the negative impacts of inflation on the purchasing power of households, overall financial distress increased, with reported financial distress at 27% among lower-income households, compared to 7.4% for higher-income households. Additionally, a decrease in the household saving rate in 2022 as a whole (while picking up in Q4), reflecting an expansion of demand for consumption following the COVID-19 recovery, could also indicate the increasing need for lower-income and middle-income households to offset financial pressure by relying on savings. The spike in energy prices in 2022, paired with overall declines in purchasing power, resulted in increased energy poverty, with all Member States (supported by the EU) implementing emergency measures to ease related financial pressures for vulnerable households and businesses.

In this challenging context, the share of people at risk of poverty or social exclusion (AROPE rate) remains relatively stable. While the AROPE rate at 21.6% in 2022 remained at a similar level to the two previous years, when broken down into its components, the AROP rate (2021 incomes) and share of persons in quasi-jobless households (reference year 2021) decreased slightly, with the SMSD rate (reference year 2022) increasing. Eurostat flash estimates show that the at-risk-of poverty (AROP) rate and income inequality in the EU remained broadly constant for 2022 incomes.

Despite the good performance of the EU economy and labour market in 2022, significant social risks persist and need to be closely monitored. High inflation in 2022 placed substantial financial pressure on households, especially those on lower incomes, posing risks to livelihoods and well-being. Ongoing economic and geopolitical uncertainty necessitates close monitoring of employment and social developments, including the evolution of real household incomes, while the risks of wage-price spirals should be monitored. ⁽⁹⁶⁾ In the longer term, the reversal of population growth and steady increases in the old-age dependency ratio, together with their negative consequences for the economy, will bring additional challenges for the EU.

Education and skills development remain crucial in promoting employment and addressing poverty and social exclusion, both within and outside work. In general, people with lower levels of educational attainment are less likely to be in employment or to take part in adult learning. In the context of the 2023 European Year of Skills, this highlights the importance of training, in particular adult learning, in reducing these risks. In general, the AROPE rate and the AROP rate of in-work poverty vary by education level, with those with lower levels of education consistently bearing the highest risk. ⁽⁹⁷⁾ The following chapters also explore the role of skills in gaining access to high-quality jobs and the impact of training programmes on different population sub-groups.

⁽⁹⁶⁾ For discussions on implications of increases in wages for wage-price spirals, see (European Commission, 2022g) (European Commission, 2023e).

⁽⁹⁷⁾ This is likely partly related to their lower labour market prospects.

Structural drivers of labour shortages in the context of changing skills needs

1. INTRODUCTION ⁽⁹⁸⁾

Labour shortages occur when the demand for workers qualified in a particular area of the labour market exceeds the supply of those workers. This can arise for a variety of interrelated reasons, such as insufficient labour supply in certain segments of the labour market or in certain geographical locations (quantitative shortages), or a discrepancy between the skills and qualifications sought by employers and those held by individuals seeking employment (qualitative shortages). In order to successfully fill a vacancy, people with the right skills and qualifications must be in the right place at the right time and must be willing to work under the conditions offered. Accordingly, individuals seeking employment must have adequate information about the requirements, working conditions, and availability of vacant positions.

Although the trend in increasing labour shortages was interrupted by the COVID-19 crisis, labour shortages have now reached or exceeded pre-pandemic levels in many EU countries (see Chapter 1). Labour shortages represent a longstanding challenge for some sectors and occupations, while others are newly facing these challenges. According to the Business and Consumer Survey (BCS) and job vacancy statistics for Q1 2023, sectoral labour shortages are most prevalent in healthcare, hospitality, professional, scientific and technical activities, transportation and construction.⁽⁹⁹⁾ Based on the 2022 European Employment Services (EURES) report – which provides information at occupational level – labour shortages and surpluses are most evident for software and healthcare-related occupations, construction and engineering craft workers.⁽¹⁰⁰⁾

Labour shortages are shaped by structural determinants (including skills) and cyclical drivers. According to the 2022 Labour Market and Wage Developments in Europe review, the geographical, occupational and sectoral patterns of labour shortages in the COVID-19 recovery have followed pre-pandemic trends, suggesting important underlying structural drivers.⁽¹⁰¹⁾ These drivers include the influence of skills shortages and mismatches (exacerbated by companies unwilling or unable to invest in training),⁽¹⁰²⁾ creation of jobs and demand for additional skills linked to the ongoing green and digital transitions, decline in the labour force due to demographic trends, low labour market participation of certain population groups (such as women, persons with

⁽⁹⁸⁾ This chapter was written by Jakub Caisl, Karolina Gralek, Gabor Katay, Linda Kunertova, Anna Lalova and Nora Wukovits-Votzi, with contributions from Alessia Fulvimari, as well as Cedefop experts Stelina Chatzichristou, Ilias Livanos, Konstantinos Pouliakas, Giovanni Russo and Giulia Santangelo, Joint Research Centre (JRC) experts Matthias Weitzel and Rafael Garaffa, and Eurofound experts Agnes Parent-Thirion and Barbora Makova.

⁽⁹⁹⁾ Critical labour and skills shortages have also been identified in the agricultural sector, which is not covered by BCS or job vacancy statistics (OECD, 2023c).

⁽¹⁰⁰⁾ (ELA, 2023).

⁽¹⁰¹⁾ (European Commission, 2022g).

⁽¹⁰²⁾ (Pouliakas and Wruuck, 2022).

disabilities, or people with a minority racial or ethnic background), labour market segregation across occupations and sectors, influence of labour mobility and migration, poor working conditions in some sectors and occupations, inefficient recruitment and human resources management (HRM) practices, incentives provided by the tax and benefit systems, and changing workers' preferences. ⁽¹⁰³⁾

While temporary labour shortages might be a sign of an economic upswing and give workers some bargaining power, persistent labour shortages are likely to have negative effects on the wider economy. ⁽¹⁰⁴⁾ Labour shortages may provide an opportunity for workers to demand higher wages, better working conditions, or investment in their skillsets, as well as enabling marginal workers to enter or remain in the labour market. However, they may also negatively impact existing workers, potentially increasing their work intensity and worsening their work-life balance. Labour shortages may limit the economic activity of companies and public institutions, lower their capacity for innovation, ⁽¹⁰⁵⁾ or force them to reduce the quality of their services and products. They may also lead to outsourcing, offshoring, remote work, or automation. ⁽¹⁰⁶⁾ At macro level, countries with labour and skills shortages may become less attractive for innovation and investment in research and development (R&D), which could weaken their competitiveness in the medium and long term. In addition, a shortage of workers with the required skills could impede the green and digital transitions. Given the prevalence of structural drivers even when economic conditions worsen, understanding them is crucial to developing the right policy responses.

In light of the European Year of Skills in 2023, this chapter analyses the structural drivers of persistent labour shortages, with a specific focus on changing skills needs in the context of the green and digital transitions. Chapter 1 presented the latest developments in labour shortages, and this chapter identifies sectors and occupations that have faced persistent labour shortages over the last 10 years. Section 2. analyses the skills needed in those occupations and presents future projections for labour shortages. Section 3. looks at how demand for new skills in the context of the green and digital transitions changes the demand for labour and contributes to labour shortages. The remainder of the chapter presents an in-depth analysis of other structural drivers of persistent labour shortages: section 4. looks at the impact of demographic trends of population ageing and lower labour market participation of some population groups; section 5. examines gender segregation in sectors and occupations with persistent labour shortages and its contribution to shortages in certain skilled occupations in science, technology, engineering and mathematics (STEM) and healthcare; section 6. considers the labour market participation of migrants born outside the EU in occupations facing persistent labour shortages; and section 7. describes the extent to which working conditions might contribute to persistent labour shortages in some sectors and occupations. Section 8. concludes with a brief overview of the chapter findings.

2. LABOUR SHORTAGES, INCLUDING SKILLS SHORTAGES, IN THE EU

There is no universally agreed methodology on how to measure labour shortages in the EU. One of the most common approaches is to use the BCS, which collects quarterly survey data from employers in the industry, manufacturing and services sectors, asking whether labour is a major factor limiting their production. ⁽¹⁰⁷⁾ Often, job vacancy rates are used as an alternative measure to identify demand for labour, as they cover more sectors, albeit with less sectoral disaggregation and with a bigger time lag. The European Labour Authority (ELA) also collects information from the public employment services (PES) on labour shortages and surpluses, by occupation and Member State. However, that information is more qualitative than quantitative, and the time series is short. This section combines all three approaches to map the sectors and occupations with persistent labour shortages in the EU – referred to as 'labour shortage sectors' and 'labour shortage occupations', respectively. The available approaches, however, do not provide a single reliable estimate of the size of labour shortages, i.e. the number of vacancies that cannot be filled due to labour shortages.

Skills shortages are often approximated by the share of employers reporting difficulties in finding employees with the right skills. Firms' recruitment difficulties may be driven by various factors. These can include the lack of skills among job applicants, ⁽¹⁰⁸⁾ but also poor recruitment, retention ⁽¹⁰⁹⁾ and HRM

⁽¹⁰³⁾ (IMF, 2022), (OECD, 2022e).

⁽¹⁰⁴⁾ (European Commission, 2022g).

⁽¹⁰⁵⁾ (Horbach and Rammer, 2022).

⁽¹⁰⁶⁾ (Erickson and Norlander, 2021), (World Economic Forum, 2023).

⁽¹⁰⁷⁾ The survey is limited to information from private businesses and does not cover public services, such as public administration and defence, compulsory social security, education, human health and social work activities, and agriculture and mining sectors.

⁽¹⁰⁸⁾ As shown in Labour Market and Wage Developments in Europe 2022 (European Commission, 2022g), the share of low-skilled workers in an economy is positively associated with labour shortages.

⁽¹⁰⁹⁾ Employee retention is inversely related to job tenure.

practices, ⁽¹¹⁰⁾ high replacement demand due to retirement, the need to fill new jobs created as a result of the green and digital transitions, or companies unwilling or unable to offer competitive wages and working conditions (see section 7.). Recruitment also varies over the business cycle, as employers tend to be more selective (e.g. raising skills requirements in their vacancies) when the pool of unemployed people is larger. ⁽¹¹¹⁾ ⁽¹¹²⁾ Exploratory research based on employer interviews suggests that employers are often unable to define and measure the specific skills they are looking for when recruiting. ⁽¹¹³⁾

Analysis of European Company Survey (ECS) 2019 data ⁽¹¹⁴⁾ shows that the lack of skills among job applicants is not the main reason for companies' overall difficulties in finding people with the right skills. Rather, the likelihood of experiencing recruitment difficulties is strongly driven by the inability to retain workers, ⁽¹¹⁵⁾ with its impact being 10 times larger than that of skills requirements (at 14.2 pp and 3.4 pp, respectively) (Table 2.1). ⁽¹¹⁶⁾ ⁽¹¹⁷⁾ There is also an institutional dimension to firms' recruitment difficulties, with the presence of a recognised body of employee representation associated with a reduced chance of experiencing difficulties in recruiting workers. Recruitment difficulties are less likely in larger firms, which are better able to recruit from a larger available talent pool (both externally and internally), as well as more likely to have an employee representation body. ⁽¹¹⁸⁾ To shed more light on the skills demanded in occupations facing persistent labour shortages in the EU, this section analyses skills needs based on the European Centre for the Development of Vocational Training (Cedefop) European skills and jobs survey (ESJS2) 2021 data. ⁽¹¹⁹⁾

Table 2.1

Companies' difficulties in finding people with the right skills are strongly driven by the inability to retain workers

Marginal effects of selected variables on the likelihood of experiencing difficulties in finding employees with the required skills (pp)

	Recruitment difficulties for required skills		
	Few	Some	Many
Difficulties in retaining employees	-13.7	-0.6	14.2
Workers in jobs offering continuous training (%)	-1.1	-0.04	1.1
Workers in jobs in which there is no need to learn new skills (%)	1.3	0.06	-1.4
Importance of training for organisational goals (index)	-3.3	0.1	3.4
Level of employee motivation	2.3	0.01	-2.4

Note: Estimated percentage change in the likelihood of reporting difficulties in finding employees with the required skills.

Source: European Foundation for the Improvement of Living and Working Conditions (Eurofound) and Cedefop ECS 2019.

[Click here to download table.](#)

2.1. Identifying persistent labour shortages and their skills needs

The first approach uses BCS data and identifies persistent labour shortages in construction, manufacturing, information and communication technology (ICT), transportation and storage, professional, scientific and technical activities, and administrative and support services. In order to identify subsectors with persistent labour shortages by country over time, several methodological assumptions ⁽¹²⁰⁾ were made about the length of time series, the threshold at which labour shortages were

⁽¹¹⁰⁾ (Ployhart, Schmitt and Tippins, 2017), (Ryan and Ployhart, 2014), (Cappelli, 2012), (Cedefop, 2015), (Cedefop, 2018).

⁽¹¹¹⁾ (Modestino, Shoag and Balance, 2020).

⁽¹¹²⁾ In countries where unemployment is particularly high, the share of firms reporting few difficulties in finding applicants with the right skills tends to be high, while the share of those reporting many difficulties tends to be low (Cedefop, 2015).

⁽¹¹³⁾ (Goulart, Rodríguez-Menés and Caroz Armayones, 2022).

⁽¹¹⁴⁾ Information about the 2019 wave of the ECS, jointly developed by Eurofound and Cedefop, available here.

⁽¹¹⁵⁾ For example, poor HRM practices, or uncompetitive wages and working conditions.

⁽¹¹⁶⁾ ECS 2019 variables used to proxy whether a high or low skill level is required in a company are: job design features, including the incidence of jobs with autonomy and problem-solving; those where there is no need to learn new skills (low skill or stagnant jobs); if there is continuous training; and if the pace of work is set by machines or routines. An additional proxy for firms' commitment to investment in their human resources is an index derived from variables capturing the importance of training to achieve organisational goals, specifically (i) to improve employees' ability to suggest ways to improve things, (ii) to ensure that all workers have the skills they need, (iii) to improve employee morale, and (iv) to increase flexibility by allowing workers to move across different positions. The index ranges from one to four. High values of the index signal that training is important to attaining many of the goals listed.

⁽¹¹⁷⁾ Among the variables proxying for skills requirements, the index describing the importance of training to meet organisational goals has the strongest association with the likelihood of recruitment difficulties.

⁽¹¹⁸⁾ In some countries, a representation body is mandatory for a given number of employees.

⁽¹¹⁹⁾ Available here; see also (Cedefop, 2022e).

⁽¹²⁰⁾ Methodological assumptions used to define thresholds:

- Last 10 years (since 2012);

considered severe, the threshold for considering severe labour shortages persistent, and the criteria for identifying subsectors with persistent labour shortages at EU level.⁽¹²¹⁾ Table 2.2 presents the full list of subsectors (NACE⁽¹²²⁾ 2-digit level and the corresponding NACE 1 level) identified as facing persistent labour shortages across the EU over the last 10 years (2012–2021).⁽¹²³⁾

Table 2.2

Persistent labour shortages are most common in the manufacturing and construction sectors

Subsectors in persistent labour shortage, 2012–2022

Subsector, NACE 2-digit level	Number of Member States facing substantial labour shortages in a given subsector	Employment in subsector (number of people in million, % of total employment) 2021	Change in employment since 2012
43 Specialised construction activities	19	7.5 (4%)	0.4
62 Computer programming, consultancy and related activities	17	4 (2%)	79%
41 Construction of buildings	17	3.9 (2%)	-2%
33 Repair and installation of machinery and equipment	16	1.1 (0.6%)	16%
49 Land transport and transport via pipelines	15	5.4(2.9%)	7%
25 Manufacture of fabricated metal products, except machinery and equipment	14	3.4 (1.8%)	2%
31 Manufacture of furniture	13	1.1(0.6%)	3%
13 Manufacture of textiles	13	0.6 (0.3%)	-8%
81 Services to buildings and landscape activities	13	3.4 (1.8%)	10%
71 Architectural and engineering activities; technical testing and analysis	12	2.8 (1.5%)	24%
30 Manufacture of other transport equipment	12	0.8 (0.4%)	4%
42 Civil engineering	11	1.3(0.7%)	-7%
80 Security and investigation activities	11	1.1 (0.6%)	3%
86 Human health activities	-	12.1 (6.4%)	11%
87 Residential care activities	-	3.9(2%)	6%
88 Social work activities without accomodation	-	5 (2.6%)	30%

Note: Analysis and selection based on BCS, except for subsectors 86, 87, 88, which use job vacancy rate at NACE 1-digit level.

Source: BCS and EU-LFS, 2012–2021.

[Click here to download table.](#)

The second approach uses Eurostat job vacancy rates and identifies persistent labour shortages in human health and social work activities. This sheds light on the labour demand in some sectors that are additional to the ones identified by the BCS such as human health and social work. Since 2012, overall vacancy

- In every quarter, a subsector (at NACE 2-digit level) was considered to experience substantial labour shortages if the reported value exceeded the average across all subsectors in the country and amounted to at least 20%, or if at least half of the employers in the subsector per country reported labour shortages;
- For each subsector and country, the number and share of quarters with substantial labour shortages was calculated;
- Labour shortages were considered persistent in a subsector where substantial labour shortages occurred in at least one-third of the quarters;
- At EU level, the subsector was considered to experience persistent labour shortages if more than 10 Member States faced persistent labour shortages in that subsector.

⁽¹²¹⁾ The BCS is limited to information from private businesses and does not cover public services such as public administration and defence, compulsory social security, education, human health and social work activities, and agriculture and mining sectors.

⁽¹²²⁾ Developed in the EU, NACE is the Statistical Classification of Economic Activities.

⁽¹²³⁾ Employment activities (N78) were also identified as facing persistent labour shortages. However, they were not considered among the labour shortage sectors in further analyses, as they include activities of listing employment vacancies and referring or placing applicants for employment, where the individuals referred or placed are not employees of the employment agencies, supplying workers to clients' businesses for limited periods of time to supplement the workforce of the client, and the activities of providing other human resources, which might themselves be driven by other labour shortages.

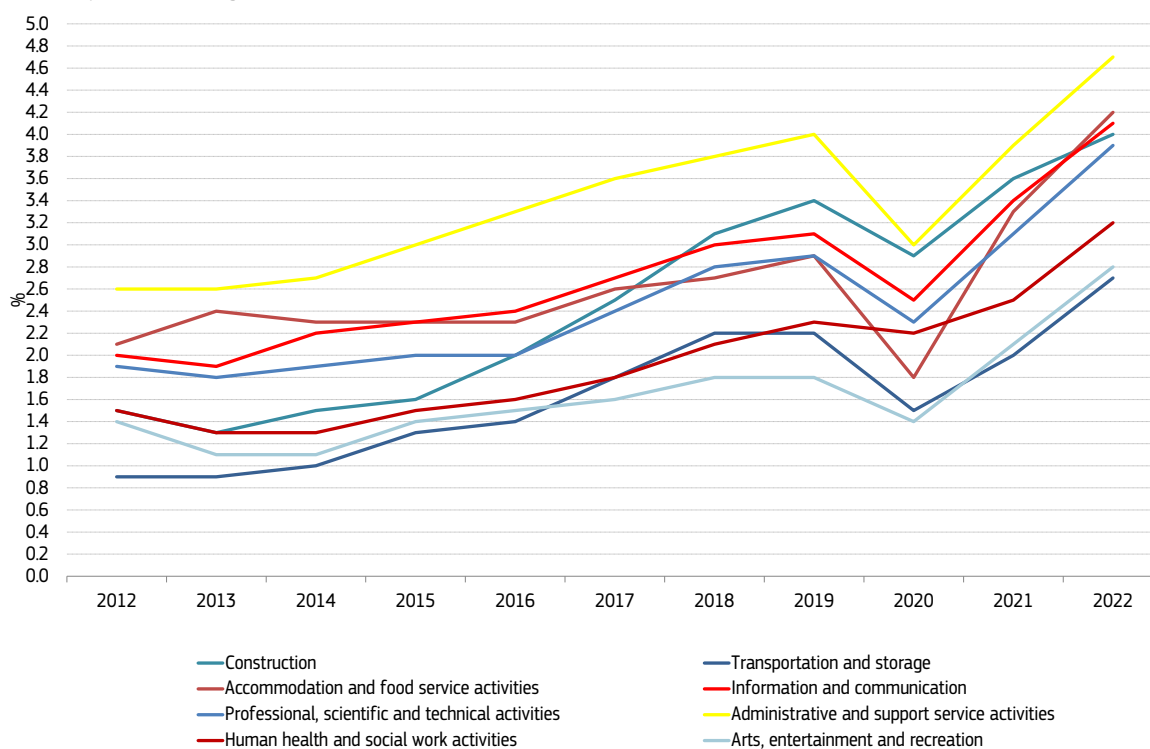
rates⁽¹²⁴⁾ are high and increasing in arts and entertainment, administrative and support services, construction, information and communication, professional, scientific and technical activities, accommodation and food services, and transport and storage (Chart 2.1). The vacancy data support the findings of the BCS and also show increasing shortages in human health and social work. A sharp decrease in overall rates was observed in 2020 due to the COVID-19 outbreak, with the exception of healthcare. From 2021, the rates increased and reached historical highs for all sectors except mining and quarrying. Looking at the latest quarterly data at the end of 2022, the overall vacancy rates slightly decreased but remained historically high, at 2.8% (Chapter 1). A significant drawback of this measure is that it does not distinguish whether high job vacancy rates in a sector are driven by high turnover or by labour shortages.

Total employment in the subsectors experiencing persistent labour shortages has increased by 11% since 2012, according to the EU-LFS (Table 2.2). The share of vacant posts in the sectors is increasing (Chart 2.1), indicating greater labour demand. Total employment is also high, due to the expansion of these economic sectors. The highest employment increases are recorded in computer programming (+79%), architectural and engineering activities (+24%), and social work activities (+30%) (Table 2.3). In 2021, approximately one-third of employed people, including the self-employed, were working in shortage subsectors. Increasing employment, coupled with reported shortages and vacancies in the specific group of sectors, provides evidence for persistent shortages over time.

Chart 2.1

Shortage subsectors despite increasing employment suggests persistent shortages over time

Job vacancy rate (%), NACE 1-digit level, annual (%), 2012-2022, EU-27



Note: Vacancy rate data for NACE Rev. 2, 1-digit level; data shown for NACE Rev. 2 sectors, which experience levels higher than the average; data missing for: agriculture, forestry and fishing; water supply; public administration and defence; compulsory social security; data for human health and social work activities, and arts, entertainment and recreation are only available and shown for 20 countries in the euro area (2023).

Source: Eurostat (online data code: jvs_a_rate_r2).

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The third approach lays the foundation for the analysis of structural drivers of persistent labour shortages at occupational level. It identifies persistent labour shortages for health, ICT professionals, personal services, sales, personal care, building and related trades, metal, machinery and related trades, and electrical and electronic trades workers, as well as drivers and mobile plant operators, and cleaners and helpers (Table 2.3). The approach is based on the occupation classifications developed by the International Labour Organization (ILO) and data collected by EURES national coordinating offices in the Member States. Since 2016, these offices have provided annual data on shortage occupations for European-level reports on labour shortages and surpluses.⁽¹²⁵⁾⁽¹²⁶⁾ In order to identify labour shortage occupations at International Standard Classification

⁽¹²⁴⁾ There are certain limitations to this approach, e.g. it does not allow for investigation of shortages at EU level before 2012, or for the full set of NACE 2-digit sectors (see Chart 2.1 notes).

⁽¹²⁵⁾ (ELA, 2023), (European Commission, 2020a), (European Commission, 2016a).

of Occupations (ISCO) 3-digit level⁽¹²⁷⁾ in the EU over time, certain assumptions were made and two criteria created.⁽¹²⁸⁾ However, shortage occupations at 3-digit level might include some occupations at 4-digit level without persistent labour shortages. At the same time, the selection criteria mean that some occupations with persistent labour shortages at 4-digit level might be excluded from a shortage occupation group when aggregated to 3-digit level.⁽¹²⁹⁾

Table 2.3

Persistent labour shortages in various types of occupations

Occupations in persistent labour shortage, ISCO-08, 2016-2021

ISCO 3-digit code	Description of occupation	Employment in 2021 (number of people in million, % of total employment)	Change in employment since 2012
221	Medical doctors	1.9 (1%)	16%
222	Nursing and midwifery professionals	1.6 (0.8%)	22%
251	Software and applications developers and analysts	3.3 (1.7%)	88%
512	Cooks	1.7 (0.8%)	-3%
513	Waiters and bartenders*	1.9 (1%)	-34%
522	Shop salespeople	10.2 (5.3%)	-6%
532	Personal care workers in health services	4.2 (2%)	9%
711	Building frame and related trades workers	4 (2%)	4.50%
712	Building finishers and related trades workers	2.3 (1.2%)	-2%
721	Sheet and structural metal workers, moulders and welders, and related workers	1.7 (0.8%)	-16%
723	Machinery mechanics and repairers	3.6 (1.8%)	19%
741	Electrical equipment installers and repairers	2.4 (1.2%)	4.60%
833	Heavy truck and bus drivers	3.8 (1.9%)	-1.30%
911	Domestic, hotel, and office cleaners and helpers	6.1 (3%)	-10.50%

Note: *Professions not in shortage for three years in the analysed period and not in shortage during the 2020-2021 period, probably due to the COVID-19 pandemic. A complete list of 3-digit and 4-digit occupations is available in Table A.1.

Source: (European Commission, 2017), (European Commission, 2020a), (ELA, 2021), (ELA, 2023) and EU-LFS 2012-2021.

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The required skills differ across occupations with and without persistent labour shortages. Based on ESJS2 2021 data, labour shortage occupations have a higher frequency of workers requiring manual skills and lower values of literacy, numeracy and digital skills than non-shortage occupations (Chart 2.2).⁽¹³⁰⁾⁽¹³¹⁾ Descriptive analysis shows that the differences between labour shortage and non-labour shortage occupations are less pronounced on social skills, routinisation, and job complexity.

⁽¹²⁶⁾ Caveats linked to the data collection on shortages in occupations include: variation in the geographical scope of the exercise over time; different reference periods covered in the same reporting year; different sources used by the PES when reporting shortages (i.e. PES administrative data, national occupation forecasts, occupation barometer, PES survey only, combination of different sources); data at Member State level available at a higher aggregated level.

⁽¹²⁷⁾ ISCO-08 contains 436 specific occupations at 4-digit level and 130 groups at 3-digit level. Data on shortages exist at 4-digit level for all years except 2016 and 2015. Data missing in 2018.

⁽¹²⁸⁾ Occupational shortages selection criteria:

- In order to aggregate occupations at ISCO 4-digit level to ISCO 3-digit level, at least half of occupations at ISCO 4-digit level under the ISCO 3-digit level needed to be in shortage in the recorded year;
- An occupation at ISCO 3-digit level was identified to face persistent labour shortages if it experienced labour shortages in at least three of the years between 2016 and 2021.

⁽¹²⁹⁾ A selection of 4-digit shortage occupations was added to Table A.1.

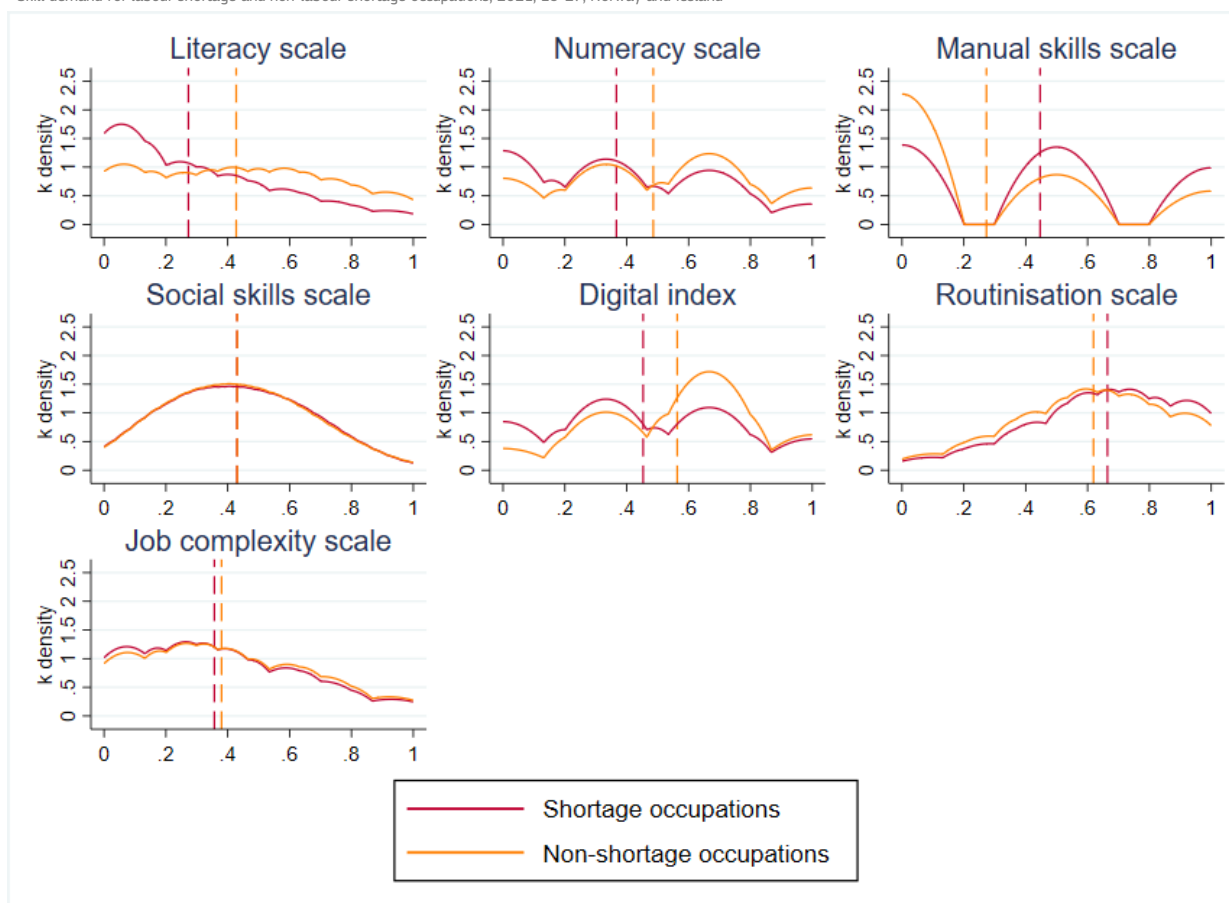
⁽¹³⁰⁾ Occupations at ISCO 3-digit level might include occupations with different skill requirements.

⁽¹³¹⁾ ESJS2 measured the intensity of foundation (literacy (reading and writing), numeracy), digital, interpersonal, problem-solving and manual skills required in the jobs of adult workers in the EU ((Cedefop, 2022d)).

Chart 2.2

Labour shortage occupations require greater manual skills and lower digital skills

Skill demand for labour shortage and non-labour shortage occupations, 2021, EU-27, Norway and Iceland



Note: Plots show the variables k-density (smoothed estimate of the probability density function), which shows the probability of having specific skills (e.g. social, digital, literacy) demand in the context of both shortage and non-shortage occupations (as indicated by red and orange lines). X-axis shows the values of the scales in the respective skill domain, rescaled to a value range from 0 to 1, with 0 representing 'no skill content' and 1 'very high skill content' of respondents' jobs in the respective task domain.

Source: Cedefop ESJS2 2021.

[Click here to download chart.](#)

Even when controlling for different characteristics of occupations facing persistent labour shortages, labour shortage occupations are still more likely to be comprised of jobs with lower skill demand (Table A.3).⁽¹³²⁾ This might explain the relatively low impact of skills in driving firms' recruitment difficulties. Labour shortage occupations are more likely to experience skills gaps. Once other factors are taken into account, employees in labour shortage occupations perform routine tasks less frequently and are more likely to exercise greater discretion in organising and planning their work and in learning or adapting to unexpected situations or varying tasks. This suggests that persistent occupational shortages might be an outcome of firms' human resource practices and their expectations of finding workers with high non-cognitive skills.⁽¹³³⁾ The findings also suggest that there is scope to further develop the skills of those employees to move towards better job performance.

There are significant differences across broad occupation skill groups in the skills needed (Table A.3).⁽¹³⁴⁾ For example, skilled shortage occupations typically rely more on physical rather than cognitive tasks, compared to skilled non-shortage occupations. However, they tend to be characterised by higher upskilling and digital skill needs, higher demand for better-educated workers, and greater job complexity, compared to skilled non-shortage occupations. Semi-skilled and manual shortage occupations are more likely to depend on

⁽¹³²⁾ A probit model is estimated using the available information on skill demand in occupations, skill mismatch, job quality, turnover, firm size and urban dimension, along with demographic characteristics of workers. In terms of skill mismatch, ESJS2 measures the extent to which the skills of EU workers need to be developed so that they can carry out their jobs proficiently. It also detects whether individuals' education levels are higher or lower than those needed to do the job. ESJS2 contains several proxies for work quality in EU labour markets. These include: (i) job complexity, as measured by the extent to which EU workers have autonomy or leverage to plan in their jobs, or have to learn and adapt to unexpected situations and varied tasks; (ii) routinisation, specifically whether EU workers have to do short, repetitive movements or tasks, or follow fixed, standardised procedures; (iii) workers' subjective job satisfaction; (iv) workers' net monthly earnings.

⁽¹³³⁾ Including soft skills such as team-work, planning, communication.

⁽¹³⁴⁾ Differences are even more pronounced when considering narrowly defined occupational clusters that are part of the same ISCO 2-digit group.

Box 2.1: Cedefop's future shortage indicator

To measure likely future labour shortages, the indicator uses expansion demand, replacement demand, and labour market imbalances, drawn from the Cedefop's Skills Forecast. ⁽¹⁾ The indicator ranges from 1 (weak or no shortage) to 4 (strong shortage). ⁽²⁾ The overall future shortage indicator is then constructed by an arithmetic average assuming equal weights. This forecast uses data and assumptions that capture recent policies and phenomena, such as the European Green Deal, COVID-19 impacts, changes in energy and commodity prices, and the ongoing Russian war in Ukraine.

Expansion demand ⁽³⁾ captures the extent to which the overall level of occupational employment by 2035 will grow or contract. It focuses on future demand for employment and can reflect trends in sectoral employment, changes in the occupational structure of employment, and overall trends in the economy. Whether or not that demand materialises will depend on the available supply of labour ready to take up such employment. However, strong employment growth may create future shortages for the occupation in question and the outcome will depend on the responsiveness of the wage mechanism, working conditions, and the availability of education and training to meet future demand.

Replacement demand ⁽⁴⁾ looks at employment needs that will arise as workers leave an occupation due to retirement, career changes, health, or other reasons. Replacement needs generally provide more job opportunities than new jobs, meaning that significant job opportunities arise even in occupations declining in size. Similar to expansion demand, the outcome will depend on other factors, as companies and organisations may decide not to replace retiring workers for budget reasons or because they can substitute labour with technology in highly routinised jobs.

Labour market imbalances capture the share of occupational employment likely to encounter difficulties due to a mismatch of supply and demand in formal education composition. Those imbalances could go in either direction: one occupation may experience insufficient numbers of highly educated workers to meet its needs, leading to skill gaps and low productivity, while another occupation may see the level of available education exceed that demanded, leading to over-education, low job satisfaction, high turnover, or increased costs for the employer.

The findings from the Cedefop future shortage indicator at occupational level should be read with caution. The comparison of different (types of) occupations is only indicative, as the indicator does not adjust for the size of occupations (i.e. it does not apply any weights). In addition, the disaggregation stops at ISCO 2-digit level, which might comprise quite different occupations and hide substantial labour shortages in some occupations. There may also be large country variations in shortages. Given the limitations of the sectoral approach, this chapter focuses on an occupational future shortage indicator, except for section 4.1. which contains sectoral analysis. ⁽⁵⁾

⁽¹⁾ Cedefop's European Skills Forecasts are available here.

⁽²⁾ More specifically, 4 (1) indicates that the value is a standard deviation above (below) the average, while 2 (3) indicates that the value is between the standard deviation above (below) the average and the average itself. The overall future shortage indicator is then constructed by an arithmetic average assuming equal weights.

⁽³⁾ 2021-2035 per annum percentage net occupational employment change.

⁽⁴⁾ 2021-2035 per annum occupational replacement change.

⁽⁵⁾ The sectoral future shortage indicator is only available for 17 sectors at NACE 1-digit level, except for some selected sectors identified as key to the green transitions (see section 4.1.), for which the indicator is available at NACE 2-digit level. As the imbalance indicator is only estimated for occupations, its value for a sector is set equal to the arithmetic average of the dominant occupations (those that add to at least 50% of employment within the sector and typically have an individual share of 8% or more), assuming equal weights.

less routine and more social tasks, compared to the same non-shortage skill groups, with a higher demand for lower-educated workers. In addition, semi-skilled shortage occupations depend more heavily on manual skills, while elementary shortage occupations primarily involve highly routinised tasks. All groups, with the exception of skilled shortage occupations, require a relatively basic or very low digital skill level, implying that a lack of digital skills is not the main driver of many persistent labour shortages.

2.2. Future labour shortages

Many occupations already facing persistent labour shortages are projected to experience high labour shortages in the future. Cedefop's 'future shortage indicator' ⁽¹³⁵⁾ is constructed from three areas of information: labour market imbalances, expansion, and replacement demand (Box 2.1). It shows that for science and engineering professionals, health professionals, ICT professionals, personal services workers, and personal

⁽¹³⁵⁾ Based on Cedefop's Skills Forecast to 2035, which offers quantitative projections of the future trends in employment (Cedefop, 2023a).

care workers, labour shortages are likely to be strongly driven by the overall level of occupational employment growth. For health professionals, personal care workers, drivers and mobile plant operators, and cleaners and helpers, replacement needs will also play a key role. Among shortage occupations, labour market imbalances are estimated to have a strong impact for personal services workers, sales workers, building, metal, machinery and related trades workers, drivers and mobile plant operators, and cleaners and helpers.

Future labour shortages at occupational level will be primarily driven by growth in employment and mismatches in education composition, with differences across broad occupation skill groups

(Table 2.4). While future shortages in high-skilled non-manual occupations will be strongly driven by expansion and replacement needs, elementary and skilled manual occupations will be significantly affected by labour market imbalances. Across broad occupation skill groups, elementary occupations and high-skilled non-manual occupations are projected to face the strongest shortages by 2035. This includes some occupations in the high-skilled and elementary occupation groups that are not currently identified as experiencing persistent labour shortages.⁽¹³⁶⁾ However, given the lower skill requirements of elementary occupations, their shortages are less likely to create significant bottlenecks in availability of staff with the required educational credentials. Rather, the challenge in these occupations relates to over-education and job satisfaction, and to retaining and attracting staff under existing wage and working conditions. By contrast, shortages in higher-skilled occupations, such as legal and business professionals, may require additional efforts in education and training, given the higher educational credentials typically required in these professions.⁽¹³⁷⁾ Also, shortages of science and engineering professionals can benefit from supporting diversification in researchers' careers.⁽¹³⁸⁾ Finally, shortages of some skilled manual and non-manual occupations are expected to be high, largely due to labour market imbalances.

Table 2.4

Future labour shortages are strongest in high-skilled non-manual and elementary occupations

Future occupational shortages to 2035, ranging from 1 (weak or no shortage) to 4 (strong shortage)

	ISCO	Occupation	Expansion	Replacement	Imbalance	Future shortage indicator
High-skilled non-manual occupations	11	Chief executives, senior officials and legislators	2	4	2	2.7
	13	Production and specialized services managers	3	3	2	2.7
	21	Science and engineering professionals	4	2	1	2.3
	22	Health professionals	3	4	1	2.7
	25	ICT professionals	4	1	1	2.0
	26	Legal, social and cultural professionals	3	3	2	2.7
	33	Business and administration associate professionals	3	3	2	2.7
	34	Legal, social, cultural and related associate professionals	4	3	2	3.0
Skilled non-manual occupations	42	Customer services clerks	3	3	2	2.7
	51	Personal services workers	3	2	3	2.7
	52	Sales workers	2	2	3	2.3
	53	Personal care workers	3	3	2	2.7
Skilled manual occupations	71	Building and related trades workers (excluding electricians)	2	2	3	2.3
	72	Metal, machinery and related trades workers	2	2	3	2.3
	74	Electrical and electronic trades workers	2	2	2	2.0
	82	Assemblers	3	2	3	2.7
	83	Drivers and mobile plant operators	2	3	3	2.7
Elementary occupations	91	Cleaners and helpers	2	4	4	3.3
	93	Labourers in mining, construction, manufacturing and transport	3	2	4	3.0
	94	Food preparation assistants	3	2	4	3.0
	95	Street and related sales and services workers	2	2	4	2.7
	96	Refuse workers and other elementary workers	3	2	4	3.0

Note: Selection of occupations at ISCO 2-digit level, including those with the highest projected future shortages (indicator of 2.7 or higher) and those characterised by persistent labour shortages (in grey) (see Table 2.3); for the full list, see Table A.2; yellow to red colouring represents low to high indicator levels.

Source: Calculations based on Cedefop Skills Forecast 2023.

[Click here to download table.](#)

⁽¹³⁶⁾ In Table 2.4, ISCO 2-digit: 11, 13, 26, 33, 34, 93, 94, 95, 96.

⁽¹³⁷⁾ The role of migration in attracting talent is discussed in section 6.

⁽¹³⁸⁾ (European Commission, Directorate-General for Research and Innovation, 2022).

3. THE TWIN TRANSITION AND CHANGING SKILLS NEEDS

For the twin transition to happen, education and training systems must ensure sufficient numbers of specialists equipped with the right skills to develop and implement new technologies and infrastructure. ⁽¹³⁹⁾ The green transition is expected to have an overall positive effect on employment, but there are considerable differences in expected impacts across sectors, regions, and skill groups. As the green and digital transitions are strongly interlinked and entail an economy-wide transformation, investments in adult learning, upskilling and reskilling will be needed in most sectors to implement green-digital solutions. ⁽¹⁴⁰⁾ More specifically, the twin transition will increase the need for the digital skills already in strong demand today. ⁽¹⁴¹⁾ This is likely to exacerbate labour shortages and skill gaps, especially in the short term. Given the priority to meet green and digital objectives and their significant impact on future skills needs, this section provides a separate analysis of how each of the transitions is expected to change skills and affect labour shortages.

3.1. Impact of green transition on labour and skills shortages

Policies under the scope of the European Green Deal are expected to have positive effects on employment. There is a wide range of estimates of the expected employment effects, depending on the underlying assumptions (Box 2.3). According to some forecasts, if supported by the right employment and education policies, ⁽¹⁴²⁾ net-zero policies could create between 1 million and 2.5 million jobs by 2030 in sectors with enhanced economic activity due to greening, as well as in other sectors indirectly affected (Box 2.2, Box 2.3). ⁽¹⁴³⁾ The commitment to reach climate neutrality in the EU by 2050 and to shift to cleaner production modes was enshrined for the first time in the European Climate Law adopted in July 2021 ⁽¹⁴⁴⁾ and is binding at national level. This commitment is accelerated by the European Green Deal Industrial Plan ⁽¹⁴⁵⁾ and the Net Zero Industrial Act, ⁽¹⁴⁶⁾ which are expected to significantly boost the demand for workforce in many industries (Box 2.4). Job losses are also projected, particularly in carbon-intensive industries, such as mining, manufacturing of steel and iron, or fuels. ⁽¹⁴⁷⁾ Despite this, the transformation towards climate neutrality is predicted to generate net employment gains across all broad economic sectors by 2030, according to the impact assessment of the European Green Deal. ⁽¹⁴⁸⁾ Nevertheless, labour shortages could hinder these employment gains.

Almost all occupational categories are expected to benefit from the implementation of the European Green Deal. Cedefop's European Green Deal scenario forecasts significant additional employment increases for science and engineering associate professionals (3.0%), science and engineering professionals (2.4%), administrative and commercial managers (2.1%), chief executives, senior officials and legislators (1.7%), ICT professionals (1.5%), and business and administration professionals (1.2%). ⁽¹⁴⁹⁾ However, those jobs may prove difficult to fill, given that skills in those areas are already scarce and the labour demand for these occupations is expected to grow. Among medium-skilled occupations, the highest impact is expected for refuse workers, building and related trades workers, electrical and electronic trades workers, and drivers, most of which are already experiencing persistent labour shortages. Although scientists, R&D researchers, specialised engineers and associate professionals may face only small changes in their employment share, they are indispensable to the development, design and implementation of green technologies, including the relevant infrastructure. ⁽¹⁵⁰⁾

⁽¹³⁹⁾ (Muench et al., 2022).

⁽¹⁴⁰⁾ For example, see (Cedefop, 2021a), (Cedefop, 2022c), (Cedefop, 2022f), (Cedefop, 2023a).

⁽¹⁴¹⁾ Technological advancement, including in sectors that are key to the green transition, increase the requirements for digital skills across the economy. For example, ICT and advanced electronic machinery are increasingly used to perform tasks in the building sector, including in the development of smart buildings, while improvements in fisheries and forestry sectors are increasing the demand for technological skills (Asikainen et al., 2021).

⁽¹⁴²⁾ Policies increasing labour market and skills matching and labour market participation will play a key role in realising employment gains. For example, estimations in (European Commission, 2020f) show that using carbon revenue to reduce labour taxation for lower-skilled workers could increase employment by 0.45% in 2030 by stimulating low-skilled labour supply.

⁽¹⁴³⁾ (Cedefop, 2021a); (Asikainen et al., 2021).

⁽¹⁴⁴⁾ More information available here.

⁽¹⁴⁵⁾ (European Commission, 2023b).

⁽¹⁴⁶⁾ (European Commission, 2023h).

⁽¹⁴⁷⁾ For example, up to 286 000 workers in the energy sector were predicted to experience job loss due to subdued economic activity in their sectors (Cedefop, 2021a).

⁽¹⁴⁸⁾ (European Commission, 2020f).

⁽¹⁴⁹⁾ (Cedefop, 2021a).

⁽¹⁵⁰⁾ (Cedefop, 2022a).

Box 2.2: Approaches to define green jobs

Scenarios to estimate impacts of the net-zero economy transition show a complex picture of multiple demand and supply channels, influencing employment patterns in different ways and at different intensities. Analysis of the actual employment trends, including labour and skills shortages in key sectors, is not clear-cut, as an established definition of 'green jobs' is not yet firmly in place. Generally, two approaches can be taken to define green employment. Firstly, the top-down approach takes a sectoral lens and establishes the greenness of a job based on the importance of the sector's output in reaching climate targets and other environmental objectives. Secondly, the bottom-up approach denotes greenness in an occupation by measuring the extent of green skills, ⁽¹⁾ tasks or knowledge, as well as the technology required in that occupation. Each of these approaches has distinct advantages and disadvantages. The top-down approach is better suited to sectoral analysis, as it denotes the greenness of jobs based on their output. However, it is limited to the initial definition of 'green' and can overlook indirect impacts of the transition. The task based-approach can be used for holistic analyses of the job impacts of greening. However, capturing the composition and relevance of tasks in jobs in the varied and dynamic labour market is a complex exercise that comes with caveats on data availability, transferability and durability.

One example of the top-down approach is Eurostat's 2021 estimates on employment in the environmental goods and services sector (EGSS) based on national accounts. According to this metric, the European economy had 4.5 million green jobs in 2019 (3.2 million in 2000), around 2% of total employment. This should be considered a narrow proxy for green jobs, as it excludes other activities making a substantial contribution to climate and environmental objectives.

A number of attempts have been made to analyse green employment based on the task-based approach. Most build on the Green Jobs Framework initially introduced by O*NET in the United States (US), ⁽²⁾ which categorises occupations based on the combination of the top-down and bottom-up approaches. This creates a four-fold division of all occupations:

- (i) New unique occupations introduced due to new nature of activities in the economy;
- (ii) Jobs that existed prior to the transition but see a considerable share of their tasks changed as a result of green activities;
- (iii) Those whose nature remains unaffected but whose demand increases due to accentuation of green activities in the economy;
- (iv) Jobs with no impacts due to the transition ('non-green' jobs).

With some limitations, this classification is adaptable to the EU labour market. ⁽³⁾ Using this framework, one study estimates that up to 40% of employment in the EU contributed to green goals in 2016. ⁽⁴⁾ Further explorations suggest that around 17% of jobs in the OECD countries include a substantial share of green tasks. ⁽⁵⁾

Given the high variation between the estimates of different approaches, they should be interpreted with caution.

⁽¹⁾ List of 'green skills' can be found in the European Classification of Occupations, Skills, and Competences (ESCO). These are defined as the skills, competences, abilities and knowledge needed to live in, develop and support a society that reduces the impact of human activity on the environment (Cedefop, 2012).

⁽²⁾ More information available on the website of O*NET Resource Center.

⁽³⁾ This approach applies a cross-reference between O*NET classification used in the US and ISCO classification used in the EU. One of its main weaknesses is the necessary aggregation, as O*NET is available at 8-digit level and ISCO at 4-digit level. Also, it assumes that EU Member States have broadly the same occupational structure as the US.

⁽⁴⁾ (Bowen and Hancke, 2019).

⁽⁵⁾ (OECD, 2023b).

The majority of EU citizens believe that policies to tackle climate change will create more jobs than they will remove and that those will be better quality jobs, at 57% and 61%, respectively. ⁽¹⁵¹⁾ More than half (55%) of the respondents to the Special Eurobarometer in 2022 reported that being in a job that contributes to the green transition is important to them personally, with 15% stating that they 'totally agree'. However, only around one-third believe that their current job contributes to that transition. Those proportions vary considerably across Member States, potentially reflecting regional differences in general public awareness of the green transition's impact and relevance to their lives.

⁽¹⁵¹⁾ Special Eurobarometer on fairness perceptions of the green transition (European Commission, 2022i).

Box 2.3: Macroeconomic modelling of employment impacts of climate scenarios

Macroeconomic simulations of labour market impacts aid policy-making to reach climate goals in the EU. These models take into account the most recently adopted climate and environmental targets and consider different scenarios, with various sets of underlying assumptions on regulation (e.g. different tax systems complementing the reforms, energy price policy mixes), as well as socioeconomic assumptions (perfect labour markets with smooth transitions and no skill shortages, assumptions on population and growth). Accordingly, the estimates vary and should be taken as purely indicative. The models outline future employment development based on different production targets in the relevant sectors and compare the final employment snapshot in a given year (either 2030 or 2050, with an analysis based on new 2040 targets forthcoming) to the baseline scenario without the climate targets. Caveats include little flexibility to incorporate unexpected shocks (such as COVID-19) and the inability to capture possible shifting employment patterns within sectors (e.g. accelerated growth in demand for specific skill-intensive occupations). Nevertheless, macro-modelling tools are crucial to identifying future labour trends and corresponding policy needs.

(Cedefop, 2021a): The green employment and skills transformation - insights from a European Green Deal skills forecast scenario	Up to 2.5 million net jobs (1.2%) could be created to 2030 , compared to the business-as-usual scenario
Joint Research Centre (JRC) (Asikainen et al., 2021): The future of jobs is green	Green transition policies could lead to a net increase in jobs of up to 884 000 (+0.45%) by 2030 , compared to the business-as-usual scenario
(European Commission, 2020f): Impact assessment accompanying the Communication 'Stepping up Europe's 2030 climate ambition - investing in a climate-neutral future for the benefit of our people'	With the right accompanying policies in place, the green transition could create around one million additional quality jobs in the EU by 2030 and two million by 2050 . Without the right policies , potential losses could reach up to 494 000 jobs (-0.26% at aggregate level by 2030, and up to 1.7 million jobs (-1.4%) in market services, in the worst-case scenario)
Employment and Social Developments in Europe (ESDE) 2019 (European Commission, 2019b): Towards a greener future: employment and social impacts of climate change policies (based on the impact assessment for the Climate Target Plan)	Create 1.2 million jobs by 2030 and up to between 1.5 million and 2 million jobs by 2050

Skills needed for the green transition include technical job-specific skills and more transversal skills. ⁽¹⁵²⁾ Technical skills are required to adapt or implement standards, processes, services, products and technologies to protect ecosystems and biodiversity, to advance the production and roll-out of net-zero technologies, and to reduce energy, materials and water consumption. They should be viewed as complementary to transversal skills such as the knowledge, abilities, values and attitudes needed to live, work and act in resource-efficient and sustainable economies and societies. Moving towards a more sustainable EU economy relies heavily on technological advancements and innovation, linked to digitalisation, automation, connectivity, artificial intelligence (AI) and blockchain, making digital skills extremely important to the green transition. While new employment opportunities stemming from climate policies are projected across all skill types until 2030, ⁽¹⁵³⁾ – mitigating the protracted decline in middle-skilled jobs ⁽¹⁵⁴⁾ – recent literature shows that green employment creation has been more prevalent among higher-skilled professions. ⁽¹⁵⁵⁾

⁽¹⁵²⁾ (Inter-Agency Working Group on Work-based Learning: Cedefop, European Commission, European Training Foundation, ILO, OECD, UNESCO, 2022).

⁽¹⁵³⁾ (European Commission, 2019b), (Asikainen et al., 2021).

⁽¹⁵⁴⁾ (European Commission, 2022c), (Asikainen et al., 2021).

⁽¹⁵⁵⁾ (OECD, 2023b), (Saussay et al., 2022), (Vona, 2019).

Box 2.4: Investment needs for additional skilled workers related to net-zero technologies

Delivering on the European Green Deal and reaching the targets of the Fit for 55 package and the RePowerEU plan requires significant acceleration of the clean energy transition in the EU. To scale up manufacturing of clean technologies (wind, solar, batteries, heat pumps, electrolyzers), the European Commission has proposed the Net Zero Industry Act (NZIA).⁽¹⁾ This will increase the need for investment in physical infrastructure, as well as additional skilled workers.

Up to 2030, the investment needs for retraining, reskilling and upskilling in manufacturing of strategic net-zero technologies are estimated at EUR 1.7 billion under the status quo (maintaining 2022 market shares of EU manufacturing of net-zero technologies), EUR 3.1 billion under the NZIA policy proposal (increasing the shares to the indicative technology-specific objectives set in the NZIA), and EUR 4.1 billion under the NZIA+ scenario (100% of demand satisfied by EU manufacturing) (Table 1). This corresponds to 198 000 additional jobs under the status quo, 350 000 under the NZIA policy proposal and 468 000 under the NZIA+ scenario. These numbers also depend on factors such as the specific technologies used, the pace of adoption and innovation, the scale of investment, and policy frameworks.

Table 1: Additional jobs in manufacturing and related investment needs until 2030

Scenario	Status quo		NZIA policy proposal		NZIA+ scenario	
	Additional jobs (thousand)	Investment (EUR million)	Additional jobs (thousand)	Investment (EUR million)	Additional jobs (thousand)	Investment (EUR million)
Wind	31	270	31	270	40	353
Solar photovoltaics	<1	3	25	223	66	578
Heat pump	28	243	28	243	60	529
Battery cell	139	1 214	261	2 284	294	2 578
Electrolysers	0	0	5	41	7	59
Total	198	1 730	350	3 062	468	4 097

Source: (European Commission, 2023g).

Additional skilled workers will also be needed for the increased installation and deployment of these key technologies. For wind and solar photovoltaics alone, this could lead to about 100 000 additional jobs by 2030 under all three scenarios (the installation of both domestically produced and imported net-zero technologies will take place in the EU). The job creation is mainly expected in construction and services (Table 2).⁽²⁾ The associated investment in skills could amount to EUR 885 million.

Table 2: Additional jobs in deployment of wind and solar photovoltaics, and related investment needs to 2030

	Additional jobs (thousand)				Investment (EUR million)
	Construction	Services	Transport	Total	
Wind	32	31	5	68	593
Solar photovoltaics	23	10	-	33	291
Total	54	41	5	101	885

Notes: JRC calculations, based on deployment capacity expansion in (European Commission, 2023g), current deployment levels from Clean Energy Technology Observatory reports for wind and solar photovoltaics ((Chatzipanagi et al., 2022), (Telsnig et al., 2022)), Global Energy and Climate Outlook 2021 macroeconomic baseline, and training expenses from ESDE 2020 (European Commission, 2020d).

While different assumptions generate different estimates, it is clear that energy transition will require a significant increase in the number of skilled workers in a range of sectors. Persistent labour shortages in the EU at both professional and technician levels can lead to delays in the design, implementation and the deployment of the net-zero technologies.

⁽¹⁾ (European Commission, 2023h), (European Commission, 2023g).

⁽²⁾ For solar photovoltaics, the number of jobs depends on the scale of the systems installed, with a higher share of smaller scale rooftop installations increasing the numbers.

Across the EU, over one-third of respondents believe that they do not have the necessary skills to support the green transition. According to the Special Eurobarometer, 38% of respondents do not feel equipped for the coming transition. This points to the need for reskilling and upskilling, which might further contribute to labour shortages, especially as several projected future labour shortages are concentrated in higher-skilled occupations (Chart 2.4). On a positive note, the majority of respondents (54%) agree that their

current skills allow them to contribute to the green transition (14% 'totally agree'), with strong heterogeneity across countries. ⁽¹⁵⁶⁾

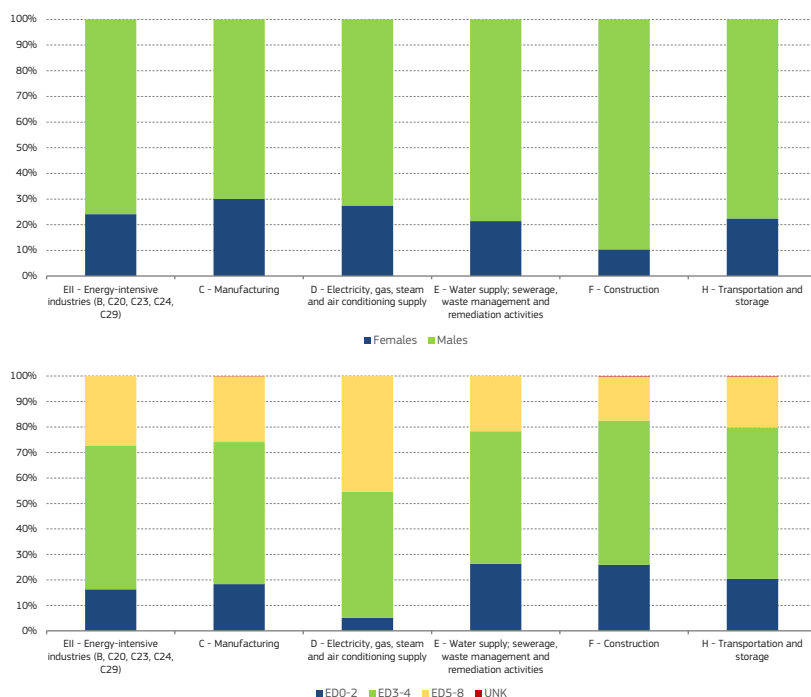
There are significant differences in employment patterns across sectors crucial to climate neutrality.

Sectors considered key to the green transition are energy-intensive industries and sectors undergoing transformation due to greening of economic activities. ⁽¹⁵⁷⁾ Employment in those sectors showed a slow growth trend in previous years, with the exception of some energy-intensive industries, where a slight decline is noted since 2018. ⁽¹⁵⁸⁾ With the exception of manufacturing of motor vehicles and basic metals, energy-intensive industries are projected to face moderate labour shortages in the future, with their employment share ranging from 0.3% (Ireland) to 8.1% (Czechia) in 2021 (Table A.4). The largest share of EU workers in transformation sectors can be found in manufacturing (16.1%) and construction (6.7%), which are also projected to face moderate-to-average overall shortages by 2035. ⁽¹⁵⁹⁾ Transportation and storage, and water supply, sewerage, waste management and remediation activities which constitute 6.1% of the total EU workforce are considered key sectors in the context of the circular economy and the green transition, and have the highest projected future shortages.

Chart 2.3

Sectors in green transformation are male-dominated and employ a high proportion of highly educated workers

Employment shares by gender (first panel) and by education level (second panel) in energy-intensive industries and sectors in green transformation, 2021, EU-27



Note: ED0-2 - Less than primary, primary and lower secondary education (levels 0-2); ED3-4 - Upper secondary and post-secondary non-tertiary education (levels 3 and 4); ED5-8 - Tertiary education (levels 5-8); UNK - Unknown.

Source: DG EMPL calculations, based on Eurostat datasets lfsa_egan2 and lfsa_egan22d.

[Click here to download chart.](#)

net-zero economy will leave deeper scars in sectors primarily occupied by men (mining), employment gains are expected in sectors where men are more represented (construction and waste management). Secondly, as projected job creation in sectors already important to the structure of the economy is greater than anticipated losses, employment gains will benefit men over women (assuming the current gender employment structure remains unchanged). Recent evidence aligns with this hypothesis, finding that almost two-thirds of green-task

Sectors that are key to the green transition, including energy-intensive industries, are typically male-dominated, albeit to varying extents.

In the EU, mining is the sector with the smallest share of women, at just 9.1% (80 600 women, compared to 484 900 men) (Chart 2.3). In water supply and waste management – which has one of the largest positive projected employment impacts due to the green transition – women constitute 21.5% of the workforce. In transport and electricity industries, their shares amount to 22.2% and 27.7%, respectively. The gender employment gap is the smallest in manufacturing (30.2% are women) and in the energy-intensive subsectors (25.1% are women). Nevertheless, the gap remains considerably above the EU industry average, where women constitute 46.3% of the workforce. This creates a two-fold gender implication in the projected sectoral employment change. Firstly, while job losses due to the transition to a

⁽¹⁵⁶⁾ There is a strong positive association between the share of respondents agreeing that their current skills allow them to contribute to the green transition and country's GDP per capita (correlation coefficient of 88.5%).

⁽¹⁵⁷⁾ Based on the greenhouse gas (GHG) emissions levels of their production or products, sectors considered energy intensive are: mining and quarrying (B05-09); manufacturing of other non-metallic minerals (C23); manufacturing of basic metals (C24); manufacturing of chemicals (C25); and manufacturing of motor vehicles, trailers and semi-trailers (C29). Sectors in transformation that are directly affected by increased greening are: electricity; water supply and waste management; manufacturing; construction; and transportation and storage. They cannot be qualified as either fully low carbon or high carbon, but are key in driving the implementation of net-zero on the ground, and/or are expected to face the largest employment impacts due to continued decarbonisation of the economy.

⁽¹⁵⁸⁾ DG EMPL calculations, based on Eurostat dataset lfsa_egan22d.

⁽¹⁵⁹⁾ With potentially high future shortages in some subsectors.

jobs across Organisation for Economic Co-operation and Development (OECD) regions are held by men.⁽¹⁶⁰⁾ Gender segregation in sectors key to the green transition might therefore exacerbate labour shortages, as it may be more difficult to fill newly created positions, given the already high participation rates of men in those sectors (see section 5.). This underlines the need for policies enabling women to benefit from the opportunities arising from the green transition (see section 3.).

The absolute number of workers with tertiary education is rising in sectors relevant to the green transition. In 2021, within these sectors, the largest proportion of highly educated workers were employed in the electricity industry (45.4%), which saw the largest increase since 2015 (5.1 pp, compared to an industry average of 4.7 pp) (Chart 2.3). The proportion of workers with higher education also grew in other transformation sectors, but did not exceed EU average growth. This trend was reversed for the groups of workers with the highest educational attainment at elementary as well as secondary level, with workers with secondary education comprising the largest group in all transformation industries, notably transportation (59.4%) and construction (56.5%).

Despite the increasing demand for higher and vocational skills, industries that are key to the green transition report below-average worker participation in education and training.⁽¹⁶¹⁾ Around 60% of employers in these sectors (e.g. manufacturing and construction) indicate that lack of the right skills is a barrier to climate-related business investment.⁽¹⁶²⁾ According to public authorities, obstacles to investment in climate change include the lack of environmental and climate assessment skills, together with digital skills, engineering and other technical skills, and regulatory understanding.⁽¹⁶³⁾ Although training provision tends to be better in large and medium companies, they identified skills gaps as a barrier to climate investment more often than small and medium-sized enterprises. This may indicate a positive relationship between firm size and integration of climate-related measures in investment planning. Investment in staff training in the construction and manufacturing sectors has not returned to pre-COVID-19 rates and has even begun to decline.⁽¹⁶⁴⁾ These developments could exacerbate labour shortages, particularly in the construction, manufacturing, and transportation and storage sectors, which are projected to experience high labour market imbalances in the future (imbalances indicator above 2, Table A.5).

Some sectors relevant for the green transition have been particularly badly hit by population ageing. Water supply and waste management has the highest proportion of older workers⁽¹⁶⁵⁾ in the EU (40.7% in 2021), followed by the electricity sector (36.1%). Since 2015, the share of older workers has increased by 5.5 pp in water supply and waste management, and by 5.0 pp in energy-intensive industries, compared to an all-industry average of 3.4 pp. This growth in older workers is not matched by similar growth in young workers, who typically account for less than 8% of employment in each of these industries. Among the green transition-relevant sectors, replacement needs are projected to be most pressing in construction, transportation and storage, and water supply, sewerage, waste management and remediation activities (future shortage indicator of 3, Table A.5).

⁽¹⁶⁰⁾ According to (OECD, 2023b), 72% of green task jobs are held by men. This does not capture all ongoing employment impacts of the green transition, however, as it only focuses on jobs with green tasks and in selected sectors as defined by O*NET. Jobs outside these sectors, where the nature of tasks was unaffected but whose demand has increased due to greening of economic activity, are not covered in the analysis.

⁽¹⁶¹⁾ EU-LFS, participation of employees in education and training (last 4 weeks), by NACE 2-digit level, 2021.

⁽¹⁶²⁾ European Investment Survey database: Tracking investment needs and constraints across Europe, available here. Data are based on survey wave 'EIBIS 2020', topic 'Climate change and energy efficiency', indicator 'Factors impacting investment in activities to tackle the impacts of weather events and emissions reduction: availability of staff with the right skills to identify and implement investments related to climate change'.

⁽¹⁶³⁾ (European Investment Bank, 2023).

⁽¹⁶⁴⁾ (Pouliakas and Wruuck, 2022).

⁽¹⁶⁵⁾ In this section, older workers are defined as the working cohort aged 50-74, based on EU-LFS data.

While data on green labour shortages are limited, available metrics hint at growing labour shortages in sectors crucial to the green transition.

Between 2015 and 2021, the rate of vacant posts doubled in these sectors.⁽¹⁶⁶⁾ The average vacancy rate increased from 1.1% in 2015 (1.3% all-industry average) to almost 2.2% in 2021 (2.1% all-industry average),⁽¹⁶⁷⁾ indicating a slightly greater shortage of workers in these key sectors. Transformation sectors all showed a stable increasing trend in vacancies from 2015 to 2021, with a decline in 2020 that can be partly attributed to the economic shocks due to COVID-19. Looking at industry-specific trends of vacancy rates, broken down by five key sectors, the strongest increase is evident in construction, which grew from 1.6% in 2015 to 3.6% in 2021, reflecting increasing construction and renovation of buildings to support the 2030 climate goals (Chart 2.4). Overall, the total proportion of vacant posts has also grown in electricity, manufacturing, and transportation. By contrast, the vacancies in traditional energy-intensive industries such as mining and quarrying (0.7% in 2021) have grown only incrementally since 2015 (by 0.5%) and are well below the EU all-industry average (2.1%). With the exception of mining and quarrying, all of those industries contain subsectors with persistent labour shortages (see section 2.1.). Other data also suggest significant shortages in some energy-intensive industries in the Member States, such as manufacturing of minerals or chemicals.⁽¹⁶⁸⁾ In 2021-2022, occupations with green skills facing persistent labour shortages were identified in construction (bricklayers, carpenters and joiners; plumbers and pipe fitters), manufacturing (metal working machine tool setters and operators) and transportation (heavy truck and lorry drivers) (see Table A.1).⁽¹⁶⁹⁾

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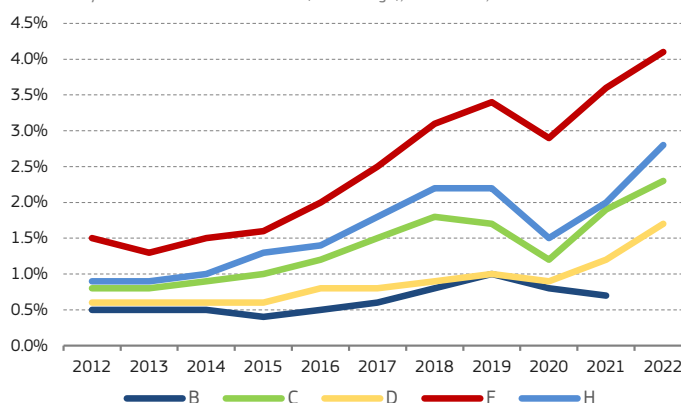
3.2. Labour and skills shortages in the digital age

Advances in digital technologies are changing the type of work people do, as well as the digital intensity of that work (Box 2.5). Technological progress has led to automation of some occupations, transformation of others, and creation of some entirely new jobs. There is a broad consensus that the overall effect on the EU labour market has been an increase in demand for high-skilled work and a decline in demand for medium-skilled jobs.⁽¹⁷⁰⁾ The discussion on impacts of digital technologies on low-skilled jobs remains more ambiguous.⁽¹⁷¹⁾ The transformation in the nature of work and skills needs has been accelerated by the recent advancements in AI. While this could have a positive impact on productivity, there are also concerns about job loss, stability, wages, and trust in employers to make the right decisions on AI.⁽¹⁷²⁾ Given the limited evidence, the impact of AI on labour shortages remains unclear.

Chart 2.4

Labour shortages are growing in green transition sectors and decreasing in polluting activities

Job vacancy rate in transformation sectors (NACE 1-digit), 2012-2022, EU-27



Note: Data missing for sector E - Water supply; sewerage, waste management and remediation activities.

Source: DG EMPL calculations, based on Eurostat dataset jvs_a_rate_r2.

[Click here to download chart.](#)

⁽¹⁶⁶⁾ The indicator vacancy rate measures the proportion of empty vacancies in the total number of vacancies. Although imperfect, it is one of the few metrics to give an indication of the extent of labour shortages faced in all sectors in the EU.

⁽¹⁶⁷⁾ Indicative figure, based on available data for 17 Member States.

⁽¹⁶⁸⁾ (European Commission, 2022g).

⁽¹⁶⁹⁾ Based on (ELA, 2023). Skills and knowledge requirements are based on the ESCO taxonomy on skills for the green transition (436 occupations at ISCO 4-digit level). Examples are identified based on their ESCO 'greenness' score and relevant sectors.

⁽¹⁷⁰⁾ (Goenaga et al., 2019), (OECD, 2019a).

⁽¹⁷¹⁾ (European Commission, 2019c), (OECD, 2019a), (Autor, Levy and Murnane, 2003).

⁽¹⁷²⁾ (OECD, 2023d).

Box 2.5: Digital intensity of work index

The digital intensity of work index⁽¹⁾ measures the proportion of digital skills among all required skills for each occupational group at ISCO 3-digit level. For example, if an occupation requires 10 skills and one of those skills is digital, the value of the index is 10%. This gives a useful approximation of the proportion of work requiring digital skills and competences, but has clear limitations in that it does not indicate the importance of digital skills in carrying out a given occupation, the level of those skills (e.g. basic or advanced), or how often they are used at work.⁽²⁾ The digital intensity index is not the only measure used in the EU context. Other definitions developed in recent years⁽³⁾ have identified similar occupations as highly digitally intensive, but with a number of differences in how occupations compare. Some of the findings presented here may depend on the specific measure of digital intensity of work adopted.

⁽¹⁾ See detailed methodology in (Barslund, 2022).

⁽²⁾ See ESDE 2022 for more detail on the definition, its strengths and shortcomings (European Commission, 2022e).

⁽³⁾ See, for example: (Cedefop, 2022e) or (Cirillo et al., 2021).

Apart from changing job structure, digitalisation has increased the digital intensity of work across occupations and sectors, a process accelerated by the COVID-19 pandemic.⁽¹⁷³⁾ This transformation of employment structure and content may contribute to increased digital skill needs in certain sectors or occupations, potentially leading to shortages of workers with these skills. At the same, digitalisation may help to fill certain vacancies, due to increases in job flexibility (place and time of work). The following analysis aims to identify shortages in digitally intensive work, the workers who could fill those gaps, and the challenges that must be addressed for this to happen. It expands on the analysis of digital intensity of work presented in ESDE 2022 by relating it to labour shortages and developing the analysis determinants of digital intensity of work.⁽¹⁷⁴⁾

3.2.1. Labour and skills shortages in digitally intensive work

Chart 2.5

Highest digital intensity of work observed in several ICT occupations

Digital intensity of work, by occupation (%), 2021, EU

Occupation (ISCO-08 3-digit)	Digital intensity (% of digital in all skills)	Shortage
<i>High digital intensity</i>		
ICT operations and user support technicians	37%	None
Database and network professionals	36%	Selected occupations
Software and applications developers and analysts	32%	All occupations
Telecommunications and broadcasting technicians	23%	None
<i>Intermediate digital intensity</i>		
Librarians, archivists and curators	17%	None
Mathematicians, actuaries and statisticians	16%	None
Numerical clerks	14%	None
Electrotechnology engineers	14%	Selected occupations
Information and communications technology service m	13%	None
Keyboard operators	12%	None
Authors, journalists and linguists	12%	None
Tellers, money collectors and related clerks	11%	None
Secretaries (general)	11%	None
Architects, planners, surveyors and designers	10%	None
Administrative and specialised secretaries	10%	None
Printing trades workers	10%	None

Note: Analysis based on all Member States where occupational statistics are available at ISCO-08 3-digit level, i.e. excluding Bulgaria, Malta and Slovenia. High digital intensity covers occupations where at least 20% of all skills required are digital. Intermediate digital intensity covers occupations where 10-19% of all skills required are digital. Low digital intensity covers occupations where less than 10% of skills required are digital.

Source: EU-LFS 2021.

[Click here to download chart.](#)

heart of the digital transformation have grown in recent years (Chart 2.5) and are projected to grow in the future (see section 2.2.). That growing demand, coupled with the need for advanced digital skills reflecting the newest technological developments,⁽¹⁷⁸⁾ opens these occupations to labour shortages. Increase in demand for less-skilled work can be seen in the context of the recent rise of work organised via digital platforms, for example.

The relationship between digital intensity of work and persistent labour shortages is not straightforward. Rather, it reflects the ambiguous effects of digitalisation on employment. New digital technologies can automate routine tasks at the core of some (usually middle- or low-skilled) occupations.⁽¹⁷⁵⁾ This can reduce demand for digitally intensive work with a high proportion of routine content,⁽¹⁷⁶⁾ for example in certain administrative occupations. Where this happens, digitalisation may help to address existing labour shortages or prevent future gaps. However, adoption of new digital technologies can also generate new demand for jobs with diverse skill profiles.⁽¹⁷⁷⁾ For example, several highly skilled ICT occupations at the

⁽¹⁷³⁾ (Cedefop, 2022e), (Cedefop, 2022b).

⁽¹⁷⁴⁾ (European Commission, 2022e). For the original publication on digital intensity of work in the EU, see (Barslund, 2022).

⁽¹⁷⁵⁾ (European Commission, 2019c), (OECD, 2019a), (Autor, Levy and Murnane, 2003).

⁽¹⁷⁶⁾ See (Cirillo et al., 2021) for a national example of this effect.

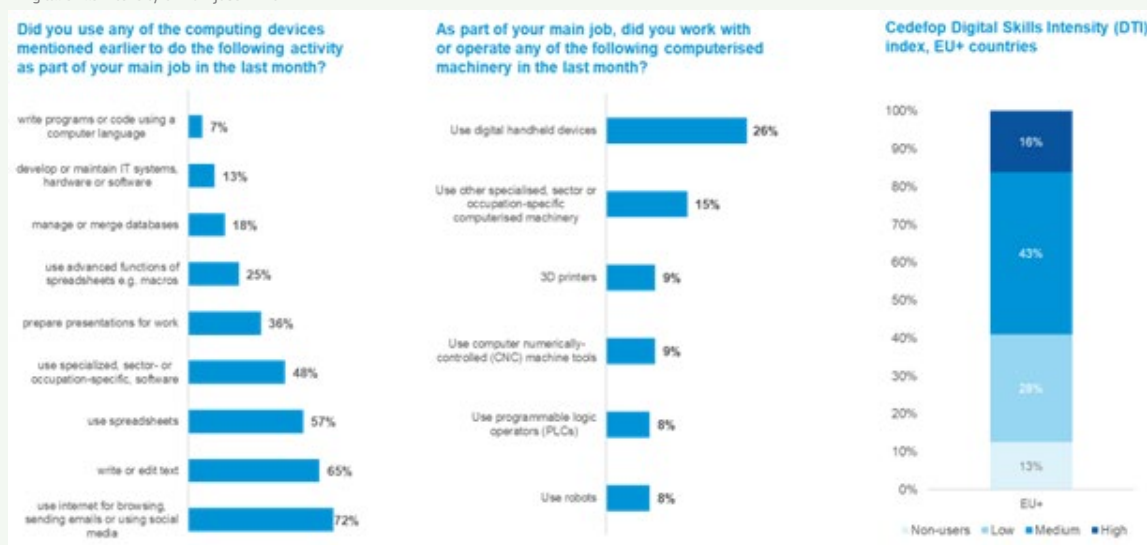
⁽¹⁷⁷⁾ (Goenaga et al., 2019), (OECD, 2019a), (Grundke et al., 2018), (Acemoglu, 2002).

⁽¹⁷⁸⁾ (Centeno, Karpinski and Urzi Brancati, 2021).

Box 2.6: Other measures of digitalisation - Cedefop's digital skills intensity (DSI) index

The Cedefop DSI index⁽¹⁾ uses a composite indicator approach to characterise jobs in terms of their intensity of use of digital technologies in 29 European countries. It blends quantitative and qualitative technology intensity: the number of computer applications Europeans use in their jobs and their skill complexity.

Chart 1
Digital skills intensity of EU+ jobs in 2021



Source: Cedefop ESJS 2021.

The Cedefop DSI index shows that around 16% of the EU+ workforce engages with advanced digital technology at work. This includes computer programming (e.g. use of AI algorithms) and ICT system maintenance and development. Of those, 43% are employed in posts with a medium-level DSI. Most carry out digital activities with an intermediate skill complexity (e.g. using sector-specific or occupation-specific software, using formulas and macros in spreadsheets, or merging and managing databases) that they do alongside more basic digital tasks. A further 10% of EU+ employees are in jobs with a very low DSI (e.g. exclusively browsing the web, sending emails, or using social media at work), while 18% are in jobs with a low DSI (e.g. using word processing and spreadsheets, or making presentations) and 13% do not use any computer devices to do their job.

⁽¹⁾ Cedefop (2022e).

Few occupations in the EU labour market require a high digital intensity of work and all are found in the ICT professional and technician occupational groups (Chart 2.5). In these occupations, digital skills account for more than one in five of all required skills. Together, ICT professionals and technicians accounted for about 3% of employment in the EU in 2021.⁽¹⁷⁹⁾ There are also several occupations with intermediate digital intensity, where at least 1 in 10 of all required skills are digital. These mostly comprise different types of professionals and clerical support workers (listed in Chart 2.5), accounting for a further 7% of EU employment in 2021. The remaining 90% of EU employment usually requires at least some basic digital skills, but these account for less than 10% of all skills required in a given occupation. These figures are broadly in line with another measure of digital intensity developed by Cedefop, which shows that around 16% of the EU workforce engages with advanced digital technology at work (Box 2.6).

Across the Member States, persistent labour shortages are common among ICT professionals,⁽¹⁸⁰⁾ notably software and applications developers and analysts. These occupations often combine high digital intensity (around one-third of all skills required are digital) with highly skilled work (more than 7 in 10 workers hold a tertiary degree). They registered considerable growth in employment over the last decade (Chart 2.6) and this growth is expected to continue, according to Cedefop forecasts (see section 2.2.). Shortages are less common in ICT occupations with technician status. These include a substantially lower proportion of tertiary-educated workers (around 40%), with employment growth also less pronounced between 2011 and 2021.

⁽¹⁷⁹⁾ According to a broader definition of ICT specialists adopted in DESI (available here), ICT specialists accounted for 4.5% of employment in the EU in 2021.

⁽¹⁸⁰⁾ This covers occupations under ISCO 2-digit code 25 (ICT professionals).

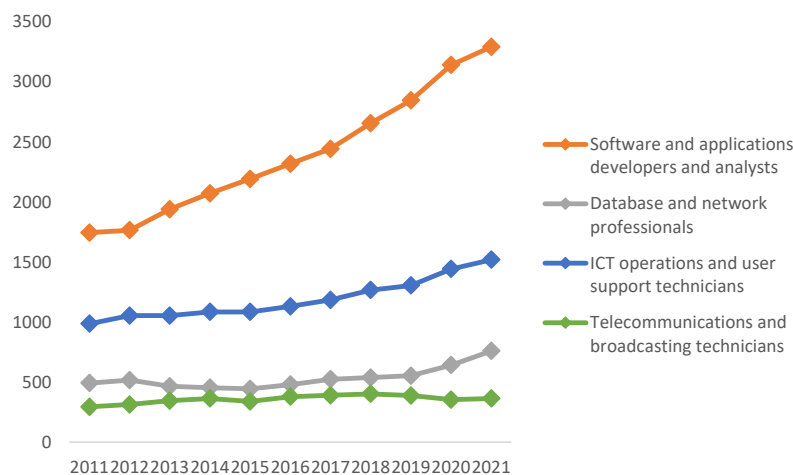
From a sectoral perspective, persistent labour shortages were widespread (reported by 17 Member States) in computer programming, consultancy and related activities (see section 2.1.). This subsector falls under the highly digitally intensive information and communication sector (Chart A.1), although data limitations prevent an assessment of digital intensity of work at subsector level. An alternative measure of digital intensity developed by Eurostat ranks around 90% of enterprises in this subsector as highly or very highly digitally intensive. ⁽¹⁸¹⁾

Other occupations and sectors facing persistent labour shortages across EU Member States are typically not very digitally intensive. Only the work of electro-technology engineers is of at least intermediate digital intensity. For the remainder, digital skills account for fewer than 1 in 10 required skills. In fact, apart from ICT occupations, shortage occupations are, on average, somewhat less digitally intensive than non-shortage occupations. ⁽¹⁸²⁾ Labour shortages in non-ICT occupations and sectors are therefore likely to be primarily driven by factors other than digitalisation (see section 2.2.).

Chart 2.6

Employment in ICT occupations grew since 2011

Number of workers employed in ICT occupations over time (thousands), EU



Note: Analysis based on all Member States where occupational statistics are available at ISCO-08 3-digit level for ICT occupations, i.e. excluding Bulgaria, Ireland, Malta and Slovenia.

Source: EU-LFS 2011-2021.

[Click here to download chart.](#)

3.2.2. Digital divides in the labour market

Addressing persistent labour shortages in digitally intensive work necessitates understanding who has the digital skills necessary to perform this kind of work. This section briefly explores the distribution of digital skills among the broader population, then analyses who performs work requiring digital skills. It concludes by analysing the key factors that affect the digital intensity of work.

There are several important digital divides in skills among the EU working-age population, including educational attainment, age, and employment status. ⁽¹⁸³⁾ A recent report highlighted that in the EU in 2019, around 60% of individuals of working age (25-64) had at least basic digital skills, ⁽¹⁸⁴⁾ ⁽¹⁸⁵⁾ with the European Pillar of Social Rights action plan setting a target of at least 80% of the EU population aged 16-74 having basic digital skills by 2030. ⁽¹⁸⁶⁾ The proportion of people with at least basic digital skills was much lower for low-educated individuals (24%), 55-64-year-olds (42%), and those who were either unemployed (45%) or inactive (33%). The evidence for a gender divide in digital skills is less conclusive, ⁽¹⁸⁷⁾ but suggests that more men than women have certain advanced digital skills. ⁽¹⁸⁸⁾ Overall, the research highlights the following priority groups for digital upskilling/reskilling actions: young people with low levels of education and NEETs; 55-64-year-olds; people with lower levels of educational attainment; those who are inactive and unemployed; those employed in low-skilled and semi-skilled occupations; those living in rural areas; and non-EU nationals. ⁽¹⁸⁹⁾

⁽¹⁸¹⁾ See Eurostat dataset [isoc_e_diiin2](#).

⁽¹⁸²⁾ (Cedefop, 2022e).

⁽¹⁸³⁾ (Elena-Bucea et al., 2021), (Centeno, Karpinski and Urzi Brancati, 2021), (EIGE, 2020b).

⁽¹⁸⁴⁾ Overall digital skills refer to five areas: information and data literacy skills, communication and collaboration skills, digital content creation skills, safety skills and problem-solving skills. To have at least basic overall digital skills, people must know how to do at least one activity related to each area. More information on the types of activities related to each skill available [here](#).

⁽¹⁸⁵⁾ (Centeno, Karpinski and Urzi Brancati, 2021).

⁽¹⁸⁶⁾ According to the relevant Digital Economy and Society Index (DESI) indicator, including a broader age range (available [here](#)), 54% of individuals aged 16-74 in the EU possessed at least basic digital skills in 2021.

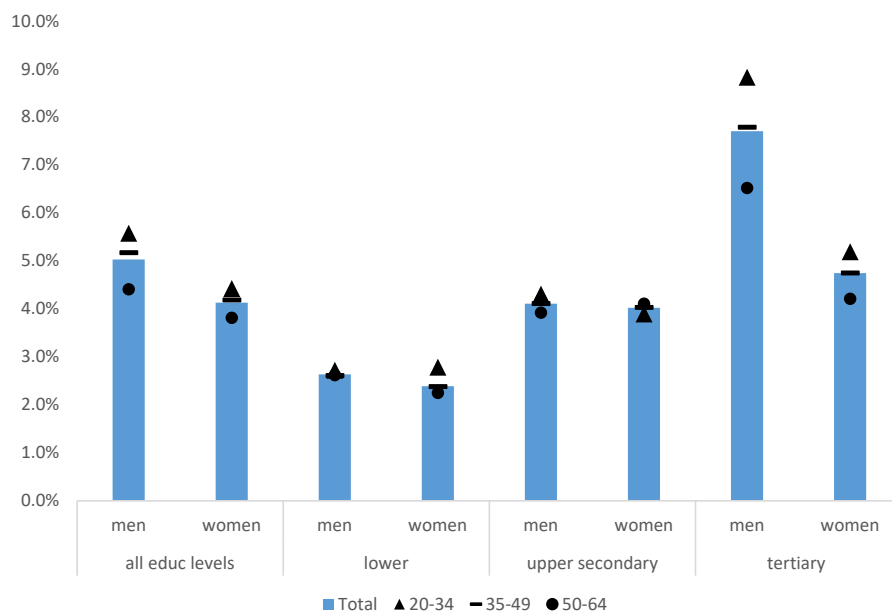
⁽¹⁸⁷⁾ There are some gender gaps in online access and digital skills among young men and women, but older and less-educated women tend to be disadvantaged compared to their male peers (EIGE, 2020b).

⁽¹⁸⁸⁾ Notably, above basic software skills (EIGE, 2020b).

⁽¹⁸⁹⁾ (Centeno, Karpinski and Urzi Brancati, 2021).

The education divide in digital skills is mirrored in the digital intensity of work (Chart 2.7). For example, the work of highly educated men is far more digitally intensive than that of less-educated men, at around 10% and 2%, respectively. Gender differences in the use of digital skills at work are more pronounced than gender differences in digital skills among the overall population, especially among workers with tertiary education. Tertiary-educated men work in occupations where around 8% of all skill requirements are digital, whereas for tertiary-educated women this proportion is only about 5%.⁽¹⁹⁰⁾ Differences in the digital intensity of work of young and older workers are quite small compared to the age divide in digital skills among all people of working age.

Chart 2.7
Work of young, highly educated men is the most digitally intensive
 Digital intensity of work, by age, gender, educational attainment (%), 2021, EU



Note: Analysis based on all Member States where occupational statistics are available at ISCO-08 3-digit level, i.e. excluding Bulgaria, Malta and Slovenia.

Source: EU-LFS 2021.

[Click here to download chart.](#)

Most divides in the digital intensity of work stem from underrepresentation of certain groups of workers in specialist ICT work with high digital intensity. This can be demonstrated by a joint analysis of factors affecting the digital intensity of work through several ordinary least squares (OLS) regression models (Chart 2.8).⁽¹⁹¹⁾ The results of this analysis should be interpreted with caution, as the data cover only some of the likely drivers of digital intensity of work.

Accounting solely for differences in basic worker and job characteristics explains less than half of the overall variation in digital intensity of work. Age, gender, country of birth, place of residence and level of educational attainment do not explain much of the variation. The same is true for several job characteristics, including the part-time or temporary nature of the work, supervisory responsibilities, employer size, and participation in training (Chart 2.8, Model 1). Together, these personal and job characteristics account for only about 6% of the overall variation in digital intensity of work at EU level. Differences in workers' fields of educational achievement and economic activity play a more prominent role. For example, the digital intensity of work increases by about 12.3 pp for workers with either secondary or tertiary qualifications in ICT, compared to those who have not achieved any secondary or tertiary qualification. Yet, accounting for these differences in addition to personal and job characteristics explains less than 40% of the variation in digital intensity of work (Chart 2.8, Model 2).

Most differences in digital intensity of work (around 80%) can be traced to who does and does not work in ICT occupations.⁽¹⁹²⁾ Working in an ICT occupation increases the digital intensity of work by 27.7 pp compared to working in a non-ICT occupation, a far larger effect than for any other factor (Chart 2.8, Model 3). Taking this effect into account considerably reduces the importance of other factors, highlighting that their impact matters only insofar as they increase the chances of working in an ICT occupation. For example, tertiary-educated men have, on average, higher digital intensity of work than similarly educated women (Chart 2.7),

⁽¹⁹⁰⁾ This gender gap is larger among young (aged 20-34) tertiary-educated workers (3.6 pp) than among those aged 50+ (2.3 pp).

⁽¹⁹¹⁾ Starting from a model that covers basic worker and job characteristics, then adding information about types of qualifications workers hold and the sectors in which they work, and finally adding information about who does/does not work in ICT occupations.

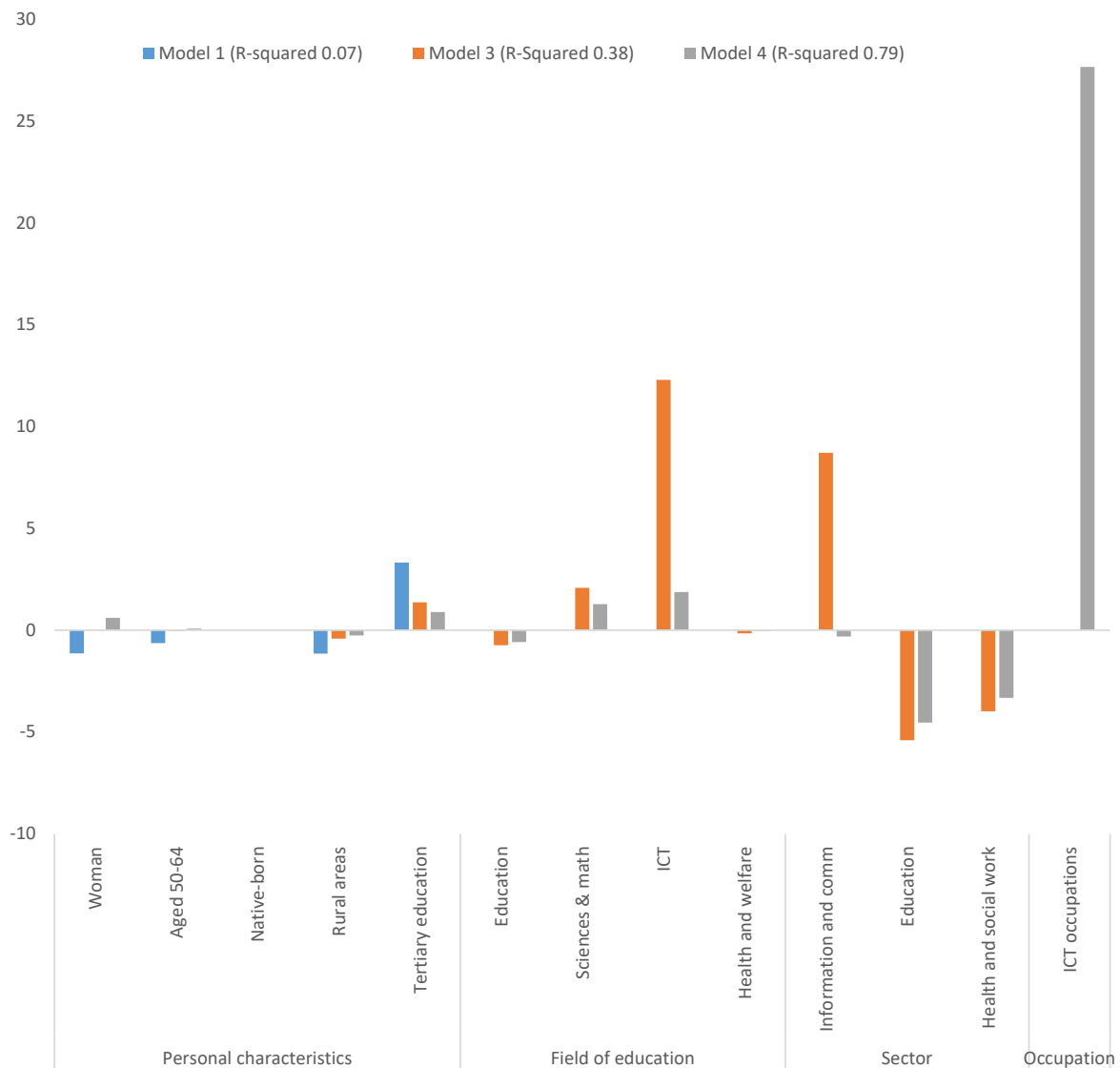
⁽¹⁹²⁾ This includes the following occupations according to ISCO-08 3-digit classification: software and applications developers and analysts; database and network professionals; ICT operations and user support technicians; telecommunications and broadcasting technicians.

largely as a result of higher male participation in ICT occupations.⁽¹⁹³⁾ Thus, attracting more women into ICT occupations has the potential to both alleviate certain labour shortages in this area (see section 3.2.3.) and reduce existing gender disparities in use of digital skills at work.

Chart 2.8

Broader divides in digital intensity of work often result from differences in participation in ICT work

Predicted changes in digital intensity of work, by selected worker and job characteristics, workers aged 20-64, 2021, EU



Note: Analysis based on all Member States where occupational statistics are available at ISCO-08 3-digit level, i.e. excluding Bulgaria, Malta and Slovenia. Specification of model 1 controls for: age, country of birth, education level, degree of urbanisation, country, part-time work, temporary contracts, supervisory responsibilities, training attendance and employer size. Specification of model 2 additionally controls for: field of education, sector of economic activity. Model 3 additionally controls for working in the following ICT occupations: Software and applications developers and analysts; database and network professionals; ICT operations and user support technicians; telecommunications and broadcasting technicians.

Source: EU-LFS 2021 data.

[Click here to download chart.](#)

3.2.3. Persistent gender segregation in shortage ICT occupations

Addressing underrepresentation of certain groups of workers among ICT professionals can help to address persistent labour shortages in digitally intensive work. This follows a similar logic to the broader group of STEM occupations (see section 5.) to which ICT professionals belong. ICT work is primarily carried out by (young or middle-aged) tertiary-educated men with advanced digital skills. Their employment rates are already very high, limiting the potential to attract additional workers from this group. Increasing the labour supply of groups underrepresented in digitally intensive work is more promising, as activity rates of some of these groups (women and older workers, in particular) are still comparatively low (see section 4.). At the same time, new workers from these groups are unlikely to move into hard-to-fill vacancies in ICT unless measures are taken to

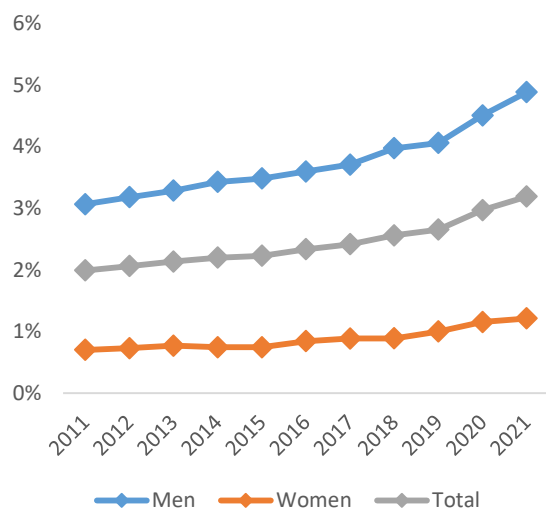
⁽¹⁹³⁾ How digital intensity of work is measured does not capture intra-occupation variation. This analysis therefore cannot capture situations where individuals work in an occupation that has low digital intensity on average, but their jobs are much more digitally intense than the average.

address the factors underpinning their current underrepresentation and to address their upskilling and reskilling needs.

The following analysis considers key factors driving women's low participation in ICT occupations. ⁽¹⁹⁴⁾ Gender segregation is known to contribute to labour shortages across all STEM occupations, including in ICT (see section 5.). However, the factors underlying the underrepresentation of women in ICT occupations differ somewhat from those for STEM as whole, reflecting the specific skill requirements, content, organisation and working conditions of ICT work.

Chart 2.9
Gender gap in ICT occupations has increased since 2011

Proportion of workers in ICT occupations, by gender (% of all workers), 2011-2021, EU



Note: Analysis based on all Member States where occupational statistics are available at ISCO-08 2-digit level, i.e. excluding Malta.

Source: EU-LFS 2011-2021.

[Click here to download chart.](#)

In 2021, there was a significant gender gap in ICT occupations (Chart 2.9). More specifically, 4.9% of all working men were employed in ICT occupations, compared to only about 1.2% of all working women, a gender gap of almost 4 pp. That gap increased considerably during the past decade (up from 2.4 pp in 2011) and may have accelerated since the start of the COVID-19 pandemic. Overall, women accounted for only about 17% of all EU employment in ICT occupations in 2021. ⁽¹⁹⁵⁾

Key factors in the underrepresentation of women in ICT broadly correspond to those for STEM occupations, but reflect the particular nature of ICT work. Children are exposed to stereotypical images of ICT work and ICT workers from an early age, which contributes to gender divides in confidence in digital skills and aspirations to work in ICT. In the EU, by 15 years of age, around 1 in 10 boys expect to work in ICT, compared to only 1 in 100 girls. ⁽¹⁹⁶⁾ Predictably, heavy overrepresentation of men in ICT studies follows, with men accounting for about 8 in 10 students in this field at EU level in 2020. ⁽¹⁹⁷⁾ Even where women hold relevant qualifications, they have a lower likelihood of progressing into and keeping ICT jobs. This may be linked to certain

aspects of employment in ICT, such as: reliance on full-time work patterns that are difficult to reconcile with unpaid care responsibilities; biases in recruitment practices, remuneration (gender pay gap), and promotion ladders; or masculine working cultures that may be particularly difficult for women to work within. ⁽¹⁹⁸⁾ There are also some indications that women's employment in ICT may be concentrated in certain occupations and workplaces, with limited opportunities available elsewhere. ⁽¹⁹⁹⁾

Around half of the gender gap in ICT occupations results from differences in worker characteristics, most notably the overrepresentation of men among workers with ICT-related qualifications and in ICT-intensive sectors (Chart 2.10). Several other gender differences explain smaller – albeit significant – parts of this gender gap, but these largely cancel one another out.

⁽¹⁹⁴⁾ Analysis follows the same methodology used in (European Commission, 2023i).

⁽¹⁹⁵⁾ When following the broader definition of ICT occupations outlined in DESI, this proportion was 19% in 2021. The definition of the ICT specialists' occupations in DESI is based on the ISCO-08 classification. It includes ICT service managers (code 133), ICT professionals (25), ICT technicians (35) and some other groups, from electronic and telecommunications engineers (215*) up to ICT installers and servicers (7422). More information available here.

⁽¹⁹⁶⁾ (OECD, 2019b).

⁽¹⁹⁷⁾ Eurostat dataset educ_uoe_grad02.

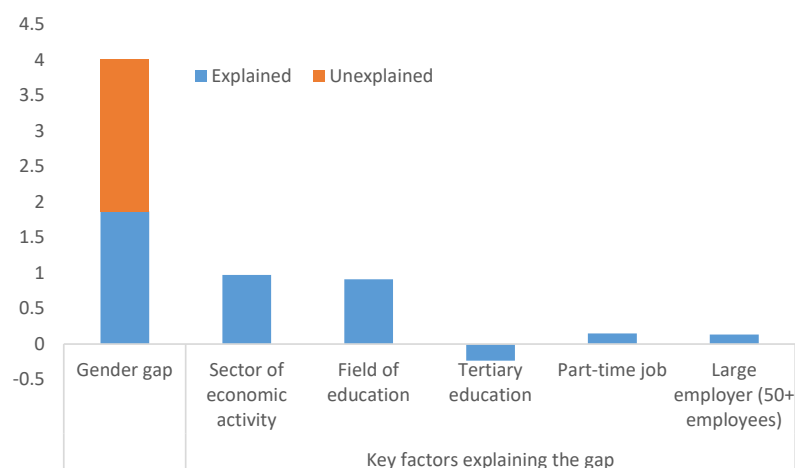
⁽¹⁹⁸⁾ (Verges Bosch et al., 2021), (EIGE, 2020a), (Graham et al., 2016), (Valenduc, 2011).

⁽¹⁹⁹⁾ Ibid.

Chart 2.10

Only one-quarter of the gender gap in ICT work is explained by men holding most ICT qualifications

Gender gaps in ICT occupations, by contributing factors (pp), workers aged 20-64, 2021, EU



Note: Analysis based on all Member States where occupational statistics are available at ISCO-08 2-digit level, i.e. excluding Malta.

Source: EU-LFS 2021.

[Click here to download chart.](#)

It is striking that around half of the gender gap in ICT remains unexplained by differences in worker characteristics. This is a much higher proportion than for STEM occupations more broadly (see section 5.). It may partly reflect the fact that certain worker characteristics significantly increase the probability of working in an ICT occupation for men, but less so for women. It may also reflect a lack of data on several important factors for participating in ICT jobs. For example, EU-LFS data do not capture information on gender discrimination and stereotypes at the workplace (including the gender pay gap), various aspects of organisational working culture, or the amount of unpaid care that workers undertake in addition to

their paid work. Studies on women's participation in ICT have highlighted all of these important factors⁽²⁰⁰⁾ and their omission may lead to biases and imprecise analysis.

Even when women hold relevant ICT qualifications, their chances of working in ICT occupations increase less than for men (Chart A.2). For male workers, holding at least a secondary qualification in an ICT field raises their chances of working in ICT occupations by more than 33 pp, almost twice as much as it does for women (less than 19 pp). Holding a qualification in science, mathematics and statistics increases men's chances of working in ICT occupations by about 5 pp on average, as does any generic qualification at secondary level or above. While these qualification types also improve the corresponding chances of women, their increases are less than half those of men. These findings support previous evidence suggesting that even where women achieve ICT-related qualifications, it is often harder for them to find and sustain employment in ICT jobs.⁽²⁰¹⁾

4. IMPACT OF POPULATION AGEING AND LABOUR FORCE PARTICIPATION ON LABOUR SHORTAGES

Several factors can limit labour supply over long periods of time. Demographic trends such as population ageing can reduce the size of the labour force, due to both an overall decline in the share of the working-age population and lower labour market participation rates among older people of working age. Structural issues limiting labour market participation of women can lead to substantial reductions in overall labour market participation rates. Low capacity to attract and integrate foreign workers into the labour market can also limit workforce size. These factors need to be considered jointly in order to understand their overall implications for the workforce and for labour shortages.

4.1. Population ageing

Given the projected demographic trends, maintaining and increasing labour supply will remain a major policy challenge. According to Eurostat's EUROPOP2023 baseline population projection (Chart 2.11), the number of people in working age (blue line) is expected to decrease in the coming decades. While the working-age population (20-64-year-olds) reached a record of 272 million people in 2009, it declined to 265 million by 2022 and is expected to fall further, to 258 million by 2030, 247 million by 2040, and 236 million by 2050. Assuming that the activity rates of people in various education groups (primary, secondary and tertiary educated) within each population subgroup (young, prime-age individuals, older people, female, male, mothers) remain constant,⁽²⁰²⁾ the number of active people is expected to follow a very similar pattern. After rising from

⁽²⁰⁰⁾ (EIGE, 2020b).

⁽²⁰¹⁾ (EIGE, 2020a), (Graham et al., 2016), (Valenduc, 2011).

⁽²⁰²⁾ This assumption does not take into account potential measures to increase the active population in the EU and should be interpreted with caution.

191 million in 2002 to a record 205 million in 2022, the number of active people is estimated to decline to 201 million in 2030, 192 million in 2040, and 184 million in 2050.

These projected activity rates will bring additional workers into the labour market. In a scenario where the activity of women in the EU converged to the target value in the three top-performing Member States for this group (Chart 2.11; see the difference between the target activity and the projected number of active women in labour market in Table 2.6 in section 4.2.), an additional 17.3 million women would enter the EU labour market. Under the same assumption for men, an additional 8.8 million men would join the EU workforce.

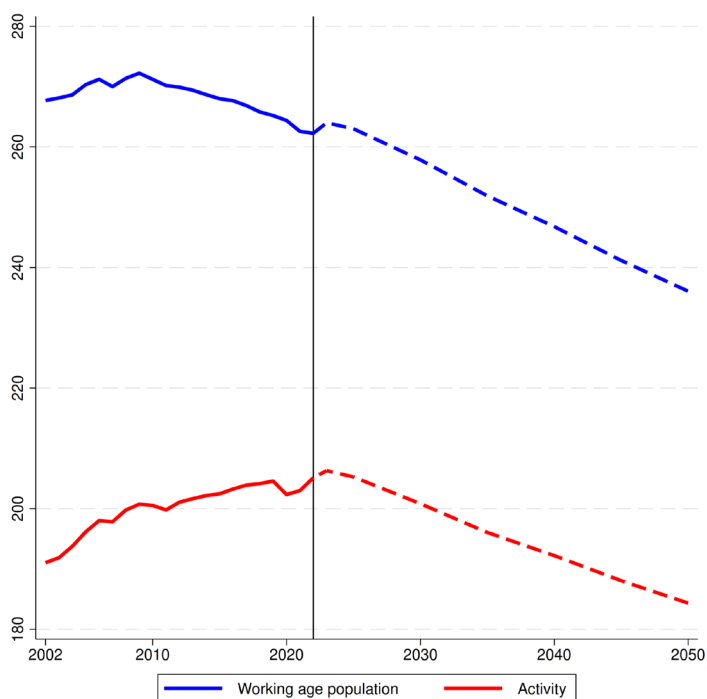
The challenges associated with a decreasing and ageing population vary significantly by country. The implications of these projected demographic changes are assessed using the European Commission's Labour Market Model (LMM). The impact of the projected demographic changes to 2030 and 2050 on the main national economic and labour market indicators were simulated for 11 Member States (Germany, Italy, Austria, Poland, Belgium, Czechia, Spain, Finland, France, the Netherlands and Slovakia), using Eurostat's baseline projections by age. Those figures were then compared with 2022 figures. The share of low-educated, middle-educated and highly educated people was assumed to remain unchanged for each age group.⁽²⁰³⁾ In other words, the simulations do not take into account possible changes in education during the forecast period.⁽²⁰⁴⁾

The population is projected to continue increasing in the next decade in the majority of the 11 Member States simulated (Table 2.5). It is expected to decrease slightly in Italy and Poland by 2030. By 2050, 4 of the 11 countries will face decreasing populations compared to 2022, with Poland experiencing the largest drop (-8%). Population ageing is a major challenge for all 11 Member States: the share of the older population (aged 70+) is expected to increase gradually in all countries in the short term (by 2030), then more sharply in the longer term (by 2050).

Chart 2.11

Working age population and activity are expected to decrease in the coming decades

Working age population and activity, EU, 2022-2050



Note: Share of working-age population defined as the ratio of the 20-64-year-olds to the total population in the EU. All other statistics also refer to the 20-64-year-old population.

Source: DG EMPL calculations, based on Eurostat and OECD data, and EUROPOP2023 population projections.

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expected to positively impact their GDP per capita by 2050, with Finland experiencing the largest increase (1.4%).

Population decline and ageing will cause GDP to decline in the Member States to varying degrees

(Table 2.5). By 2030, Belgium and Finland are projected to be the only countries benefiting from demographic changes, with GDP increases of 0.3% and 0.7%, respectively. In the other countries, demographic trends are expected to exert a negative effect on GDP, ranging from 0.2% (the Netherlands) to 9.1% (Poland). By 2050, however, the vast majority of these countries will be negatively affected by demographic changes. The projected GDP loss associated with demographic trends varies between 3.3% (Finland) and 24% (Poland). Over this period, demographic changes are expected to exert a positive impact on GDP only in Belgium (+2.6%) and the Netherlands (+0.7%). In six countries, GDP loss will be more significant than the decline in the population, due to the increase in the old-age dependency ratio. As a result, the GDP per capita (15-69-year-olds) will deteriorate in these countries: by 2050, it is expected to decline by between 1.4% (Italy) and 7.6% (Poland). On the other hand, the demographic trends in Belgium, Finland, France, and the Netherlands are

⁽²⁰³⁾ Population forecasts not available by education level in EUROPOP2023.

⁽²⁰⁴⁾ This does not take into account policies such as reskilling and upskilling, or reinforced integration efforts; however, the baseline EUROPOP2023 projection considers projected immigration flows.

Table 2.5

Population decline and ageing are expected to have profound effects on the economy

Impact of demographic trends in selected Member States: 2022-2030 and 2022-2050

	DE	IT	AT	PL	BE	CZ	ES	FI	FR	NL	SK
Population change 2022-2030 (thousands)	2 047	-256	236	-234	391	335	1 834	83	1 514	751	15
(% in parentheses)	(2.46)	(-0.43)	(2.63)	(-0.62)	(3.37)	(3.18)	(3.87)	(1.5)	(2.23)	(4.27)	(0.28)
- 15-69	-49	-298	29	-1 141	205	148	1 327	27	288	225	-139
	(-0.08)	(-0.73)	(0.45)	(-4.21)	(2.54)	(2.03)	(3.92)	(0.71)	(0.63)	(1.82)	(-3.53)
- 15-24	138	96	17	373	110	219	493	38	257	-109	43
	(1.65)	(1.66)	(1.84)	(10.09)	(8.28)	(22.38)	(10.02)	(6.17)	(3.16)	(-5.03)	(8)
- 25-54	-169	-1 878	-130	-846	42	-198	-767	62	-327	195	-169
	(-0.53)	(-8.2)	(-3.53)	(-5.23)	(0.92)	(-4.5)	(-3.88)	(2.99)	(-1.31)	(2.89)	(-7.09)
- 55-69	-18	1 484	142	-668	53	127	1 601	-73	357	138	-14
	(-0.1)	(12.05)	(7.93)	(-9.17)	(2.4)	(6.58)	(17.51)	(-6.82)	(2.85)	(4.01)	(-1.3)
- 70+	1 268	1 074	186	1 362	279	215	1 322	144	1 861	495	184
	(9.41)	(10.21)	(14.69)	(28.91)	(17.19)	(14.22)	(18.96)	(15.54)	(18.03)	(19.72)	(30.4)
GDP (%)	-1.03	-7.62	-2.64	-9.05	0.28	-3.01	-4.93	0.69	-1.80	-0.15	-6.68
Capital stock (%)	-0.99	-7.65	-2.60	-9.07	0.24	-3.10	-5.10	0.66	-1.83	-0.14	-6.69
Employment (%)	-0.65	-2.89	-1.73	-4.72	1.78	0.00	1.93	1.70	-0.20	2.34	-5.45
Employment (thousands)	-268	-645	-74	-780	86	0	380	43	-54	215	-139
Participation rate - 15-69 yrs. (pp. change)	-0.46	-1.07	-1.17	-0.97	-0.46	-1.72	-1.29	0.18	-0.40	0.51	-1.48
Active population - 15-69 yrs. (thousands)	-301	-614	-55	-973	93	-20	455	26	6	239	-153
Wages (%)	-0.38	-4.77	-0.97	-4.43	-1.37	-2.89	-6.34	-1.07	-1.47	-2.21	-1.28
Population change 2022-2050 (thousands)	1 577	-1 512	548	-3 031	942	231	3 027	-89	2 770	1 153	-255
(% in parentheses)	(1.89)	(-2.56)	(6.11)	(-8.05)	(8.1)	(2.19)	(6.38)	(-1.61)	(4.08)	(6.56)	(-4.69)
- 15-69	-2 873	-5 776	-184	-4 449	160	-424	-2 542	-177	-1 364	-74	-610
	(-4.94)	(-14.08)	(-2.87)	(-16.4)	(1.98)	(-5.79)	(-7.51)	(-4.68)	(-2.99)	(-0.6)	(-15.43)
- 15-24	399	-1 160	-4	-555	-26	77	-688	-92	-588	-130	-33
	(4.77)	(-20.03)	(-0.48)	(-15.04)	(-1.97)	(7.88)	(-14)	(-15.16)	(-7.23)	(-6.03)	(-6.21)
- 25-54	-1 486	-2 849	-244	-4 398	125	-637	-1 943	-97	-574	148	-651
	(-4.64)	(-12.44)	(-6.62)	(-27.22)	(2.75)	(-14.47)	(-9.83)	(-4.63)	(-2.3)	(2.19)	(-27.35)
- 55-69	-1 785	-1 767	64	504	61	136	89	12	-202	-92	74
	(-10.02)	(-14.35)	(3.59)	(6.92)	(2.79)	(7.03)	(0.98)	(1.15)	(-1.61)	(-2.68)	(7.07)
- 70+	4 485	5 291	767	2 630	842	738	6 188	227	4 883	1 259	484
	(33.3)	(50.28)	(60.58)	(55.84)	(51.86)	(48.92)	(88.75)	(24.49)	(47.31)	(50.2)	(79.81)
GDP (%)	-6.60	-15.45	-6.07	-24.00	2.55	-10.78	-11.30	-3.30	-2.39	0.68	-21.89
Capital stock (%)	-6.65	-15.35	-6.06	-23.93	2.59	-10.87	-11.26	-3.19	-2.34	0.74	-21.91
Employment (%)	-4.91	-12.59	-4.77	-21.69	2.37	-8.12	-7.09	-4.04	-2.55	0.27	-20.72
Employment (thousands)	-2 013	-2 811	-204	-3 584	115	-419	-1 397	-102	-703	25	-528
Participation rate - 15-69 yrs. (pp. change)	-0.58	0.77	-1.07	-2.77	0.29	-2.14	0.05	0.81	0.31	0.55	-3.40
Active population - 15-69 yrs. (thousands)	-2 422	-3 205	-198	-3 433	126	-456	-1 725	-99	-757	10	-536
Wages (%)	-1.71	-3.25	-1.41	-2.71	0.13	-2.59	-4.32	0.46	0.07	0.21	-1.40
Population change 2022-2100 (thousands)	880	-8 836	598	-8 138	938	129	-2 311	-763	171	720	-882
(% in parentheses)	(1.06)	(-14.97)	(6.66)	(-21.61)	(8.08)	(1.23)	(-4.87)	(-13.76)	(0.25)	(4.09)	(-16.24)
- 15-69	-6 926	-11 151	-605	-9 468	-452	-792	-6 977	-931	-5 022	-1 249	-1 228
	(-11.91)	(-27.19)	(-9.42)	(-34.9)	(-5.61)	(-10.82)	(-20.62)	(-24.68)	(-11)	(-10.1)	(-31.04)
- 15-24	-138	-1 461	-34	-873	-103	91	-869	-181	-1 385	-407	-68
	(-1.66)	(-25.24)	(-3.6)	(-23.65)	(-7.77)	(9.29)	(-17.68)	(-29.7)	(-17.03)	(-18.88)	(-12.63)
- 25-54	-3 594	-6 691	-481	-6 450	-375	-792	-5 165	-548	-3 066	-696	-879
	(-11.23)	(-29.21)	(-13.01)	(-39.93)	(-8.27)	(-17.99)	(-26.12)	(-26.26)	(-12.26)	(-10.28)	(-36.93)
- 55-69	-3 193	-2 999	-90	-2 145	27	-91	-943	-202	-570	-146	-281
	(-17.93)	(-24.35)	(-5.05)	(-29.44)	(1.21)	(-4.71)	(-10.31)	(-18.77)	(-4.55)	(-4.24)	(-27.05)
- 70+	7 992	4 036	1 241	3 256	1 625	1 120	5 925	438	7 463	2 212	557
	(59.34)	(38.35)	(98)	(69.14)	(100.03)	(74.22)	(84.99)	(47.38)	(72.32)	(88.18)	(91.86)
GDP (%)	-13.64	-30.47	-13.27	-40.29	-7.30	-15.53	-26.62	-25.22	-11.58	-10.07	-34.54
Capital stock (%)	-13.67	-30.36	-13.26	-40.29	-7.24	-15.63	-26.59	-25.12	-11.48	-9.90	-34.58
Employment (%)	-11.90	-26.94	-11.27	-37.10	-6.91	-12.69	-21.43	-24.90	-11.30	-10.25	-33.35
Employment (thousands)	-4 879	-6 013	-482	-6 130	-334	-656	-4 226	-629	-3 120	-942	-850
Participation rate - 15-69 yrs. (pp. change)	-0.73	-0.10	-1.30	-2.24	-0.57	-2.18	-0.99	0.23	-0.01	0.24	-2.74
Active population - 15-69 yrs. (thousands)	-5 442	-6 743	-505	-6 365	-333	-717	-5 038	-669	-3 300	-941	-924
Wages (%)	-1.94	-4.77	-2.33	-4.86	-0.45	-3.01	-6.23	-0.59	-0.40	0.10	-1.73

Note: Simulations do not take into account possible changes in education during the forecast period, and the distribution of the highest level of education is assumed to remain constant for each age group.

Source: DG EMPL simulations using the LMM, based on EUROPOP2023.

[Click here to download table.](#)

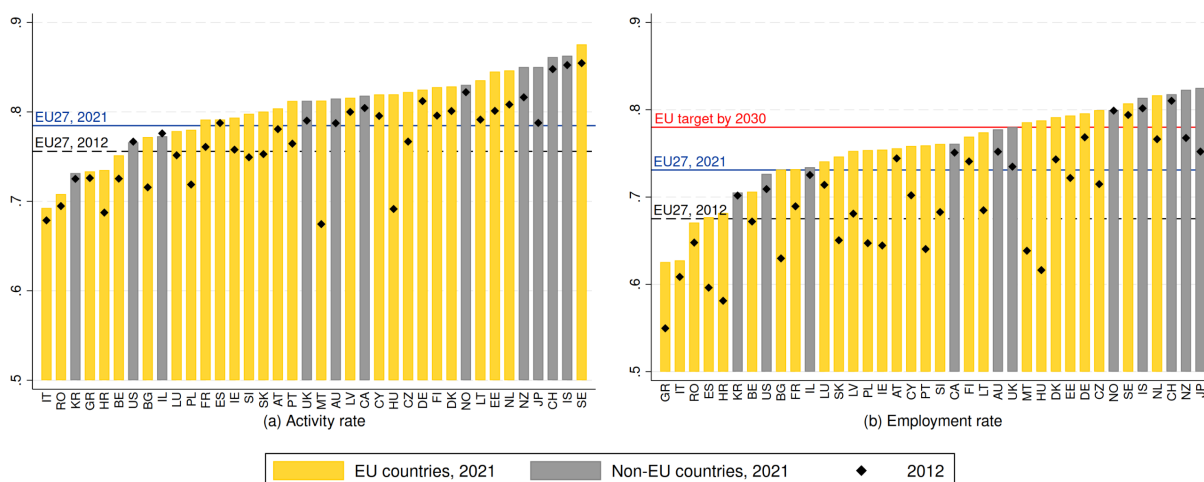
Both production factors – capital and labour – are affected by the expected demographic trends. The impact on the aggregate participation and employment rates results from two opposing effects: firstly, the increase in the old-age dependency ratio negatively impacts the average activity and employment rates; and secondly, the decreasing proportion of young people of school age partly counterbalances the negative effect of the increasing share of older people. As a result, by 2050, both the active population (15-69-year-olds working or actively seeking employment) and the number of employed people are expected to shrink in all countries except Belgium and the Netherlands. Poland is expected to see the largest employment drop, both in absolute numbers (-3.6 million people) and as a percentage (-21.7%). Overall, in these 11 countries, the active population is expected to decrease by about 12.7 million, and the number of employed people by 11.6 million.

The decreasing working-age population, together with constant consumption patterns by an increasing older population, are likely to drive up labour shortages as long as the population age structure continues to shift towards older ages. This is the case because retired people continue to consume, maintaining the demand at a relatively high level, while supply decreases due to the shrinking of the working-age population. The impact of population ageing on labour shortages is even stronger when fiscal policy is expansionary. ⁽²⁰⁵⁾

4.2. Untapped labour potential to fill existing shortages

Insufficient labour market participation is one of the factors underlying labour shortages. The activity rate in the EU in 2021 was 78.5%, higher than in 2012. It showed considerable cross-country heterogeneity, being lowest in Italy (69.2%) and highest in Sweden (87.5%) (Chart 2.12). In 2021, on average, labour market participation in the EU was slightly lower than in other developed OECD member countries. ⁽²⁰⁶⁾

Chart 2.12
Activity rates and employment rates in selected countries
 Activity rates and employment rates, people aged 20-64, 2021, EU-27 and selected OECD member countries



Note: European Pillar of Social Rights action plan sets a target of at least 78% employment rate at EU level by 2030; KR=South Korea; IL=Israel; AU=Australia; CA=Canada; NO=Norway; NZ=New Zealand; JP=Japan; CH=Switzerland; IS=Iceland.

Source: OECD (YYYY).

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In 2021, the EU employment rate was 73.1%. This was some 5 pp lower than the 2030 employment target of 78% at EU level set out in the European Pillar of Social Rights action plan. While eight EU Member States had already reached this level in 2021, Greece and Italy continue to have a substantially lower employment rate, at 62.6% and 62.7%, respectively. Assuming a constant population, reaching the targeted employment rate of 78% by 2030 requires an additional 12.7 million people to work in the EU in the coming years.

The EU employment rate has increased gradually over the past decade. In the past nine years, it grew by more than 5.5 pp. Hungary experienced the largest increase (17%), due in part to a large-scale public work programme introduced in 2011, radical changes in its tax-benefit system over the past decade, ⁽²⁰⁷⁾ and the 2021 reclassification of mothers on parental leave as being in employment (mechanically raising the

⁽²⁰⁵⁾ An expansionary fiscal policy boosts demand by inciting people to consume more. As retired people do not contribute to the production of goods and services, but create additional demand for those goods and services, the demand increases even more compared to the supply when the population is ageing. For example, the analysis in European Commission (2022a) suggests that labour shortages increased more in periods when fiscal policy was expansionary.

⁽²⁰⁶⁾ Of the 11 non-EU countries considered, only three lagged behind the EU average: South Korea, US, and Israel.

⁽²⁰⁷⁾ See (Benczur, 2011) and (Mihály Szoboszlai, 2018) on the effects of past tax and benefits reforms in Hungary.

employment rate). The employment rate increased by more than 10 pp in six other countries: Croatia, Bulgaria, Poland, Ireland, Portugal and Malta. With the exception of Croatia, they all reached or surpassed the EU average by 2021, and Malta even reached the employment target.

The employment target cannot be reached at EU level without increasing labour market participation. If the participation rate were to remain unchanged, at 78.5%, the employment rate target would be consistent with an unemployment rate of 0.6%, implying practically non-existent involuntary unemployment and a frictionless labour market. ⁽²⁰⁸⁾

Cross-country differences in participation and employment rates are at least partly explained by differences in tax-benefit systems. For example, a recent study ⁽²⁰⁹⁾ shows that more than two-thirds of the (3.6 pp) difference in participation of the prime-age population (25-54-year-olds) in Czechia and Hungary in 2008 could be explained by differences in their tax-benefit systems. The largest difference explained by the differences in the tax-benefit systems is identified for low-educated individuals and for married women. These differences related to higher personal income taxes for low earners and more generous maternity allowances in Hungary than in Czechia. Other possible drivers explaining the cross-country differences in participation rates include differences in schooling, pension schemes, or access to social services such as childcare. Chapter 3 looks at a selection of possible policy measures to incentivise people to work.

Chart 2.13

Marginal effects of selected individual characteristics on participation probability

Effects of individual characteristics on participation probability among people aged 20-64, 2004-2020, EU-27



Note: Marginal effects calculated on sample mean based on an estimated logit model. Model also includes country and year dummies. Reference categories are: primary education, male, prime-age individuals, and single. Confidence intervals not presented, but extremely narrow.

Source: DG EMPL calculations, based on EU-LFS 2004-2020.

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Individual characteristics are significant predictors of people's participation probability.

The effects of individual characteristics on the probability of being active (i.e. the marginal effects of individual characteristics) are estimated using EU-LFS microdata. ⁽²¹⁰⁾ Students in regular education are less likely to work (-35 pp) (Chart 2.13). The highest level of education attained has a strong impact on the probability of being employed or actively seeking work: on average, secondary education increases participation probability by about 11 pp compared to lower levels of education, and a person who has completed tertiary education has a 23 pp higher probability of working or actively seeking employment. ⁽²¹¹⁾ Women are less likely to be active on the labour market (-12 pp), especially mothers of infants under three years (marginal effect of -10 pp). People aged 55+ participate in the labour market significantly less than younger generations (-28 pp compared to prime-age individuals), partly due to early retirement schemes. Marital status (being single, separated or married) has only a limited influence on people's participation decisions.

Individual characteristics as determinants of labour market participation show similar patterns across countries.

A separate regression for each Member State shows that the impacts of these factors are very similar (Chart A.3). The largest variation is observed for the participation of students. In Luxembourg, Croatia, Romania, Hungary and Greece, the marginal negative impact of regular education (formal education, including schools, colleges and universities) exceeds -60 pp, while in the Netherlands it is about -10 pp. The participation of

older people also shows important cross-country variation, albeit to a lesser extent. Interestingly, Czechia,

⁽²⁰⁸⁾ Unemployment rate: $1 - (\text{employment rate} / \text{activity rate}) = 1 - (0.78 / 0.785) = 0.006$, i.e. about 0.6%.

⁽²⁰⁹⁾ (Galuscak, 2019).

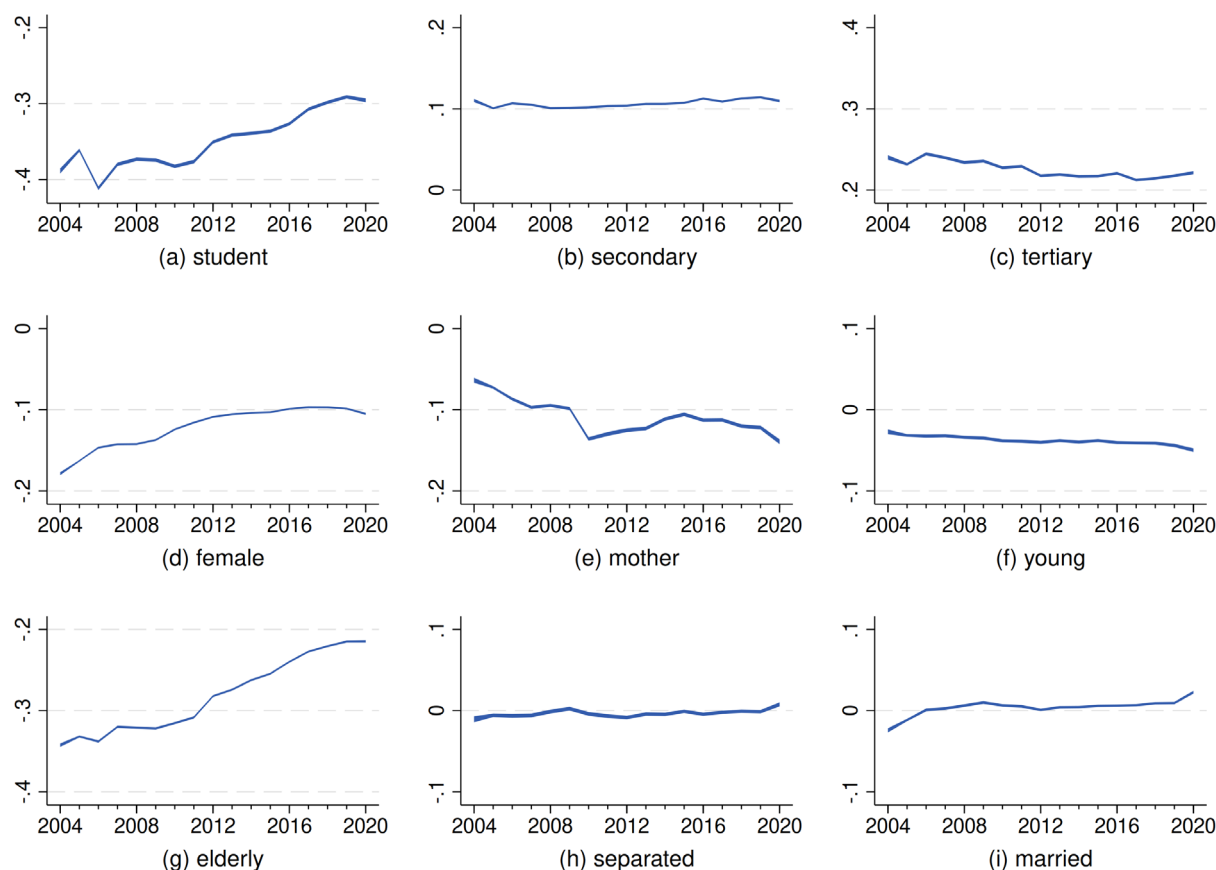
⁽²¹⁰⁾ Logit models are estimated on the panel of EU countries, with individual characteristics presented in Chart 2.13 as explanatory variables. The model also includes country and year dummies.

⁽²¹¹⁾ There are major differences, such as between graduates from general upper secondary education versus vocational education. A summary indicator of 'secondary education' simply shows the average impact of secondary education in relation to primary education.

Chart 2.14

Marginal effects of individual characteristics on participation probability in the EU, by year

Effects of individual characteristics on participation probability among people aged 20-64, 2004-2020, EU-27



Note: Marginal effects (and 95% confidence intervals) calculated on sample mean based on estimated logit models for each year. Model also includes year dummies.

Source: DG EMPL calculations, based on EU-LFS 2004-2020.

[Click here to download chart.](#)

Hungary and Slovakia stand out for their activity rates of mothers with infants. This may be explained by their comparatively generous maternity benefit systems (together with parental leave, these can cover the first three years of a child's life) and the lack of sufficient early childcare provision (0-3 years of age).⁽²¹²⁾ In these countries, the marginal impact is between -34 pp and -44 pp, about twice as large as the next country in the ranking (Bulgaria).

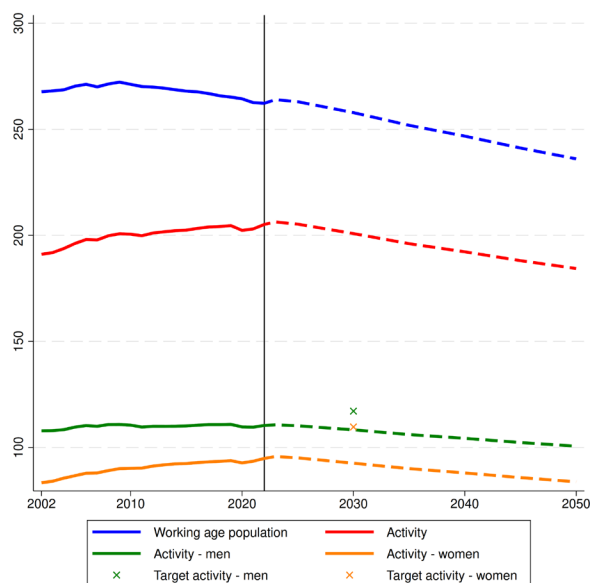
Most of the estimated effects of individual characteristics on labour market participation probability have remained quite stable over time (Chart 2.14). However, the past 20 years have seen students and older people participate more in the labour market. To a lesser extent, the gap between men and women also narrowed, until 2012, when the marginal effect for women stabilised at around -10 pp. Nevertheless, the labour market activity of mothers with infants has deteriorated over the past two decades (in 2020, the estimated marginal effect was close to -14 pp). The impact of other individual characteristics has remained fairly stable, including for those with tertiary education.

It is therefore important to understand which underrepresented population groups have the highest potential to contribute to increasing overall participation in the labour market. The following analysis assumes that the potential to contribute to the aggregate participation rate of a selected population group is determined by the weight of the particular subgroup in the total active population and the difference between the activity rate of this subgroup and the average activity rate of the same subgroup of the three best-performing countries (target activity).⁽²¹³⁾

⁽²¹²⁾ In 2021, parental leave was redefined and counted as 'in employment' for these countries in the EU-LFS, considerably increasing mothers' employment rates.

⁽²¹³⁾ In reality, increasing the participation rate of a subpopulation would likely influence the activity rate of other population groups as well, and cumulating the untapped potential of subgroups would be misleading. See Box 2.7 for the methodology.

Chart 2.15
Working age population and activity in the EU, by gender, 2022-2050



Note: Working-age population defined as the population from 20-64-year-olds in the EU. All other statistics also refer to the 20-64-year-old population.

Source: DG EMPL calculations, based on Eurostat and OECD data, and EUROPOP2023 population projections.

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By 2030, female, older workers and secondary educated people represent the largest untapped potential workforce in the EU. Table 2.6 shows an indicator of the potential to influence the aggregate activity rate and the number of active people for nine selected labour market subgroups: young, prime-age individuals, older people, female, male, mothers, as well as primary, secondary and tertiary-educated people. ⁽²¹⁴⁾ Women have the potential to increase the activity rate by 7.1 pp, adding around 17.3 million more active people by 2030 (Chart 2.15, difference between orange dotted line and target activity rate), primarily because they represent more than half of the population. Men's potential for contribution is considerably more limited (8.8 million). Secondary-educated people contribute 5.4 pp to the aggregate activity rate, representing about 13 million people. Similarly, this potential is mainly driven by the relatively high share of secondary-educated people (51.1%) in the total active population. Older people could also have a high impact on the activity rate in the EU, with a contribution of 4.7 pp, or about 11 million additional active people, due to the relatively large lag in the activity rate of older people in the EU compared to the best-performing countries.

Table 2.6
Female, secondary-educated and older people represent the largest untapped potential workforce in the EU
Potential contribution of various population groups to the aggregate activity rate by 2030

Subgroup	Subgroup-specific activity rate in 2021 (%)	Target subgroup-specific activity rate (%)	Resulting EU activity rate in 2030 if the target is reached (%)	Contribution of the subgroup to the EU activity rate (p.p.)	Resulting number of active people in the EU in 2030	Contribution to the number of active people in the EU in 2030
Young	69.8	84.5	81	3.2	208,751,872	7,431,456
Prime	86.9	93.1	81.6	3.8	210,341,056	9,020,640
Elderly	63	80.9	82.4	4.7	212,499,952	11,179,536
Female	71.9	85.4	84.8	7.1	218,637,600	17,317,184
Male	83.7	90.5	81.5	3.8	210,146,800	8,826,384
Mother	68.2	86.9	78.7	1	202,904,512	1,584,096
Primary	61.3	77.7	81.1	3.4	209,167,840	7,847,424
Secondary	76.7	86.6	83.1	5.4	214,375,600	13,055,184
Tertiary	89.3	93.2	79.2	1.5	204,302,400	2,981,984

Note: Calculation based on a purely hypothetical simulation of how much the overall activity rate would increase by 2030 if the activity rate of any of the listed labour market subgroups was equal to the average of the three highest group-specific activity rates currently observed among the EU-27. Activity rates of the other subgroups are assumed to remain constant. This calculation should not be confused with a realistic activity rate growth, nor is it intended to serve as a forecast or impact assessment.

Source: DG-EMPL calculations, based on Eurostat data and EUROPOP2023 projections.

⁽²¹⁴⁾ The analysis does not include third-country nationals as a separate population group because the EUROPOP2023 projections do not include future gross migration (data are available only for net migration). Section 6. is dedicated to the labour market participation of migrants born outside the EU.

Box 2.7: Estimating the potential contribution of selected population subgroups to the aggregate activity rate

The potential contribution of selected population subgroups to the EU activity rate is estimated in two steps. First, we forecast the future aggregate activity rate in 2030 by assuming that subgroup-specific activity rates remain constant between 2021 and 2030. Therefore, the change in overall activity rate is solely driven by the demographic changes, forecasted by EUROSTAT population projections in the EU (EUROPOP2023). Second, we assume that the overall activity rate is influenced by the increase of the activity rate of a specific subgroup, keeping constant the activity rate of the rest of the population. More specifically, we consider a scenario in which the labour market subgroup activity rate reaches the same level as the average of the three highest activity rates for this specific subgroup currently observed among EU27 countries, according to the Labour Force Survey data for 2021.

Results are presented in Table 2.6. The first two columns of the table present the current subgroup-specific activity rates and the target activity rates, the latter defined as the average activity rate of the three best performing EU countries for the specific subgroup. The third and the fifth columns show the estimated aggregate activity rate and the estimated number of active people in the EU by 2030, assuming that the population will change according to Eurostat's EUROPOP2023 baseline forecast and group-specific activity rates remain constant. The fourth and sixth columns show how the aggregate activity would change in the EU by 2030 if the activity rate of the specific labour market subgroup reached the target.

5. LABOUR SHORTAGES IN A GENDER-SEGREGATED ECONOMY

Gender segregation contributes to persistent labour shortages to the extent that it hampers efficient functioning of the labour market. ⁽²¹⁵⁾

There are two key channels in which labour market efficiency can be impaired. Firstly, the efficiency with which available workers are allocated to jobs that best match their skills and talents can be reduced by discrimination in hiring, pay and promotions, specific aspects of working conditions (such as availability of the flexible working arrangements important for work-life balance) or undervaluation of certain types of jobs (such as care work) and expectations about who works in them. Secondly, gender segregation can affect the current and future supply of certain skills in ways that make suboptimal use of women's and men's talents. Segregation in different fields of education is of paramount importance. It tends to start early in life, when children first encounter gender stereotypes signalling that some subjects are typically male and some typically female, for example in educational materials, or through teacher/parent perceptions. Such stereotypes are not grounded in (or exaggerate) gender differences in early educational outcomes, ⁽²¹⁶⁾ but nevertheless affect children's long-term aspirations and self-confidence, contributing to stereotypical subject choices irrespective of individual ability. For example, girls with similar scientific and mathematical achievements to boys enter STEM studies considerably less often. ⁽²¹⁷⁾ Together, these factors can result in labour markets where many occupations and sectors are dominated by either men or women, with limited efforts to use and/or develop labour supply from the underrepresented gender. This limits the pool of people available to fill new vacancies in times of rising demand, making certain jobs more prone to persistent labour shortages.

The EU labour market is heavily gender segregated across occupations and economic activities. ⁽²¹⁸⁾

In 2021, fewer than one in four occupations were gender balanced, ⁽²¹⁹⁾ accounting for less than one-fifth of the overall EU workforce. Almost 4 in 10 workers in the EU worked in an occupation where one gender accounted for more than 80% of all workers. Aggregate measures of gender segregation ⁽²²⁰⁾ by occupation imply that roughly every second man or woman would need to change occupation (e.g. more men becoming nursing professionals rather than ICT specialists, and vice versa for women) if all occupations were to become perfectly gender balanced. The picture was similar across sectors and subsectors of the EU economy – less than one-third of subsectors were gender balanced in 2021, comprising about one-quarter of the EU workforce.

⁽²¹⁵⁾ (European Commission, 2009), (EIGE, 2018).

⁽²¹⁶⁾ For recent studies discussing gender differences in maths performance, see e.g. (Bertoletti et al., 2023a) and (Bertoletti et al., 2023b).

⁽²¹⁷⁾ See, for example, (EIGE, 2018).

⁽²¹⁸⁾ (EIGE, 2018), (Eurofound and Joint Research Centre, 2021), (Mariscal-De-Gante et al., 2023). Gender segregation by occupation is a fairly widespread problem that also occurs frequently in non-EU countries, as shown in a recent study by the World Bank (Das and Kotikula, 2019).

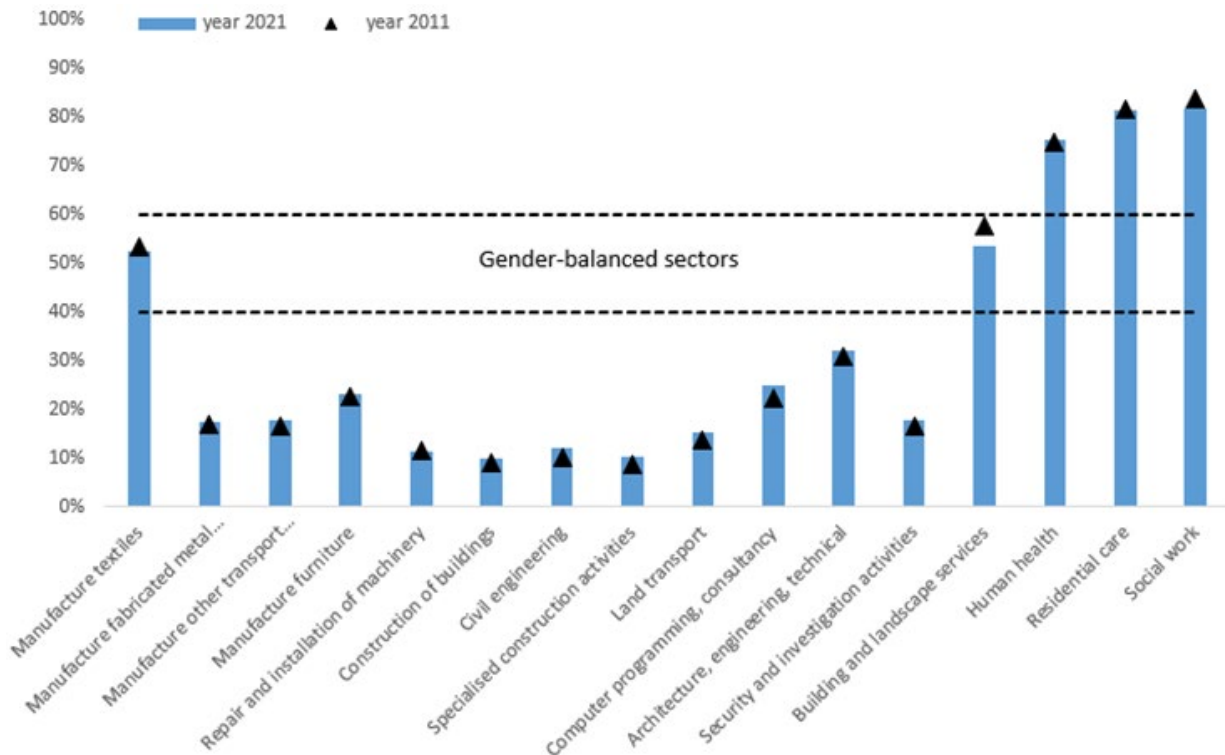
⁽²¹⁹⁾ Occupations with 40-60% of each gender are considered gender-balanced. Occupations are taken at ISCO-08 3-digit level. The analysis is based on all Member States where occupational statistics at this level are available, i.e. excluding Bulgaria, Malta and Slovenia.

⁽²²⁰⁾ Gender segregation is captured by the Duncan dissimilarity index (see (Eurofound and Joint Research Centre, 2021)).

Chart 2.16

Low shares of women in shortage sectors

Proportion of women in shortage sectors (% of all workers in a given sector), 2021, EU-27



Source: EU-LFS 2021.

[Click here to download chart.](#)

Historically, increases in women's activity rates have led to increases in their employment rates, but without substantially changing existing patterns of gender segregation in the EU labour market.

Around 82% of the increase in the employment of women since 2011 happened along existing patterns of gender segregation, i.e. without changing the 2011 shares of women in different occupations. The last two decades have seen little change in existing aggregate measures of gender segregation across occupations. ⁽²²¹⁾

5.1.1. Gender segregation in sectors and occupations with labour shortages

In the EU, persistent labour shortages are more common in economic activities with low shares of women workers. Most of the sectoral labour shortages common across the Member States (see section 2.1.) are in male-dominated activities, including: computer programming, consultancy and related activities; civil engineering; land transport; several construction and manufacturing activities; repair and installation of machinery and equipment; and security and investigation (Chart 2.16). Women account for most workers in three shortage sectors: health, residential care and social work. In 2021, only 2 out of 16 shortage sectors were gender balanced (manufacture of textiles, and building and landscape services).

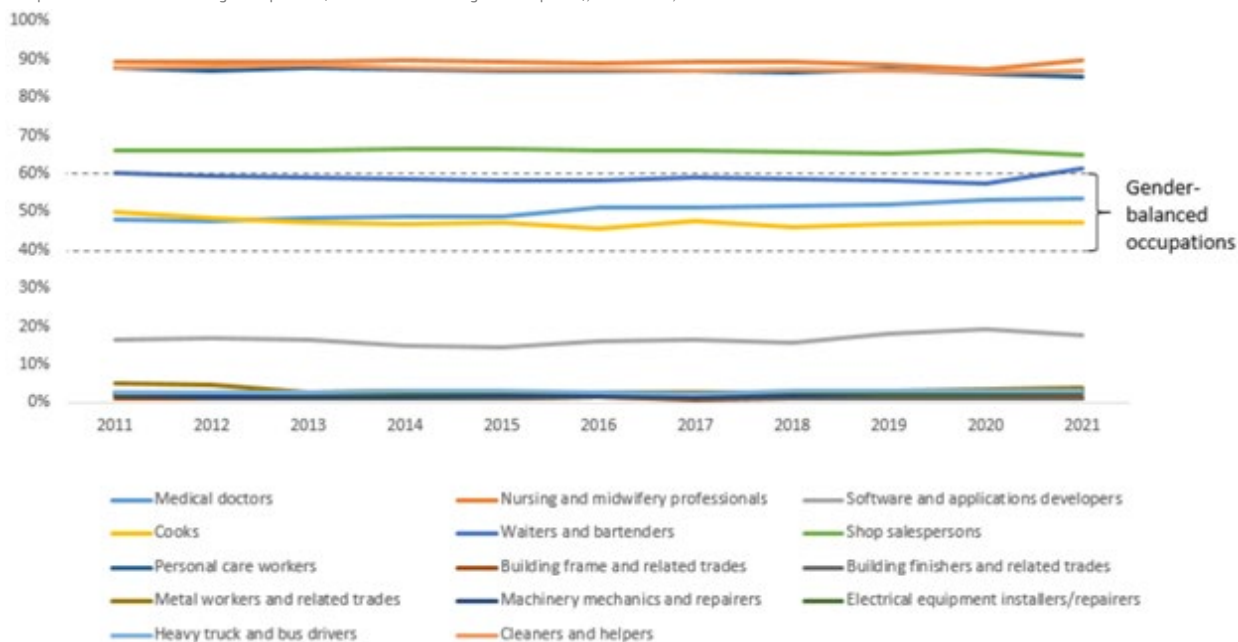
Around half of all occupations showing persistent labour shortages across the Member States are male-dominated (Chart 2.17). Shortage occupations where men accounted for more than 80% of workers in 2021 included several STEM occupations (civil engineers, highly skilled ICT occupations), several specialist construction occupations, machinery mechanics and repairers, electrical equipment installers and repairers, and heavy truck and lorry drivers.

⁽²²¹⁾ (Eurofound and Joint Research Centre, 2021).

Chart 2.17

Most shortage occupations are segregated by gender

Proportion of women in shortage occupations (% of all workers in a given occupation), 2011-2021, EU



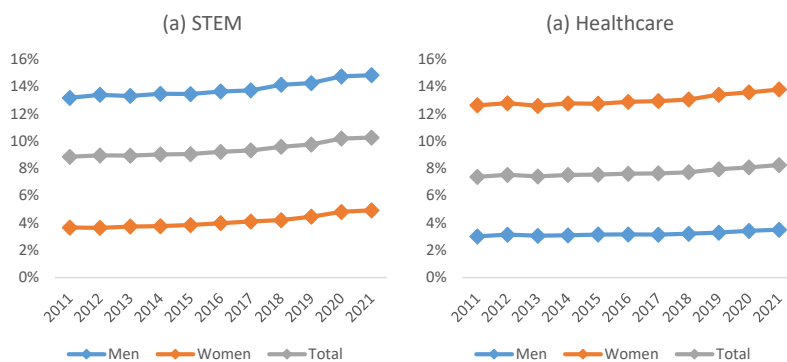
Note: Analysis based on all Member States where occupational statistics are available at ISCO-08 3-digit level, i.e. excluding Bulgaria, Malta and Slovenia.
 Source: EU-LFS 2011-2021.
[Click here to download chart.](#)

Conversely, three occupations characterised by persistent labour shortages are jobs in which women account for more than four-fifths of workers. These are nursing and midwifery professionals, personal care workers, and domestic and office cleaners. Gender representation is approximately balanced in only two of the shortage occupations – medical doctors and cooks. For doctors, recent evidence points towards segregation by specialty (e.g. in paediatrics or surgery) in high-income countries. ⁽²²²⁾

Chart 2.18

Persistent gender segregation in STEM and healthcare occupations

Proportion of workers in STEM and healthcare occupations, by gender, EU



Note: Analysis based on all Member States where occupational statistics are available at ISCO-08 2-digit level, i.e. excluding Malta.
 Source: EU-LFS 2011-2021.
[Click here to download chart.](#)

Gender segregation in occupations facing persistent labour shortages has not changed over time (Chart 2.17).

Where either women or men accounted for more than 80% of all workers in an occupation in 2011, this was also the case in 2021, with little or no change in the gender composition of the relevant workforce. This implies that in the absence of measures to tackle gender segregation, increases in women’s labour market participation will address labour shortages only in occupations where women already account for substantial shares of all workers.

5.1.2. Gender segregation in skilled STEM and healthcare occupations facing shortages

Reducing gender segregation in skilled occupations characterised by persistent labour shortages offers a significant opportunity to attract additional talent. In order for this to happen, the key factors contributing to underrepresentation of either men or women in these occupations must be addressed. This section focuses on factors that lead to segregation in two broader occupational groups known to contain skilled occupations facing shortages: STEM and healthcare. Not only are these two groups already facing labour

⁽²²²⁾ (Pelley and Carnes, 2020), (World Health Organisation, 2019).

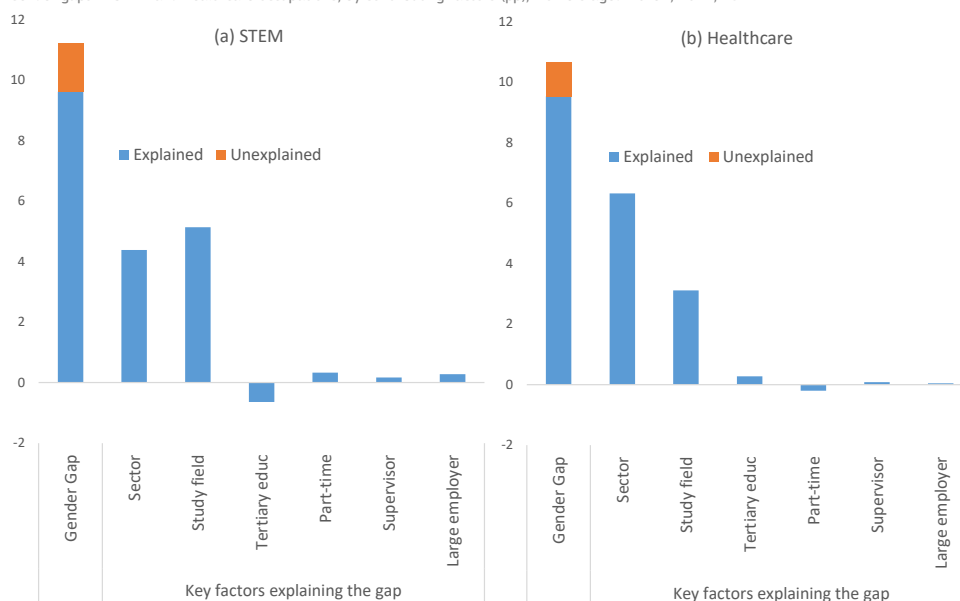
shortages, they are also projected to see employment demand expand substantially in the coming years (see section 2.1.), making efforts to attract additional talent ever-more pressing.

STEM and healthcare occupations remain gender segregated despite persistent labour shortages. At EU level, in 2021, around 15% of all male workers were employed in STEM occupations, compared to about 5% of all female workers, leading to a gender STEM gap of about 10 pp (Chart 2.18). A similar gender gap can be observed in healthcare occupations, in this case with women as the overrepresented gender – around 14% of all female workers were employed in healthcare occupations in 2021, compared to about 3% of all male workers. While the overall share of employment in STEM and healthcare occupations grew slightly since 2011, the gender gap remained broadly the same in both occupational groups.

Chart 2.19

Gender gaps in STEM and healthcare are explained by gender differences in fields of education and economic activity

Gender gaps in STEM and healthcare occupations, by contributing factors (pp), workers aged 20-64, 2021, EU



Note: Analysis based on all Member States where occupational statistics are available at ISCO-08 2-digit level, i.e. excluding Malta. The available data distinguish education by study field and ISCED level, but do not distinguish between types of education (e.g. post-secondary vocational vs university tertiary education).

Source: EU-LFS 2021.

[Click here to download chart.](#)

gender stereotypes contribute to gender segregation in both STEM and healthcare from early in life. For example, stereotypes in teachers' perceptions or depictions of engineers or nurses in school textbooks help to shape children's future work aspirations.⁽²²⁶⁾ Other factors are more specific to the area. For example, the underrepresentation of women in STEM is linked to the gender divide in advanced digital skills, masculine organisational cultures in some workplaces, and a lack of work-life balance options and role models in certain STEM fields.⁽²²⁷⁾ In healthcare, women particularly dominate occupations that can be linked to their expected roles as unpaid caregivers in society,⁽²²⁸⁾ such as nurses or personal care workers. Given this link to unpaid care, these occupations are often undervalued in status, working conditions and salary. By contrast, some well-paid, high-status healthcare professions associated with technical skills, such as surgery, tend to be performed primarily by men.⁽²²⁹⁾

Differences in study fields of qualifications⁽²³⁰⁾ held by women and men explain large shares of gender gaps in STEM and, to a lesser extent, healthcare occupations (Chart 2.19).⁽²³¹⁾ They account for

⁽²²³⁾ (McNally, 2020), (EIGE, 2020a), (European Parliament, 2015).

⁽²²⁴⁾ Eurostat educ_uoe_grad02.

⁽²²⁵⁾ (European Commission, 2022d).

⁽²²⁶⁾ See, for example, (Thebaud and Charles, 2018) for a detailed discussion of how stereotypes contribute to segregation of STEM work.

⁽²²⁷⁾ (EIGE, 2020b).

⁽²²⁸⁾ (Shannon et al., 2019), (World Health Organisation, 2019).

⁽²²⁹⁾ (EIGE, 2018), (World Health Organisation, 2019).

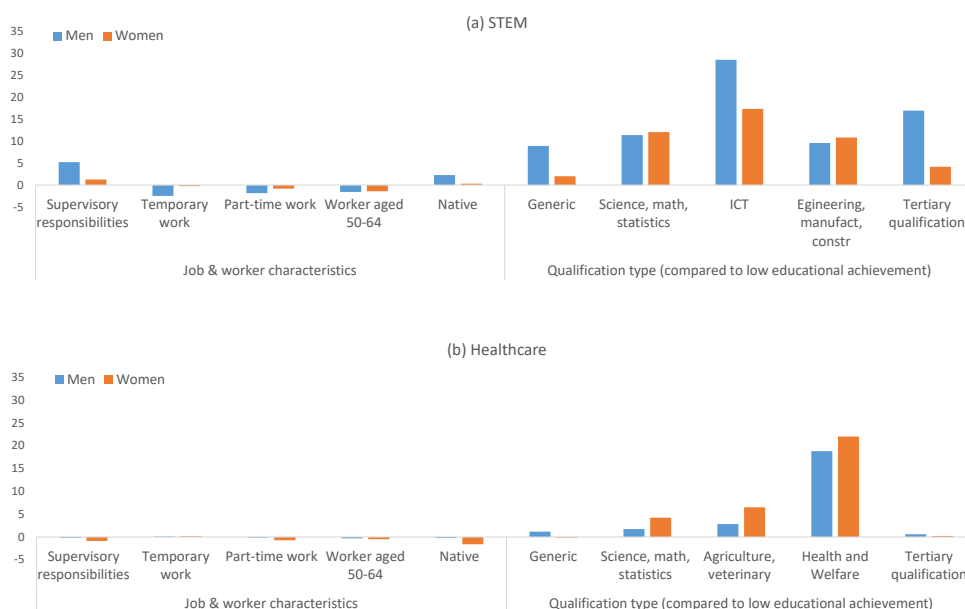
⁽²⁴⁸⁾ Analysis controls for the following broad fields of education in respect of (at least) secondary qualifications: generic programmes and qualifications; education; arts and humanities; social sciences, journalism and information; business, administration and law; natural sciences, mathematics and statistics; ICT; engineering, manufacturing and construction; agriculture, forestry, fisheries and veterinary; health and welfare; services.

Several factors contribute to persistent gender segregation in STEM and healthcare work. Gender segregation in relevant educational fields is crucial.⁽²²³⁾ Women account for about one in four tertiary education graduates in engineering, manufacturing and construction, and one in five graduates in ICT,⁽²²⁴⁾ but more than two-thirds of tertiary education graduates in health. Similar patterns can be observed in VET.⁽²²⁵⁾ Various

almost half of the underrepresentation of women in STEM and about one-third of underrepresentation of men in healthcare at EU level, with considerable variation across Member States.⁽²³²⁾ This reflects the high skill and knowledge intensity of STEM and healthcare work. In 2021, almost two-thirds of workers in STEM occupations held tertiary qualifications, with men holding most of the qualifications directly relevant to STEM work. For example, around 10% of all male workers in the EU achieved a tertiary qualification in engineering, manufacturing and construction, while a further 3% held an ICT qualification. Corresponding proportions for female workers were much lower, at 3% and 1%, respectively. Similar but less pronounced patterns applied to healthcare workers in 2021 – about half were tertiary educated, with women holding the majority of healthcare-related qualifications.

The fact that women and men tend to work in different sectors accounts for much of the remaining gender gap in STEM and healthcare occupations. The drivers of gender segregation outlined at the beginning of this section often operate at sectoral, as well as occupational, level. This includes broader gender norms and stereotypes around work in certain sectors,⁽²³³⁾ sectoral differences in remuneration,⁽²³⁴⁾ and sector-specific aspects of working conditions (e.g. option to combine work with unpaid childcare) or work culture.⁽²³⁵⁾ For example, gender segregation in healthcare occupations tends to be far more pronounced in the female-dominated healthcare sector (8 out of 10 workers in healthcare occupations in the EU are women) than in the more gender-balanced professional, scientific and technical activities (where healthcare occupations employ roughly as many men as women).

Chart 2.20
Higher probability of working in STEM or healthcare for women and men with relevant qualifications
 Predicted changes in probability of working in healthcare and STEM occupations, by selected worker and job characteristics (pp), workers aged 20-64, 2021, EU



Note: Analysis based on all Member States where occupational statistics are available at ISCO-08 2-digit level, i.e. excluding Malta. Data distinguish education by study field and ISCED level, but do not distinguish between types of education (e.g. post-secondary vocational vs university tertiary education).

Source: EU-LFS 2021.

[Click here to download chart.](#)

Holding relevant qualifications increases the likelihood of working in STEM or healthcare occupations for both women and men, but this effect tends to be stronger for the dominant gender (Chart 2.20). For men, holding an ICT qualification increases the chance of working in STEM occupations by almost 30 pp,⁽²³⁶⁾ compared to less than 20 pp for women.⁽²³⁷⁾ A similar, albeit weaker, pattern can be observed for healthcare qualifications, which

increase a woman’s chances of working in a healthcare occupation by 22 pp, compared to 19 pp for men.

⁽²³¹⁾ For details on analytical methodology, see (European Commission, 2023i). The results of this analysis need to be read with caution, as considerable data limitations affect the robustness of analysis. The data do not directly capture a number of factors identified as important contributors to occupational gender segregation, such as certain important working conditions (e.g. pay), unpaid childcare obligations, or certain gender norms and stereotypes.

⁽²³²⁾ For details on variation by Member State, see (European Commission, 2023i).

⁽²³³⁾ See, for example, (Thebaud and Charles, 2018) for a detailed discussion of role of stereotypes in STEM sectors.

⁽²³⁴⁾ For example, declining wages in the health sector have been associated with the increasing proportion of women in this sector in high-income countries (Shannon et al., 2019). There also appears to be a sizeable gender pay gap in the health sector, indicating that men tend to enter in better paid positions (Boniol et al., 2019), (EIGE, 2018).

⁽²³⁵⁾ (EIGE, 2020a).

⁽²³⁶⁾ Compared to workers with lower educational achievement (ISCED 0-2).

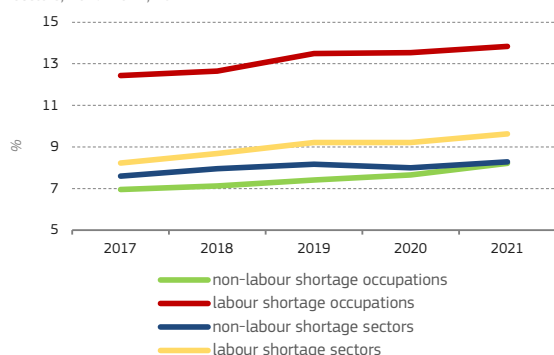
⁽²³⁷⁾ This corroborates existing evidence showing that achieving a tertiary qualification in a STEM-related field improves men’s chances of working in that field more than women (EIGE, 2018).

For men, the probability of working in STEM occupations also increases with achieving at least a secondary generic ⁽²³⁸⁾ qualification and with the level of achieved qualification (regardless of field). Men holding at least an upper secondary generic qualification are almost 9 pp more likely to work in STEM occupations than those who did not complete upper secondary education, and the probability increase is even sharper for those holding any tertiary qualification (by about 17 pp). For women, the corresponding increases are far smaller, at less than 5 pp.

6. MIGRANT EMPLOYMENT IN OCCUPATIONS WITH LABOUR SHORTAGES

In the light of the ageing EU population and increasing labour shortages, improved participation of migrants in the labour market would strengthen their potential contribution to sustaining economic performance (see section 4.). Previous sections have discussed additional reskilling and upskilling needs, in particular related to the green and digital transitions, and the potential of increasing participation of other underrepresented groups to mitigate labour shortages, and this section considers the possible contribution of migrants in that context. More specifically, it analyses their occupational distribution and the main obstacles that could explain their lower labour market participation rates. Here, migrants are defined as people born outside the EU but residing in the EU, while people born in the country of residence are termed the native population. ⁽²³⁹⁾

Chart 2.21
Higher share of migrants in labour shortage occupations and sectors
Share of migrants within labour shortage and non-labour shortage occupations and sectors, 2017-2021, EU



Note: Migrant and native workers identified based on country of birth. Analysis limited to population aged 20-64. Excludes data on Bulgaria, Hungary, Malta, Poland and Slovenia, as the EU-LFS files do not provide country of birth for people born outside Europe.

Source: EU-LFS 2017-2021.

[Click here to download chart.](#)

In 2021, the share of migrants was higher in occupations characterised by persistent labour shortages in the EU. That share stood at 13.8%, compared to 8.2% in non-labour shortage occupations (Chart 2.21). There was strong heterogeneity in migrant share across labour shortage occupations, ranging from <10% for nursing and midwifery professionals, electrical equipment installers and repairers, machinery mechanics and repairers, and shop salespersons, to over 20% for cooks and domestic, hotel and office cleaners. Between 2017 and 2021, ⁽²⁴⁰⁾ the share of migrants increased almost equally in both labour shortage and non-labour shortage occupations, by 1.4 pp and 1.3 pp, respectively. In labour shortage occupations, the strongest increase in migrant share was observed for software and applications developers and analysts (+3.9 pp), followed by building finishers and related trade workers (+3 pp) and personal care workers in health services (+2.9 pp).

In 2021, sectors facing persistent labour shortages had a higher share of migrants compared to non-labour shortage sectors in the EU. Those shares were 9.6% and 8.3%, respectively (Chart 2.21). This difference was less pronounced than the gap in migrant share between labour shortage and non-labour shortage occupations, at 1.3 pp and 5.6 pp, respectively. In labour shortage sectors, the highest shares of migrants were in services to buildings and landscape activities (22.4%), residential care activities (12.4%), specialised construction activities (10.7%), and computer programming, consultancy and related activities (10.6%), with shares below 7% in repair and installation of machinery and equipment, human health activities, architectural and engineering activities, manufacture of other transport

⁽²³⁸⁾ This includes basic programmes and qualifications, literacy and numeracy, personal skills and development, and other generic programmes and qualifications not further defined.

⁽²³⁹⁾ EU-LFS does not include information on nationality and its change over time. This makes it impossible to use the definition for third-country nationals and EU citizens with migration background suggested in the European Commission Action Plan on Integration and Inclusion 2021-2027, which defines EU citizens with a migration background as nationals of EU Member States who had a third-country nationality and became EU citizens through naturalisation in one of the EU Member States, as well as EU citizens who have a third-country migrant background through their foreign-born parents (European Commission, 2020b). Given the data limitations, this section defines migrant and native workers based solely on their country of birth, without taking account of background. This leads to a much higher number of migrants than using the concept of nationality (around 25.6 million people born outside the EU, compared to 16.8 million third-country nationals in 2021). The analysis does not account for the possible persistence of intergenerational inequalities linked to migration for the native-born children of migrants (OECD, 2018). In addition, it only focuses on migrants residing in the EU and does not consider outsourcing to non-EU countries (which might have a significant impact for teleworkable jobs, such as call centres or ICT assistance), or offshoring to non-EU countries (which might be particularly relevant for manufacturing). This section does not cover intra-EU mobile workers, as their occupational mobility is extensively analysed in the European Commission Annual Report on Intra-EU Labour Mobility 2022 (European Commission, 2023a). That report showed a limited impact for intra-EU mobile workers in mitigating labour shortages in the short-term.

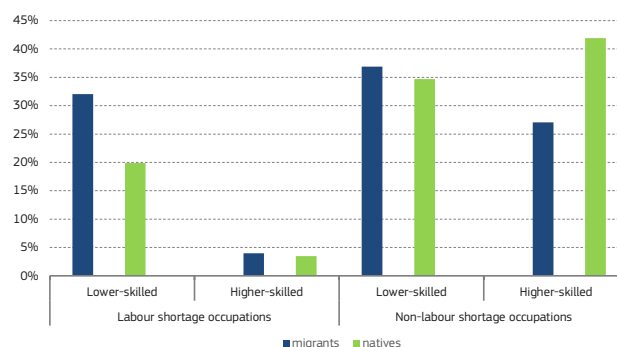
⁽²⁴⁰⁾ Comparison to earlier years is not possible – there is a break in time series for migrants as Germany's EU-LFS data do not report country of birth for people born outside the country of residence before 2017.

equipment, and manufacture of furniture. Between 2017 and 2021, the share of migrants increased more strongly in labour shortage sectors (1.4 pp) than non-labour shortage sectors (0.7 pp). The highest increases were observed in services to buildings and landscape activities (2.9 pp), computer programming, consultancy and related activities (2.8 pp), and residential care activities (2.5 pp).

Among occupations characterised by persistent labour shortages, the majority of migrants were concentrated in lower-skilled occupations in 2021 (Chart 2.22).⁽²⁴¹⁾ At 88.9%, this was significantly higher than their corresponding share within non-labour shortage occupations, at 57.7%.

Overall, migrants were distributed quite equally between lower-skilled labour shortage occupations, lower-skilled non-labour shortage occupations, and higher-skilled occupations (around one-third in each), while native workers were more concentrated in higher-skilled non-labour shortage occupations (41.9%) and lower-skilled non-labour shortage occupations (34.7%). Around 1 in 10 migrants indicated that their current job requires lower skills than the last job they held before migrating, particularly for higher-educated migrants (14.5%), pointing to possible overqualification. However, around half did not have any work experience before migrating and likely accepted jobs that were less popular among native workers, potentially easing their entry into the labour market.

Chart 2.22
Migrants are concentrated in lower-skilled occupations
Segregation of migrant and native workers across occupations, by skill level, 2021, EU



Note: Migrant and native workers identified based on country of birth. Analysis limited to population aged 20-64. Excludes Bulgaria, Hungary, Malta, Poland and Slovenia, whose EU-LFS data do not provide country of birth for people born outside Europe.

Source: EU-LFS 2021.

[Click here to download chart.](#)

Strong growth in the share of migrants was observed in higher-skilled occupations facing persistent labour shortages in the EU between 2017 and 2021. That share increased by 2.4 pp, compared to average increases of 1.4 pp in other occupations. For labour shortage occupations, the gap between the share of migrants in occupations with lower and higher skill levels decreased from 4.5 pp in 2017 to 3.5 pp in 2021, but remained stable for non-labour shortage occupations.

EU countries reporting shortages in occupations identified as experiencing persistent labour shortages tend to have a lower share of migrants working in those occupations.⁽²⁴²⁾ In those countries, the share of migrants was 13.5% in 2021-2022, compared to 14.3% in countries not reporting labour shortages in shortage occupations.⁽²⁴³⁾⁽²⁴⁴⁾ However, there were significant differences across labour shortage occupations.⁽²⁴⁵⁾ For example, the share of migrants among building frame workers, and waiters and bartenders was more than 7 pp higher in countries with no labour shortages. For other occupations, such as machinery mechanics and repairers, sheet and structural metal workers, drivers, and personal care workers, the opposite was true, with the share of migrants higher in countries facing labour shortages.⁽²⁴⁶⁾ This points to a positive contribution of migrants in alleviating labour shortages in certain occupations.

⁽²⁴¹⁾ Skill levels '1, 2 and 4' and '2' were grouped as lower-skilled; skill levels '3', '3 and 4' and '4' were grouped as higher-skilled. All labour shortage occupations had a corresponding skill level of either '2' or '4'.

⁽²⁴²⁾ Reported shortages by country taken from the 2022 EURES report on labour shortages and surpluses, primarily referring to the period between Q3 2021 and Q2 2022, depending on the country (ELA, 2023).

⁽²⁴³⁾ Part of this result could be driven by other country-specific factors, such as overall tightness of the labour market. For example, following the same methodology and based on (ELA, 2023), the migrant share in occupations facing persistent labour shortages was 4.4 pp higher in EU countries that did not report labour shortages in those occupations in 2020-2021 (compared to 0.8 pp in 2021-2022). This suggests that in recent years, persistent labour shortages in some occupations have (re-)emerged in some countries not previously facing labour shortages in occupations characterised by persistent labour shortages.

⁽²⁴⁴⁾ This result is in line with the 2022 EURES report on labour shortages and surpluses (ELA, 2023), which shows that in 2021, the share of people born outside the EU-27 and working in most widespread shortage occupations (11%) was higher than the share of those people in all occupations (8%).

⁽²⁴⁵⁾ Most of the countries reported severe labour shortages in the labour shortage sectors (at NACE 2-digit level) in 2021 (based on BCS and definition of severe labour shortages described in section 2.1.).

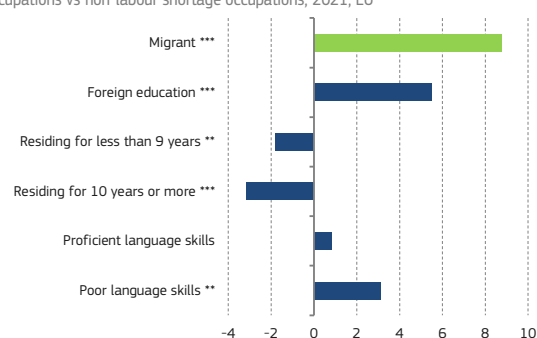
⁽²⁴⁶⁾ This may be related to the differences in regulation of those professions across countries (see Regulated Professions Database here).

In addition to migrant status, completing the highest level of education abroad or possessing poor language skills⁽²⁴⁷⁾ increase the likelihood of employment in occupations with persistent labour shortages. Here, being a migrant contributes +8.7 pp, while achieving the highest level of education abroad increases the likelihood by 5.5 pp, and low language skills by 3.1 pp (Chart 2.23).⁽²⁴⁸⁾ The two latter factors may point to lower hiring requirements and indicate a lower skills demand in labour shortage occupations (see section 2.1.). The analysis shows that people residing in a country for a longer period are less likely to work in occupations characterised by persistent labour shortages than those who arrived more recently. This might indicate that integration prompts people to move to occupations that require higher skills and offer better pay or working conditions (see section 7.). Also, the higher concentration of migrants in lower-skilled occupations does not fully explain their higher probability of being employed in labour shortage occupations. After the skill level of the occupation is taken into account, the probability of migrants to be employed in labour shortage occupations decreases (to 5.5 pp), but remains significant and sizeable, confirming their role in mitigating labour shortages (Figure A.2).

Chart 2.23

Migrants are more likely to be employed in occupations with persistent labour shortages

Factors connected to the probability of being employed in labour shortage occupations vs non-labour shortage occupations, 2021, EU



Note: Regression on full sample (migrants, natives, EU-mobile workers, identified based on country of birth). Analysis limited to population aged 20–64. Excludes Bulgaria, Hungary, Malta, Poland and Slovenia, whose EU-LFS data do not provide country of birth for people born outside Europe. Chart shows a selection of key variables of interest where the deviation from zero shows the difference with respect to the reference group in parenthesis: migrant (people born in the country of residence), foreign education indicates highest level of education achieved abroad (highest level of education achieved in country of residence), residing for less than nine years or residing for 10 years or more (born in the country of residence), proficient language skills comprising advanced and intermediate language skills or poor language skills comprising basic, hardly any, and no language skills (mother tongue). *** significant at 1%, ** significant at 5%, * significant at 10%, no * = not significant. For full set of results, see Figure A.1.

Source: EU-LFS 2021.

[Click here to download chart.](#)

Some untapped potential may remain in the current available pool of migrants. In 2021, the share of employed migrants (63.1%) was significantly lower than that of the native population (74.0%). This difference was more pronounced for women (53.9% of migrant women in employment, compared to 69.4% of native women). This may be linked to the fact that 58.7% of migrant women left their country for family reasons, compared to only 17.2% leaving for employment. Migrant women not in employment indicated care responsibilities as the most common reason for not searching for work. By contrast, family and employment were of about equal importance for men, each reported by around one-third of male migrants.⁽²⁴⁹⁾ This suggests that a better care offer might increase the labour market participation of migrant women.

More than one-quarter of migrants reported facing obstacles to finding a suitable job in 2021. Host country language skills (24%), recognition of formal qualification obtained abroad (16%), and absence of suitable jobs (15%) were the most frequently cited obstacles. Indeed, 37.4% of migrants reported having little or no host country language skills before migrating, and also showed the highest share of participation in a language course (61.5%). More than one-fifth of migrants reported that their formal qualification obtained abroad was not recognised, they were unaware of the job possibilities or application procedures, or it was too costly, complex or not possible to apply. Only around one-third of migrants found their first job in the host country within the first three months, with slightly more than half finding work within the first year. Over one-tenth of migrants reported that it took longer than four years to find a job, or they did not manage to find a job at all, increasing the risk of long-term unemployment and depreciation of skills.

⁽²⁴⁷⁾ Following the methodology in the EU-LFS 2021 ad hoc module on the labour market situation of migrants and their immediate descendants, analysis on language skills here focuses on the main host country language. For multilingual countries, the main host country language is the official language of the region where the respondent lives.

⁽²⁴⁸⁾ When controlling for degree of urbanisation, level of education, gender, length of residence in a country, age, temporary work, part-time work, size of the firm, country where highest level of education was achieved, and current language skills in the main host country language.

⁽²⁴⁹⁾ Studies show that migrating for family-related reasons is associated with poorer labour market outcomes than moving for employment or other reasons ((Gillespie, Mulder and Thomas, 2021), (Kanas and Steinmetz, 2021), (Lens, Marx and Vujic, 2018)).

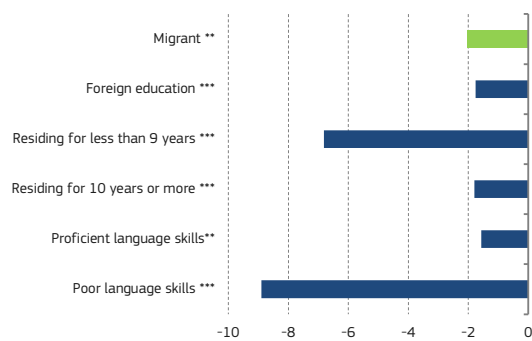
Having little or no skills in the main host country language reduces the likelihood of employment

(Chart 2.24). That reduction is significant, at 8.9 pp. A recent study shows that the positive effect of better language skills is equally important across very different types of occupations, including low-skilled and medium-skilled jobs and occupations where immigrants are overrepresented. ⁽²⁵⁰⁾ Having achieved the highest level of education abroad decreases the probability of being employed by 1.8 pp, indicating some potential difficulties in recognising and fully utilising foreign qualifications. ⁽²⁵¹⁾ The negative impact on the likelihood of employment decreases the longer a person resides in a country, but does not fully disappear, even after living there for 10 or more years. However, even when controlling for workers' characteristics, ⁽²⁵²⁾ people born in a non-EU country have a lower probability of being employed than native workers (by 2.0 pp). A separate analysis limited only to migrants shows that migrating for employment reasons increases the probability of employment by 14.5 pp (Figure A.4). These results confirm the obstacles highlighted by migrants and imply unused potential among current migrants to mitigate labour shortages.

Chart 2.24

Migrants are less likely to be employed

Factors connected to the probability of being employed vs being not employed, 2021, EU



Note: Regression on full sample (migrants, natives, EU-mobile workers, identified based on country of birth). Analysis limited to population aged 20-64. Excludes Bulgaria, Hungary, Malta, Poland and Slovenia, whose EU-LFS data do not provide country of birth for people born outside Europe. Figure presents a selection of key variables of interest where the deviation from zero shows the difference with respect to the reference group in parenthesis: migrant (people born in the country of residence), foreign education indicates highest level of education achieved abroad (highest level of education achieved in country of residence), residing for less than nine years or residing for 10 years or more (born in the country of residence), proficient language skills comprising advanced and intermediate language skills or poor language skills comprising basic, hardly any, and no language skills (mother tongue). *** significant at 1%, ** significant at 5%, * significant at 10%, no * = not significant. For full set of results, see Figure A.3.

Source: EU-LFS 2021.

[Click here to download chart.](#)

When in employment, migrants more often report experiencing discrimination. In 2021, the reported discrimination rate was 8.6% among migrants (5.4% for native workers), with most (65.2%) indicating their foreign origin as the most common reason. By contrast, native workers believed that the discrimination they perceived stemmed from gender (20.5%) or grounds other than age, disability or foreign origin (64.2%). Many studies show that higher-educated migrants are more likely than lower-educated migrants to report feeling discriminated against, with higher perceptions of discrimination associated with higher perceptions of being overqualified for their job. ⁽²⁵³⁾ Finally, anti-immigration attitudes have a negative and significant impact on migration inflows to the EU, which might hinder governments' efforts to attract migrants with the required skills. ⁽²⁵⁴⁾

Migrants more frequently work in non-standard forms of employment. ⁽²⁵⁵⁾ In 2021, one in five migrants was employed on a temporary contract, compared to around one in eight native workers. More migrants were employed on a contract with a temporary employment agency (4.7%, compared to 2.5% native workers). Migrants worked part-time more often (23.9%, compared to 18.2% native workers), a difference that was even more pronounced in labour shortage occupations, with around 10 pp more migrants in part-time jobs. This could indicate a missed opportunity in not increasing the working hours of migrants to mitigate labour shortages, particularly as 45.1% of migrants working part-time reported their willingness to work more hours (10.5 pp more than native workers).

⁽²⁵⁰⁾ (Carlsson, Eriksson and Rooth, 2023).

⁽²⁵¹⁾ Overall, receiving some part of their education abroad (i.e. through Erasmus or other exchange programmes) might be linked to higher employability and earnings' potential (Kratz and Netz, 2018), (Wiers-Jenssen, Tillman and Matherly, 2020)). However, this analysis considers the country where the highest level of education was successfully completed rather than international education experience more generally. While the findings suggest that completing the highest level of education abroad is likely to lower the probability of being employed, the results might be more diverse when considering the impact on earnings, which is outside the scope of this analysis (Wiers-Jenssen and Try, 2005).

⁽²⁵²⁾ Characteristics considered: degree of urbanisation, level of education, gender, length of residence in the country, age, country where the highest level of education was achieved, and current language skills in the main host country language.

⁽²⁵³⁾ (OECD, 2018), (Schaeffer, 2019), (Steinmann, 2019), (Migration Policy Group, 2022).

⁽²⁵⁴⁾ (Di Iasio and Wahba, 2023) show that a 10% increase in negative attitudes reduces migration inflows by 0.4%. However, this effect is smaller than for other economic factors, such as income and unemployment.

⁽²⁵⁵⁾ Defined as having a temporary job, or a contract with a temporary employment agency, or working part-time.

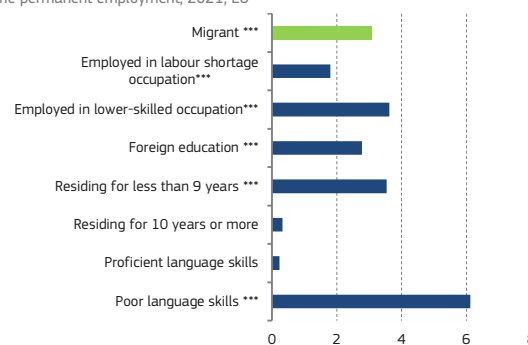
Migrants are more likely to have non-standard work arrangements (+3.1 pp) even when accounting for personal factors and employment in lower-skilled occupations or those characterised by persistent labour shortages (Chart 2.25).⁽²⁵⁶⁾ This could be linked to social stigma or other characteristics not captured by the model, making it more difficult for migrants to find full-time permanent employment. This might increase their risk of detachment from the labour market and reduce their potential to contribute to alleviating labour shortages.

Further policies might be needed to strengthen the potential of migrants already residing in the EU to fill future labour shortages (see section 2.2.). Around 47.2% of migrants work in jobs that are likely to experience strong future shortages, compared to 37.6% of natives.⁽²⁵⁷⁾ However, among those occupations, migrants are primarily concentrated in elementary occupations (38.6% of migrants, compared to 16.2% of native workers) and are strongly underrepresented in high-skilled non-manual occupations (23.4% of migrants, compared to 48.1% of native workers). Complementary to policies targeted at increasing participation rates of other population groups underrepresented in the labour market, such as women, policies addressing the inefficient use of skills of migrants already residing in the EU (due to difficulties in recognising their qualifications or overqualification related to discrimination) and insufficient investment in their upskilling and reskilling (including language skills) could help to reduce future labour shortages, especially in higher-skilled occupations.

Chart 2.25

Migrants are more likely to work in non-standard forms of employment

Factors connected to the probability of non-standard forms of employment vs full-time permanent employment, 2021, EU



Note: Regression on full sample (migrants, natives, EU-mobile workers, identified based on country of birth). Analysis limited to population aged 20-64. Excludes Bulgaria, Hungary, Malta, Poland and Slovenia, whose EU-LFS data do not provide country of birth for people born outside Europe. Chart presents a selection of key variables of interest where the deviation from zero shows the difference with respect to the reference group in parenthesis: migrant (people born in the country of residence), employed in labour shortage occupation (employed in non-labour shortage occupation), employed in lower-skilled occupation (employed in higher-skilled occupation), foreign education indicates highest level of education achieved abroad (highest level of education achieved in country of residence), residing for less than nine years or residing for 10 years or more (born in the country of residence), proficient language skills comprising advanced and intermediate language skills or poor language skills comprising basic, hardly any, and no language skills (mother tongue). *** significant at 1%, ** significant at 5%, * significant at 10%, no * = not significant. For full set of results, see Figure A.5.

Source: EU-LFS 2021.

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7. EMPLOYMENT AND WORKING CONDITIONS IN SECTORS AND OCCUPATIONS WITH PERSISTENT LABOUR SHORTAGES

Improved working conditions and quality jobs (Box 2.8) are potential drivers of increased labour force participation but also depend on productivity gains.⁽²⁵⁸⁾ Employment and working conditions potentially affect the prevalence and extent of labour shortages in certain sectors and occupations, particularly when relevant skillsets and experience are not lacking within the available workforce (see section 3.). More specifically, job quality, employment conditions, and earnings can be relevant supply-side factors in attracting labour to sectors and occupations with persistent labour shortages.⁽²⁵⁹⁾ Training opportunities can also increase the overall attractiveness of work environments and workers' potential to grow earnings (see Chapter 3, section 3.3.), as well as improving worker retention and preventing skills mismatches through upskilling and reskilling. Variations in employment and working conditions can be the outcome of multiple factors. Differences across sectors and occupations can result from a country's production structure, differences in productivity gains and demand for labour, as well as the management practices of organisations and firms. They can also stem from a country's labour supply, including the characteristics and skills of the available workforce.⁽²⁶⁰⁾ For example, the COVID-19 crisis amplified poor working conditions and job insecurity in some sectors and occupations, such as healthcare, hospitality, and tourism, and for seasonal workers. This led to a growing share of workers moving away from low-quality jobs (low-paying, less flexible, contact-intensive, physically demanding), with a minor impact on the efficiency of EU labour market matching.⁽²⁶¹⁾

⁽²⁵⁶⁾ Controlling for degree of urbanisation, level of education, gender, length of residence in a country, age, temporary work, part-time work, size of the firm, country where highest level of education was achieved, current language skills in the main host country language, and employment in labour shortage or lower-skilled occupations.

⁽²⁵⁷⁾ Occupations with a future shortage indicator with a value of at least 2.7 (Table 2.4).

⁽²⁵⁸⁾ More generally, employment and working conditions also depend on the productivity of sectors. They also support and accommodate the inclusion of wider groups of people in the labour market and can prevent premature labour market exit, for example due to illness.

⁽²⁵⁹⁾ Given that they are offered by employers, they are also characteristics of labour demand.

⁽²⁶⁰⁾ The analysis of variation here does not allow for an assessment of a causal relationship between working conditions and persistent labour shortages.

⁽²⁶¹⁾ (European Commission, 2022g), (European Commission, 2023a).

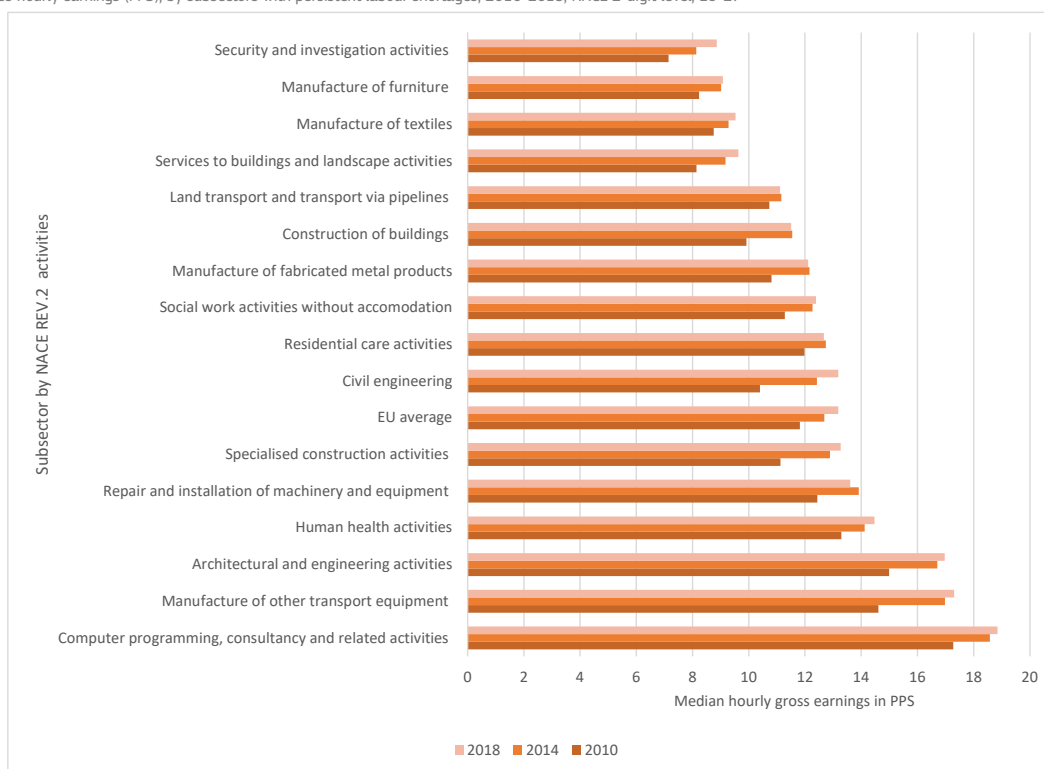
Fair working conditions are anchored in the European Pillar of Social Rights. They cover employment conditions, wages, and health and safety at work, among others. ⁽²⁶²⁾ The Pillar states that ‘regardless of the type and duration of the employment relationship, workers have the right to fair and equal treatment regarding working conditions’, adding that ‘employment relationships that lead to precarious working conditions shall be prevented, including by prohibiting abuse of atypical contracts’. In addition, it stresses that ‘workers have the right to a high level of protection of their health and safety at work’.

Definitions of working conditions vary and can include the physical, organisational, social, and economic dimensions of jobs. Broadly defined, a working condition is a characteristic, or combination of characteristics, of work that can be modified and improved. According to Eurofound, working conditions refer to the conditions in and under which work is performed, including the organisation of work and work activities, training, health, safety and working time. ⁽²⁶³⁾ For the ILO, the term also incorporates the economic dimension of work and its effects on living conditions. ⁽²⁶⁴⁾ While not always included in definitions of working conditions, ⁽²⁶⁵⁾ wages are correlated with workers’ well-being and are widely considered a marker of job quality. The OECD’s Job Quality Framework focuses on the measurement and assessment of job quality and encompasses three dimensions: earnings quality, labour market security, and quality of working environment. ⁽²⁶⁶⁾ Using OECD methodology to capture non-economic aspects of jobs, Eurofound’s job quality indicator focuses on six dimensions, including working time arrangements and the nature and content of work (Box 2.8).

Chart 2.26

Subsectors with persistent labour shortages had both above and below EU average median gross hourly earnings

Median gross hourly earnings (PPS), by subsectors with persistent labour shortages, 2010-2018, NACE 2-digit level, EU-27



Note: Size classes in number of employees is for 10 employees or more.

Source: Eurostat SES (EARN_SES_PUB2N).

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In 2018, substantial differences in median gross hourly earnings were recorded across subsectors with persistent labour shortages in the EU. ⁽²⁶⁷⁾ For nearly two-thirds (10 out of 16) of subsectors with persistent labour shortages, the median gross hourly earnings ⁽²⁶⁸⁾ expressed in purchasing power standard

⁽²⁶²⁾ (European Commission, 2018).

⁽²⁶³⁾ More information available here.

⁽²⁶⁴⁾ According to the ILO definition, working conditions cover a broad range of topics and issues, from working time (hours of work, rest periods, and work schedules) to remuneration, as well as the physical conditions and mental demands of the workplace.

⁽²⁶⁵⁾ Article 153 of the Treaty on the Functioning of the European Union (TFEU) excludes pay from the scope of its actions in the area of working conditions.

⁽²⁶⁶⁾ More information available here.

⁽²⁶⁷⁾ Based on the latest available data of the Eurostat Structural Earnings Survey (SES).

⁽²⁶⁸⁾ Gross hourly earnings are defined as gross earnings in the reference month divided by the number of hours paid during the same period. The number of hours paid includes all normal and overtime hours worked and remunerated by the employer during the reference month.

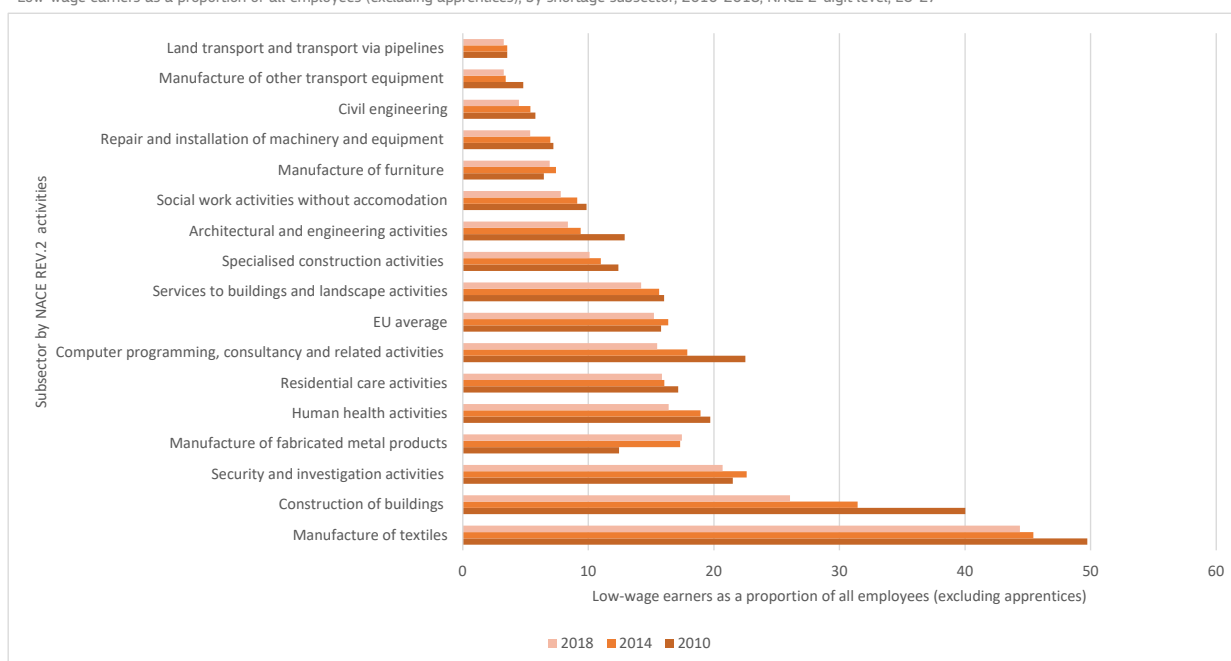
(PPS) ⁽²⁶⁹⁾ were below the EU average of 13.2. Security and investigation activities (8.9), and manufacture of furniture (9.1) and textiles (9.5) recorded well below average earnings. By contrast, computer programming, consultancy and related activities (18.9), manufacture of other transport equipment (17.3) and architectural and engineering activities (17.0) had far higher than average median hourly gross earnings (Chart 2.26). ⁽²⁷⁰⁾ Between 2010 and 2018, the largest increases in median gross hourly earnings were recorded for civil engineering (27%) and security and investigation services (24%), while increases were far lower for land transport and transport via pipelines (4%) and residential care activities (6%).

Almost half of the subsectors facing persistent labour shortages recorded an above-average share of low-wage earners (7 out of 16). In 2018, the proportion of low-wage earners (i.e. those earning two-thirds or less of the national median gross hourly earnings) varied significantly across shortage subsectors. Many subsectors with lower than average median earnings also had higher than average (15%) shares of low-income earners, in particular for manufacture of textiles (44%) and construction of buildings (26%) (Chart 2.27). ⁽²⁷¹⁾ However, nearly all subsectors with persistent labour shortages – with the exception of manufacture of furniture and manufacture of fabricated metals – experienced a decrease in the share of low-wage earners between 2010 and 2018.

Chart 2.27

Several subsectors facing persistent labour shortages recorded an above-average share of low-wage earners

Low-wage earners as a proportion of all employees (excluding apprentices), by shortage subsector, 2010-2018, NACE 2-digit level, EU-27



Note: Size classes in number of employees is for 10 employees or more.

Source: Eurostat SES, NACE Rev.2, 2-digit level.

[Click here to download chart.](#)

In 2021, several occupations characterised by persistent labour shortages reported an above EU average proportion of workers having difficulties in making ends meet. ⁽²⁷²⁾ This was most notable for cleaners (47%), cooks and bartenders (44%), and carers (43%), against the EU average of 26% (Chart 2.28). Only medical doctors (5%) and computer developers (7%) had substantially lower than average shares of workers reporting difficulties in making ends meet. Occupations with persistent labour shortages reporting higher than average difficulties in making ends meet also had higher shares of workers unable to predict their earnings in the next three months, pointing to a link between lower pay and less stable earnings. At least one-quarter of cleaners, building workers, salespeople and cooks reported being unable to tell in advance how much they were going to earn in the next three months. In addition, certain shortage occupations did not believe they were fairly rewarded. For instance, only 40% of nurses felt that they were paid fairly in relation to their efforts and achievements (19 pp lower than the average).

⁽²⁶⁹⁾ Derived by dividing any economic aggregate of a country in national currency by its respective purchasing power parities.

⁽²⁷⁰⁾ At sectoral level, the persistent shortage sectors administrative and support services and transport and storage activities recorded the lowest median hourly earnings in PPS, with information and communication activities recording the highest (Chart A.4).

⁽²⁷¹⁾ At sectoral level, the persistent shortage sectors administrative and support services and transport and storage activities recorded the highest share of low-wage earners, while information and communication activities recorded the lowest (Chart A.5).

⁽²⁷²⁾ Data based on the Eurofound 2021 European Working Conditions Telephone Survey (EWCTS).

Workers' reasons for opting into temporary or solo self-employment are heterogeneous and can be markers of both a desired flexibility and comparatively higher job insecurity.

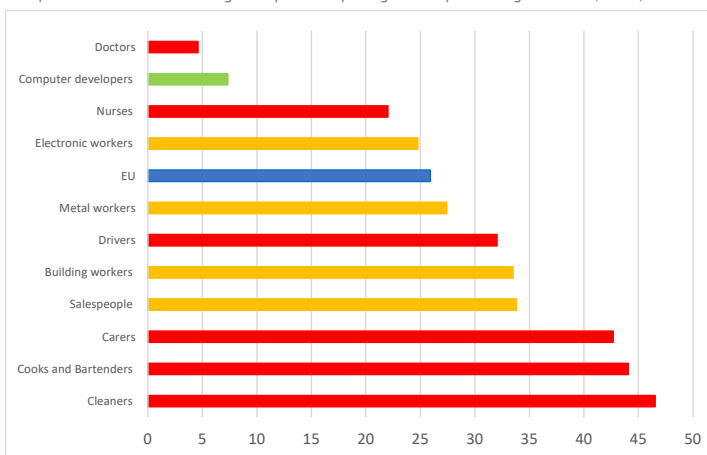
Where job insecurity associated with non-standard forms of employment is indicative of less favourable employment and working conditions, this can make sectors and occupations less attractive for workers and contribute to driving persistent labour shortages. On the one hand, workers may seek out more flexible employment arrangements, and non-standard forms of work⁽²⁷³⁾ can offer such autonomy. Self-employed, including solo self-employed (or 'own-account'⁽²⁷⁴⁾) workers, can choose to work for multiple clients. Non-standard workers may also see such employment forms as a stepping-stone to more permanent contracts.⁽²⁷⁵⁾ In addition, more fixed-term forms of employment relationship are common for jobs with a higher rate of seasonal employment, such as those in hospitality and tourism. On the other hand, due to its limited duration, temporary employment – which is by definition fixed-term – can be associated with higher job insecurity, especially when workers do not subsequently move to more stable and permanent jobs.⁽²⁷⁶⁾ Solo self-employment can also be marked by job insecurity, involve elevated risks of precariousness⁽²⁷⁷⁾ (not least because in many EU countries it implies more limited access to social protection compared to permanent employment⁽²⁷⁸⁾), and may conceal dependent employment relationships and bogus self-employment⁽²⁷⁹⁾, as well as signalling labour market segmentation within sectors and occupations. A recent European Commission report on the implementation of the 2019 Council Recommendation on access to social protection confirmed that many self-employed workers still face significant gaps in social protection coverage.⁽²⁸⁰⁾ In 2022, 19 Member States had at least one branch of social protection for which self-employed people were not covered, and, where participation in social protection schemes was voluntary for the self-employed, take-up rates were generally low. Despite offering flexibility and lowering barriers to labour market access for some workers, employment statuses that involve lower job security and elevated risks of precariousness (including due to associated gaps in social protection) can contribute to less favourable employment and working conditions in certain shortage sectors and occupations, in particular where workers do not actively seek them out.

Temporary employment and solo self-employment are common in certain subsectors with persistent labour shortages but far less typical in others. In 2021, the share of temporary employment was substantially higher for social work activities without accommodation (17%) and residential care activities⁽²⁸¹⁾ (16%), compared to the EU average (12.1%). By contrast, these shares were lowest for architectural and engineering (7%) and computer programming, consultancy, and related activities (7%). Across shortage subsectors, architectural and engineering activities (20%), specialised construction activities (19%), construction

Chart 2.28

Several shortage occupations have above-average difficulties in making ends meet

Proportion of workers in shortage occupations reporting difficulty in making ends meet, 2021, EU-27



Note: Red indicates significantly above EU average job strain, orange indicates slightly above EU average job strain, and green indicates below EU average job strain.

Source: Eurofound, EWCTS 2021.

[Click here to download chart.](#)

⁽²⁷³⁾ Non-standard forms of employment analysed here include temporary employment and solo self-employment.

⁽²⁷⁴⁾ Own-account workers are those who, working on their own account or with one or more partners, hold the type of job defined as a self-employed job, and have not engaged any employees to work for them on a continuous basis during the reference period.

⁽²⁷⁵⁾ (Filomena and Picchio, 2021).

⁽²⁷⁶⁾ While temporary contracts can facilitate entry to the labour market for low-skilled and young workers, there is a risk they may not move to more stable and permanent jobs (European Commission, 2022g)

⁽²⁷⁷⁾ Solo self-employed people in the selected Member States are particularly vulnerable to in-work poverty (Horemans and Marx, 2017). A recent report also analyses the AROP and SMSD rates for solo self-employed workers in selected Member States (De Becker et al., 2022).

⁽²⁷⁸⁾ (Spasova and Wilkens, 2018).

⁽²⁷⁹⁾ For example, labour market segmentation is a major challenge in Poland. One instrument that impedes social security coverage is bogus self-employment. Civil law contracts are the most common instrument replacing full-time employment, with data suggesting that 20-30% of workers have these precarious contracts.

⁽²⁸⁰⁾ (European Commission, 2023a)

⁽²⁸¹⁾ Residential care includes activities for the elderly and people with disabilities, those with mental and substance abuse issues, nursing, and other residential care activities.

Box 2.8: Measuring job quality in subsectors and occupations with persistent labour shortages

Job quality is a multidimensional concept that is used to complement job quantity measures, with different actors and disciplines emphasising different dimensions.

Eurofound's 2021 EWCTS⁽¹⁾ captured six dimensions of job quality: physical and social environment; job tasks; organisational characteristics; working time arrangements; job prospects; and intrinsic job features. The job quality indicator uses a methodology developed by the OECD that compares job demands (which affect workers negatively) and job resources (which affect workers positively). When workers have more demands than resources, they experience poorer job quality or job strain.

The job quality index is positively associated with well-being.⁽²⁾ The dimensions of work and employment included in the index have been selected for their positive/negative association with health and well-being, as demonstrated in high quality epidemiological prospective studies. Occupation and sector have been identified as important determinants of all job quality indices⁽³⁾ and variation in job quality indices can be observed across both elements.

Where job strain is reported as high, this suggests that improving job quality in the sectors and occupations experiencing persistent labour shortages could potentially increase their attractiveness and participation rates. Job strain also entails higher risks to health and well-being.

⁽¹⁾ EWCTS is a Europe-wide probability-based survey conducted between March and November 2021. It was carried out via telephone survey, unlike the previous 2015 European Working Conditions Survey (EWCS), which used face-to-face interviews. Data collection for the EWCTS took place when the specific demands of the COVID-19 pandemic may still have had an effect on jobs.

⁽²⁾ (OECD, 2022d).

⁽³⁾ (Eurofound, 2021).

of buildings (13%), and computer programming, consultancy and related activities (11%) recorded above EU average (10.3%) shares of solo self-employed workers.⁽²⁸²⁾

Dependent self-employment is highest in the construction and human health and social work sectors, and comparatively low in the ICT sector.⁽²⁸³⁾ With self-employed workers constituting a heterogeneous group of workers overall, their economic and organisational dependency are factors that are useful in assessing the boundaries between employment and self-employment. Across shortage sectors, the largest share (17%) of dependent self-employed workers without employees is in construction, followed by human health and social work activities (11%). Professional, scientific, and technical activities contain a substantial share of both dependent (10%) and independent (13%) self-employed people, with ICT (7%) recording a lower share of dependent self-employed workers.⁽²⁸⁴⁾

In 2021, workers reported high levels of job strain in some sectors and occupations characterised by persistent labour shortages (Chart 2.29). This was particularly evident in the health (48%), residential care (notably in the context of the on-going COVID-19 pandemic) (47%),⁽²⁸⁵⁾ and transport (41%) sectors, which were far above the EU average (30%). The share of extremely strained jobs was nearly double the average (4%) in residential care and health sectors (Chart 2.29). By contrast, computer programming, consultancy and related services (9%) and architectural and engineering activities (14%) reported levels of job strain well below the EU average.⁽²⁸⁶⁾⁽²⁸⁷⁾ Across shortage occupations, job strain was substantially higher for nurses (61%), carers (55%), drivers (44%), cooks and bartenders (43%), doctors (43%), and cleaners (36%). It was about average for

⁽²⁸²⁾ At sectoral level, the share of temporary employment was above the EU average for administrative and support services, and human health and social work activities. The share of solo self-employment was above the EU average for professional, scientific, and technical activities, construction and information and communication activities (Chart A.6 and Chart A.7).

⁽²⁸³⁾ Based on the 2017 EU-LFS ad hoc module on self-employment, which defined dependent self-employment as having one client or one dominant client in the past 12 months.

⁽²⁸⁴⁾ No reliable data for the subgroup of own-account workers by sector.

⁽²⁸⁵⁾ Results should be interpreted within the context of the COVID-19 pandemic, with the EWCTS being carried out between March and November 2021.

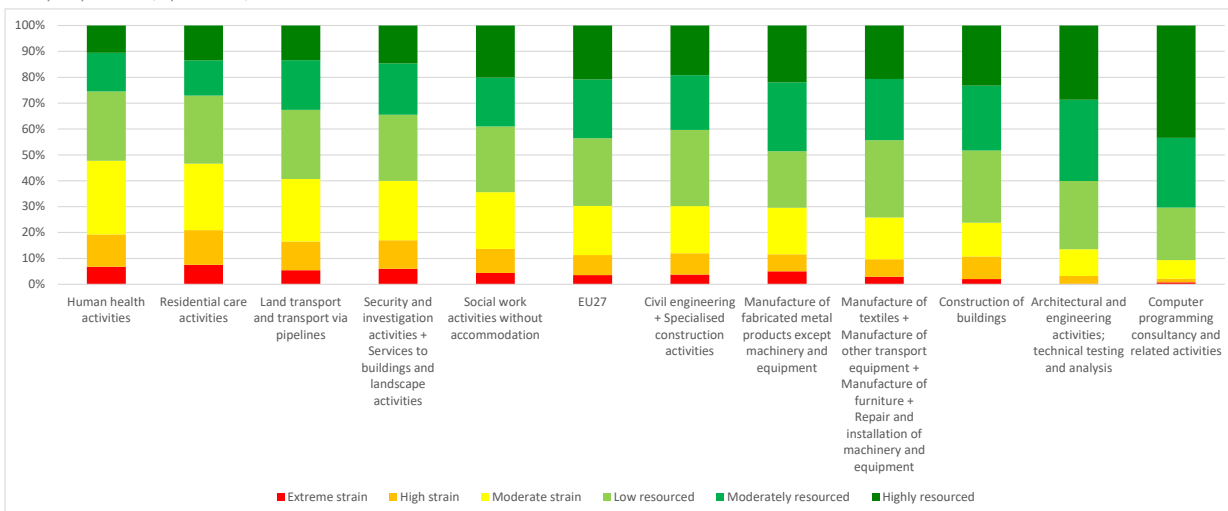
⁽²⁸⁶⁾ When the number of observations collected within a subsector/occupation of interest was too low to provide reliable statistical estimations, the respective subsector/occupation was merged with other subsector(s)/occupation(s) within the same sectoral/occupational group of close level.

⁽²⁸⁷⁾ Even though the EU average is referred to as a value distinguishing better and worse results, it is worth noting that not in all cases is the EU average itself is not always a satisfactory result.

building, sheet metal, electrical workers, and shop salespeople, and well below average for computer developers (Chart 2.30).

Chart 2.29
Job strain was highest for health, residential care, and transport workers

Job quality index (%), by subsector, EU-27

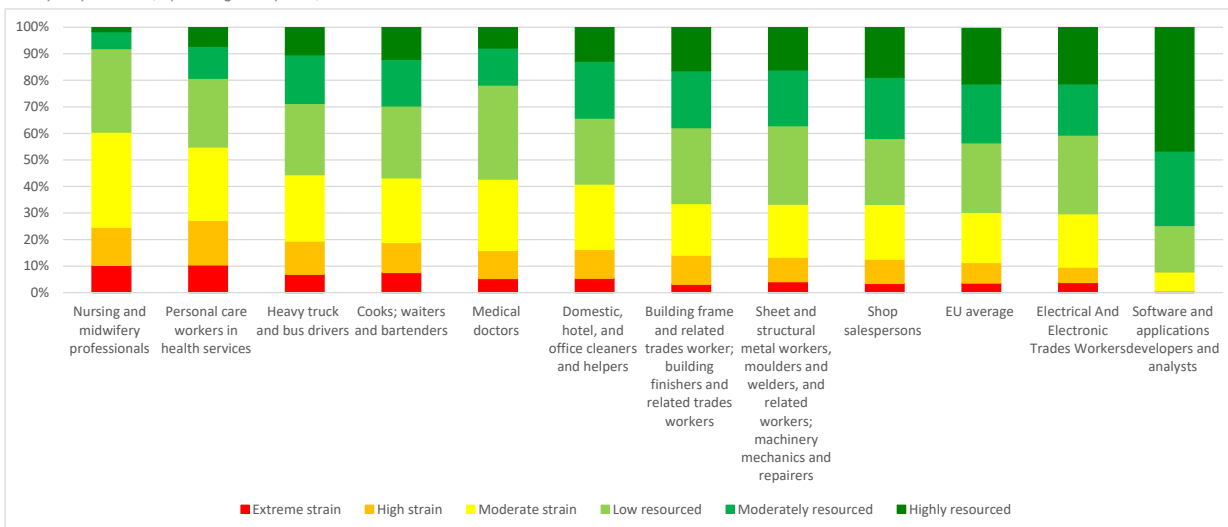


Source: Eurofound, EWCTS 2021.

[Click here to download chart.](#)

Chart 2.30
Job strain for nurses was double the EU average

Job quality index (%), by shortage occupation, EU-27



Source: Eurofound, EWCTS 2021.

[Click here to download chart.](#)

Nurses and carers indicated far higher than average exposure to all physical risks, physical demands, and social demands. A breakdown of the job quality index for shortage occupations experiencing above-average job strain reveals that work intensity is most severe for medical doctors and nurses, who report higher than average levels of working at high speed, to tight deadlines, and with elevated emotional demands. Looking at job prospects, between one-quarter and one-third of nurses, carers and cooks expect an undesirable change in their work situation. Nevertheless, workers in shortage occupations with above-average job strain (with the exception of cooks and bartenders) report a higher than average level of intrinsic satisfaction with their job, including feelings of carrying out useful work, being able to do their work well, and having enough opportunities to use their knowledge and skills in their current job.

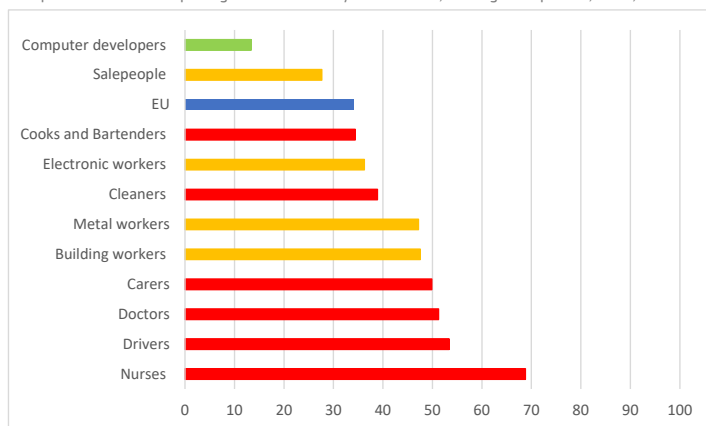
Workers in occupations experiencing persistent labour shortages and significantly higher levels of job strain more often report that their health and safety is at risk because of their work (Chart 2.31). In 2021, the highest levels of health and safety at risk at work were reported by nurses (69%), drivers (53%), doctors (51%) and carers (50%), while it was on par with the EU average (34%) for cooks and bartenders. Data

on non-fatal accidents at work also show elevated risks in the construction sector, with 48% of building workers and 47% of metal workers reporting health and safety risks at work. ⁽²⁸⁸⁾ Of the shortage occupations, only computer developers and sales workers report below average health and safety risks at work. Similar conclusions are drawn for shortage sectors experiencing higher levels of job strain, with over half (52%) of the workers in human health and land transportation, 47% of workers in residential care services, and 45% of workers in security activities reporting that their health and safety is at risk at work.

Chart 2.31

High shares of nurses, drivers, doctors and carers report health and safety risks at work

Proportion of workers reporting health and safety risks at work, shortage occupations, 2021, EU-27



Note: Occupations in red/orange/green have a job strain well above/close to/well below the EU average.

Source: Eurofound EWCTS 2021.

[Click here to download chart.](#)

Most of the occupations characterised by persistent labour shortages involve substantial customer contact and activities in numerous work locations. Customer contact is less common for cleaners, developers, and metal workers. Except for three shortage occupations (doctors, nurses, computer developers), the use of digital technology at work is below average (see section 3.2.). With the exception of computer developers, activities of shortage occupations mostly take place outside workers' homes, i.e. at their employers' or clients' premises, on the road, or from multiple locations.

When the gender segregation of occupations with persistent labour shortages is considered, three in four female-dominated occupations report higher than average job strain. These include nurses, carers, and cleaners. Gender-mixed shortage occupations, such as cooks and doctors, also report significantly poorer levels of job quality. Most male-dominated shortage occupations report average job strain, with substantially higher overall job quality for computer developers.

Overall, earnings, job strain and employment status could help to explain persistent labour shortages in certain subsectors. Analysing all factors across subsectors with persistent labour shortages, workers in social and residential care and workers in security and services to buildings activities have lower median gross hourly earnings, higher job strain and higher shares of temporary employment, compared to the EU average. ⁽²⁸⁹⁾ For the construction of buildings, non-standard employment forms are more common, with lower than average hourly earnings and job strain. By contrast, computer programming, architectural and engineering activities, and specialised construction services stand out as shortage subsectors with higher median gross hourly earnings, ⁽²⁹⁰⁾ lower job strain ⁽²⁹¹⁾, and higher shares of solo self-employment than the EU average, with other factors (notably, skills) likely to determine their persistent shortages.

Job strain and adequate pay could play a role in explaining persistent shortages in certain occupations. Of the shortage occupations experiencing higher than average job strain, cleaners, cooks and bartenders, carers, salespeople, building workers, drivers and metal workers report above-average difficulties in making ends meet. Nurses indicate the highest job strain and health and safety risks at work and report less difficulty in making ends meet, but also feel they are not fairly rewarded. By contrast, computer developers and electronic workers report below-average job strain and less difficulty in making ends meet, pointing to other drivers (e.g. skills) as the primary cause of their persistent shortages.

⁽²⁸⁸⁾ In 2020, the highest incidence of non-fatal accidents at work in the EU was in construction, with 2 987 accidents per 100 000 people employed [HSW_N2_01].

⁽²⁸⁹⁾ Similarly, workers in health have much higher than average job strain and slightly higher shares of temporary employment, paired with above-average hourly earnings. Workers in transport and transport via pipelines activities report lower than average earnings and higher job strain, paired with lower shares of non-standard forms of work.

⁽²⁹⁰⁾ Aggregated due to sample sizes. In the case of civil engineering, median gross hourly earnings in PPS are reportedly in line with the EU average.

⁽²⁹¹⁾ To note for the measurement of job strain the sub-sectors civil engineering and specialised construction services were merged, due to sample sizes.

8. CONCLUSIONS

A number of sectors and occupations in the EU are characterised by persistent labour shortages.

Important underlying structural drivers include the influence of skills shortages and mismatches, new demands linked to the ongoing green and digital transitions, demographic trends, low labour market participation of certain population groups, occupational segregation by gender, the influence of labour mobility and migration, poor working conditions in some sectors and occupations, inefficient company practices, incentives provided by the tax and benefit systems, and changing worker preferences. In the future, new labour shortages are projected to emerge, likely intensified by the structural changes stemming from the twin transition.

In general, occupations with persistent labour shortages tend to be characterised by demand for lower skills.

Employers' recruitment difficulties seem to be largely an outcome of poor HRM practices (e.g. retention issues) and unattractive jobs (e.g. poor working conditions, including high job strain), rather than workers' failing to meet high skills needs. However, there are significant differences across occupations (e.g. ICT professionals). Skills policies play an important role in reinforcing better job performance across all skill levels and enabling access to higher quality jobs. They are also central to addressing expected future labour shortages in higher-skilled occupations, which often require more time and investment to attain the necessary skills and credentials.

The green transition is expected to lead to net job creation of between 1 million and 2.5 million jobs by 2030, with resulting changes in skills needs potentially exacerbating current labour shortages.

The estimated effect of the green transition on employment differs across sectors, countries, and skills groups, and will depend on the successful implementation of accompanying policies, including reskilling, upskilling and adult learning. High expansion needs and a strong segregation of men and older workers in some sectors relevant for the green transition, coupled with the increasing demand for technical, transversal and digital skills in those sectors, might contribute to existing and new labour shortages.

The digital transition is associated with increasing demand for ICT professionals, but there is little evidence of its effects on persistent labour shortages more broadly.

The numbers of ICT professionals in the EU almost doubled in the last decade and are projected to expand further, driven by the interlinkages between the green and digital transitions. ICT occupations are by far the most digitally intensive form of work in the EU, with around one-third of ICT professionals' skills being digital, compared to less than one-tenth for most other occupations. Lower digital intensity of work among women, older workers, and those with lower levels of educational achievement stems largely from underrepresentation of these groups in ICT work.

Ageing population and insufficient labour market participation of certain groups are key drivers of labour shortages.

The decreasing working-age population, together with sustained consumption by a growing older population, will likely drive up labour shortages. The EU suffers from a relatively low participation rate among older people, women (especially mothers of children younger than three years old), lower-educated people, migrants, particularly migrant women, and young people. Increasing the labour market participation of these groups could help to tackle persistent labour shortages. It will also be necessary if the EU is to reach the 2030 Porto target of 78% employment rate and address the higher employment needs resulting from the green transition.

Gender segregation in the labour market contributes to persistent labour shortages.

This is true in occupations where men account for the majority of workers (e.g. STEM, including ICT) and in occupations where women are overrepresented (e.g. healthcare). Gender segregation contributes to labour shortages by hindering efficient matching of labour supply and demand, and by shaping supply of certain skills in ways that make suboptimal use of women's and men's talents. A substantial part of gender segregation can often be traced back to gendered participation in certain education paths. Increasing participation of women in relevant educational fields offers an opportunity to mitigate future labour shortages, including in fast-growing jobs, such as ICT, that are relevant for the twin transition.

Migrants residing in the EU have lower labour market participation, hindering their potential to contribute to tackling labour shortages.

They are more often employed in occupations already facing persistent labour shortages or projected to experience strong labour shortages in the future in the EU. This is particularly the case for lower-skilled shortage occupations. However, the lack of skills in the host country language(s), difficulties in recognising their formal qualifications obtained abroad, care responsibilities, and discrimination present significant obstacles to migrants in getting a (suitable) job. This leads to lower labour market participation rates and dampens their potential to mitigate existing and future labour shortages, particularly in higher-skilled occupations.

Working conditions might explain the persistence of labour shortages in certain sectors and occupations, but are not the primary driver in others. A number of sectors facing persistent labour shortages record lower median gross hourly earnings, higher job strain, and higher shares of non-standard employment, which can be associated with desired job flexibility, but also lower job security and elevated risk of precariousness than permanent employment. Similarly, some occupations characterised by persistent labour shortages report higher job strain and difficulties in making ends meet. By contrast, high-skilled sectors and occupations, such as ICT professionals, stand out as being better remunerated and having lower job strain, highlighting the need for different types of measures to tackle their shortages.

Policy actions can play a key role in mitigating persistent and future labour shortages. These include supporting labour market matching through upskilling and reskilling, including in the context of changing skills needs in light of the green and digital transitions, increasing labour market participation through provision of effective employment and social services, reforms of tax-benefit systems, attracting and integrating foreign talent into the EU labour market, and improving working conditions, including with the help of social partners. Chapter 3 presents an overview of some selected policy actions that could help to address persistent labour shortages.

Annex: Structural drivers of labour shortages

Table A.1

Complete list of persistent labour shortages in various types of occupations

Occupations in persistent labour shortage, ISCO-08, 2016-2021

ISCO 3-digit code	Description of occupation	Employment in 2021 (number of people in million, % of total employment)	Change in employment since 2012
Shortage identified at ISCO 3-digit using the selection criteria:			
221	Medical doctors	1.9 (1%)	16%
	2211 Generalist medical practitioners		
	2212 Specialist medical practitioners		
222	Nursing and midwifery professionals	1.6 (0.8%)	22%
	2221 Nursing professionals		
251	Software and applications developers and analysts	3.3 (1.7%)	88%
	2511 Systems analysts		
	2512 Software developers		
	2513 Web and multimedia developers		
	2514 Applications programmers		
	2519 Software and applications developers and analysts not elsewhere classified		
512	Cooks	1.7 (0.8%)	-3%
	5120 Cooks		
513	Waiters and bartenders*	1.9 (1%)	-34%
522	Shop salespeople	10.2 (5.3%)	-6%
532	Personal care workers in health services	4.2 (2%)	9%
	5321 Healthcare assistants		
	5322 Home-based personal care workers		
711	Building frame and related trades workers	4 (2%)	4.50%
	7112 Bricklayers and related workers		
	7114 Concrete placers, concrete finishers and related workers		
	7115 Carpenter and joiners		
712	Building finishers and related trades workers	2.3 (1.2%)	-2%
	7121 Roofers		
	7126 Plumbers and pipe fitters		
	7127 Air conditioning and refrigeration mechanics		
721	Sheet and structural metal workers, moulders and welders, and related workers	1.7 (0.8%)	-16%
	7212 Welders and flamecutters		
	7213 Sheet metal workers		
	7214 Structural metal preparers and erectors		

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723	Machinery mechanics and repairers	3.6 (1.8%)	19%
	7231 Motor vehicle mechanics and repairers		
	7233 Agricultural and industrial machinery mechanics and repairers		
741	Electrical equipment installers and repairers	2.4 (1.2%)	4.60%
	7411 Building and related electricians		
	7412 Electrical mechanics and fitters		
833	Heavy truck and bus drivers	3.8 (1.9%)	-1.30%
	8331 Bus and tram drivers		
	8332 Heavy truck and lorry drivers		
911	Domestic, hotel, and office cleaners and helpers	6.1 (3%)	-10.50%
	9112 Cleaners and helpers in offices, hotels and other establishments		
<u>Shortage identified only at ISCO 4-digit level:</u>			
	2142 Civil engineers		
	2151 Electrical engineers		
	2411 Accountants		
	3112 Civil engineering technicians		
	7223 Metal working and machine tool setting		

Source: BCS and EU-LFS 2012-2021.
[Click here to download table.](#)

Table A.2

Future labour shortages are strongest in high-skilled non-manual and elementary occupations

Future occupational shortages to 2035, ranging from 1 (weak or no shortage) to 4 (strong shortage)

	ISCO	Occupation	Expansion	Replacement	Imbalance	Future shortage indicator
High-skilled non-manual occupations	11	Chief executives, senior officials and legislators	2	4	2	2.7
	12	Administrative and commercial managers	3	2	2	2.3
	13	Production and specialised services managers	3	3	2	2.7
	14	Hospitality, retail and other services managers	2	3	2	2.3
	21	Science and engineering professionals	4	2	1	2.3
	22	Health professionals	3	4	1	2.7
	23	Teaching professionals	2	3	1	2.0
	24	Business and administration professionals	4	2	1	2.3
	25	ICT professionals	4	1	1	2.0
	26	Legal, social and cultural professionals	3	3	2	2.7
	31	Science and engineering associate professionals	2	2	2	2.0
	32	Health associate professionals	3	2	2	2.3
	33	Business and administration associate professionals	3	3	2	2.7
	34	Legal, social, cultural and related associate professionals	4	3	2	3.0
	35	Information and communications technicians	3	1	2	2.0
Skilled non-manual occupations	41	General and keyboard clerks	2	3	2	2.3
	42	Customer services clerks	3	3	2	2.7
	43	Numerical and material recording clerks	2	1	2	1.7
	44	Other clerical support workers	1	1	2	1.3
	51	Personal services workers	3	2	3	2.7
	52	Sales workers	2	2	3	2.3
	53	Personal care workers	3	3	2	2.7
54	Protective services workers	2	2	2	2.0	
Skilled manual occupations	61	Market-oriented skilled agricultural workers	1	3	3	2.3
	62	Market-oriented skilled forestry, fishery and hunting workers	1	2	3	2.0
	63	Subsistence farmers, fishers, hunters and gatherers	1	1	4	2.0
	71	Building and related trades workers (excluding electricians)	2	2	3	2.3
	72	Metal, machinery and related trades workers	2	2	3	2.3
	73	Handicraft and printing workers	2	2	3	2.3
	74	Electrical and electronic trades workers	2	2	2	2.0
	75	Food processing, woodworking, garment and other craft and related trades workers	2	2	3	2.3
	81	Stationary plant and machine operators	2	2	3	2.3
82	Assemblers	3	2	3	2.7	
83	Drivers and mobile plant operators	2	3	3	2.7	

Source: DG EMPL calculations, based on Cedefop Skills Forecast 2023.

[Click here to download table.](#)

Table A.3

Shortage occupations characterised by lower skill demand

Skills in shortage occupations, by broad occupation skill group, EU-27 plus Norway and Iceland

		<i>All sample</i>	<i>Skilled</i>	<i>Semi-skilled</i>	<i>Manual</i>	<i>Elementary</i>
Job skills requirements	Literacy scale	-0.137*** (-16.73)	-0.0813*** (-8.48)	-0.191*** (-10.26)	0.0468 -1.86	0.0272 -0.78
	Numeracy scale	-0.0538*** (-7.41)	-0.0482*** (-7.27)	-0.0410* (-2.57)	-0.00484 (-0.27)	-0.224*** (-7.17)
	Manual skills scale	0.101*** -15.15	0.0496*** -5.78	0.196*** -11.8	0.00984 -0.49	-0.0273 (-1.14)
	Social skills scale	0.0806*** -5.86	-0.0189 (-1.30)	0.355*** -14.33	0.123** -3.1	0.0145 -0.25
	Digital skills index					
	Non-user	0 (.)	0 (.)	0 (.)	0 (.)	0 (.)
	Low	-0.0587*** (-5.63)	-0.023 (-1.33)	-0.0900*** (-5.13)	0.0596* -2.23	-0.0557** (-2.79)
	Medium	-0.101*** (-9.02)	-0.0275 (-1.45)	-0.150*** (-9.05)	-0.00019 (-0.01)	-0.115*** (-5.40)
	High	-0.0262* (-2.06)	0.0845*** -4.4	-0.163*** (-10.02)	-0.0698* (-2.33)	-0.0538 (-1.62)
	Job quality	Job complexity scale	0.0204* -2.06	0.0192* -2.55	0.0286 -1.77	-0.0266 (-0.90)
Routinisation scale		-0.0258** (-3.26)	-0.0122 (-1.74)	-0.0569*** (-3.59)	-0.135*** (-4.67)	0.0743* -2.48
Demography	Education					
	Low	0 (.)	0 (.)	0 (.)	0 (.)	0 (.)
	Medium	-0.0074 (-0.98)	0.0313*** -3.52	-0.0524*** (-4.43)	-0.024 (-0.83)	0.009 -0.44
	High	-0.0234*** (-2.85)	0.0404*** -4.21	-0.0514*** (-3.15)	-0.0781** (-2.27)	-0.0083 (-0.28)
Skill mismatch	Skill gap					
	Great extent	0 (.)	0 (.)	0 (.)	0 (.)	0 (.)
	Moderate extent	-0.0261*** (-4.66)	-0.0244*** (-5.58)	-0.0183 (-1.76)	-0.0213 (-0.94)	-0.0209 (-0.60)
	Small extent	-0.0303*** (-4.99)	-0.0336*** (-5.56)	-0.0179 (-1.51)	-0.0438* (-2.06)	-0.0301 (-0.91)
	None	-0.0252*** (-3.57)	-0.0389*** (-3.75)	-0.0339* (-2.21)	-0.038 (-1.67)	-0.013 (-0.41)
Observations		41375	22587	11167	4829	2137

Note: Marginal effects of regression coefficients following the estimation of probit models with binary dependent variable, indicating if an individual is employed in a labour shortage occupation at 3-digit level. Regressions are carried out for the whole sample of paid adult employees in the EU-27 plus Norway and Iceland, as well as individually for samples of broad occupational skill groups (i.e. skilled, semi-skilled, manual, elementary occupations). Other control variables include required education for job, firm size, private sector, work hours, remote work and country dummies.

The occupational skills groups are defined as follows:

Skilled occupations: Managers ISCO 1, Professionals ISCO 2; Technicians and associate professionals ISCO 3;

Semi-skilled occupations: Clerical support workers ISCO 4; Service and sales workers ISCO 5;

Manual occupations: Skilled agriculture, forestry and fishing ISCO 6; Craft and related trades workers ISCO 7; Plant and machine operators and assemblers ISCO 8;

Elementary: Elementary occupations ISCO 9

Source: Cedefop ESJS2 2021.

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Table A.4

Moderate future labour shortages in energy-intensive industries

Future sectoral shortages in energy-intensive industries to 2035, NACE 2-digit level

	NACE 2-digit	Expansion	Replacement	Imbalance	Cedefop future shortage indicator
Mining of coal and lignite	05	1	1	2.0	1.3
Extraction of crude petroleum and natural gas	06	2	1	2.0	1.7
Mining of metal ores; other mining and quarrying; mining support service activities	07-09	3	1	2.0	2.0
Manufacture of chemicals and chemical products	20	2	2	2.0	2.0
Manufacture of other non-metallic mineral products	23	2	2	2.7	2.2
Manufacture of basic metals	24	2	3	2.7	2.6
Manufacture of motor vehicles, trailers and semi-trailers	29	3	3	2.3	2.8

Source: DG EMPL calculations, based on Cedefop Skills Forecast 2023.

Table A.5

Future labour shortages are strongest in business services

Future sectoral shortages to 2035, NACE 1-digit level

	NACE 1-digit	Expansion	Replacement	Imbalance	Cedefop future shortage indicator
Accommodation and food service activities	I	3	3	2.5	2.8
Activities of households as employers	T	3	4	3.0	3.3
Administrative and support service activities	N	3	3	2.6	2.9
Agriculture, forestry and fishing	A	1	4	2.0	2.3
Arts and entertainment	R	3	3	2.3	2.8
Construction	F	2	3	2.5	2.5
Education	P	3	3	1.0	2.3
Electricity, gas, steam and air conditioning supply	D	3	2	1.5	2.2
Financial and insurance activities	K	3	2	1.6	2.2
Human health and social work activities	Q	3	3	2.2	2.7
Information and communication	J	4	1	1.5	2.2
Manufacturing	C	2	2	2.3	2.1
Mining and quarrying	B	1	1	2.3	1.4
Other service activities	S	3	3	2.7	2.9
Professional, scientific and technical activities	M	3	2	1.7	2.2
Public administration and defence, compulsory social security	O	3	2	1.7	2.2
Real estate	L	3	3	2.7	2.9
Transportation and storage	H	3	3	2.3	2.8
Water supply, sewerage, waste management and remediation activities	E	3	3	2.0	2.7
Wholesale and retail trade, repair of motor vehicles and motorcycles	G	3	2	2.7	2.6

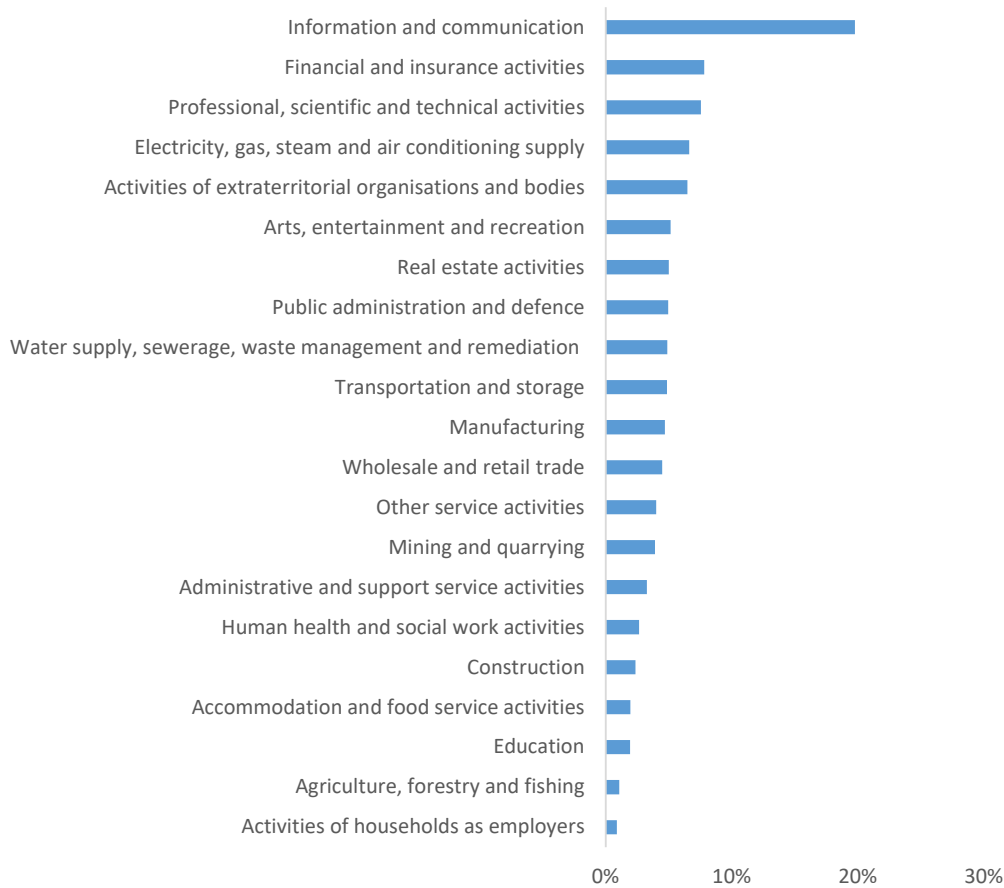
Note: Sectors in grey include sectors at NACE 2-digit level indicated to face persistent labour shortages (see section 2.1).

Source: DG EMPL calculations, based on Cedefop Skills Forecast 2023.

Chart A.1

Work in information and communication activities is the most digitally intensive

Digital intensity of work by sector of economic activity (percentage), 2021, EU



Note: Analysis based on all Member States where occupational statistics are available at ISCO-08 3-digit level, i.e. excluding Bulgaria, Malta and Slovenia

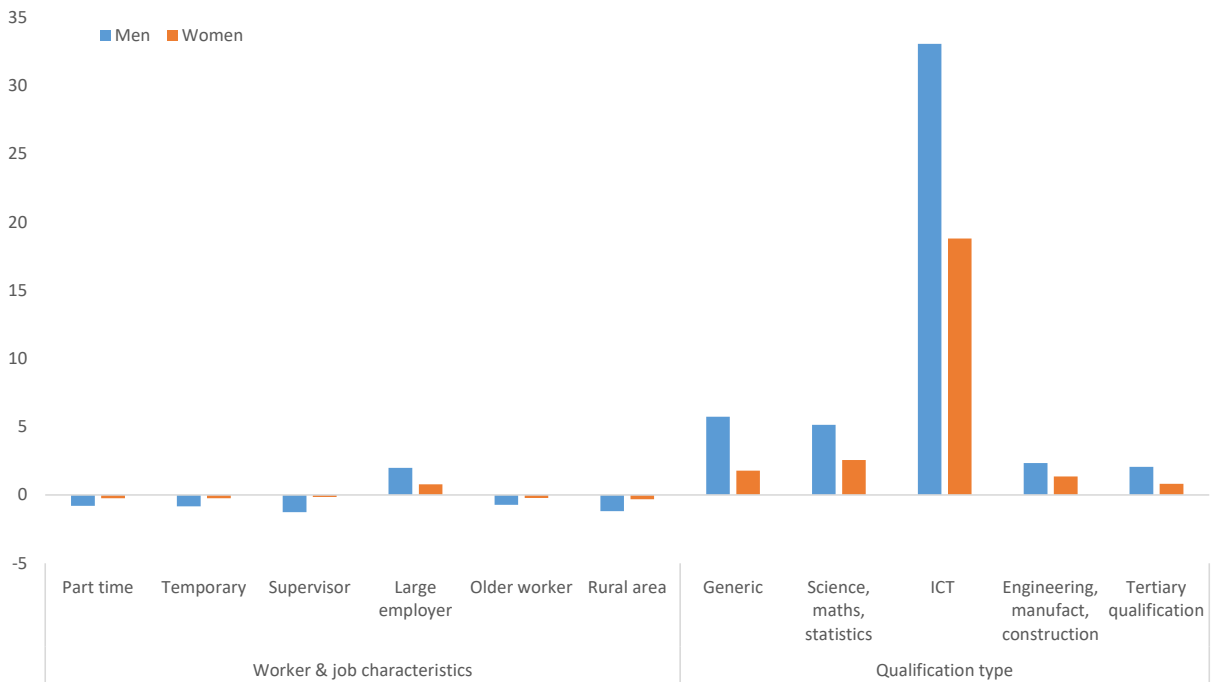
Source: EU-LFS 2021

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Chart A.2

Holding ICT qualifications sharply increases the probability of working in ICT for men, but less so for women

Gender gaps in ICT occupations, by contributing factors (pp), workers aged 20-64, 2021, EU



Note: Analysis based on all Member States where occupational statistics are available at ISCO-08 2-digit level, i.e. excluding Malta.

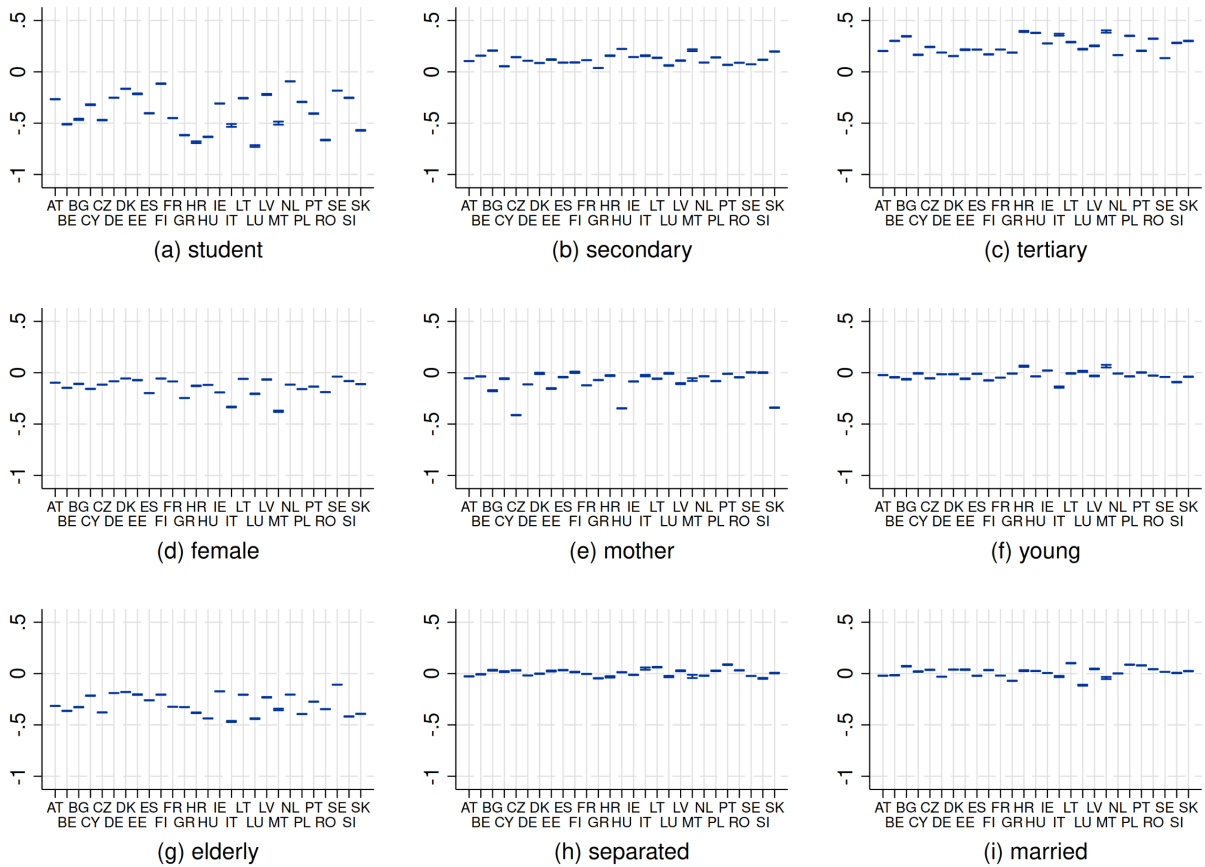
Source: EU-LFS 2021

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Chart A3

Marginal effects of individual characteristics on participation probability, by country

The effects of individual characteristics on participation probability among people aged 20-64, 2004-2020, EU-27 countries.



Note: Marginal effects (and 95% confidence intervals) calculated on sample mean based on estimated logit model for each Member State. I; model also included year dummies.

Source: DG EMPL calculations, based on EU-LFS 2004-2020.

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Figure A.1

Migrants are more likely to be employed in occupations with persistent labour shortages

Factors connected to the probability of being employed in labour shortage occupations vs non-labour shortage occupations, 2021, EU

Average marginal effects
Model VCE: Robust

Number of obs = 339,560

Expression: Pr(1socc), predict()
dy/dx wrt: 1.migrant 1.eu_mobile 1.town 1.rural 1.low_education 1.high_education 1.foreign_edu
1.no_formal_edu 1.female 1.resid_below_9y 1.resid_10y_more 1.lang_advanced
1.lang_beginner 1.age_35_49 1.age_50_64 1.temporary 1.parttime 1.size_1_9
1.size_50_more

	Delta-method		z	P> z	[95% conf. interval]	
	dy/dx	std. err.				
1.migrant	.0874206	.0110508	7.91	0.000	.0657615	.1090797
1.eu_mobile	.0546365	.0113056	4.83	0.000	.0324779	.0767951
1.town	.0030778	.0025596	1.20	0.229	-.0019389	.0080946
1.rural	.0010936	.0028082	0.39	0.697	-.0044103	.0065975
1.low_education	.0624712	.0033749	18.51	0.000	.0558566	.0690858
1.high_education	-.148143	.0023442	-63.20	0.000	-.1527375	-.1435484
1.foreign_edu	.055103	.0069989	7.87	0.000	.0413854	.0688206
1.no_formal_edu	.009576	.0197268	0.49	0.627	-.0290879	.0482398
1.female	-.027396	.0023002	-11.91	0.000	-.0319043	-.0228877
1.resid_below_9y	-.0177867	.0076547	-2.32	0.020	-.0327896	-.0027838
1.resid_10y_more	-.0313755	.0060895	-5.15	0.000	-.0433106	-.0194404
1.lang_advanced	.0083069	.0082408	1.01	0.313	-.0078449	.0244586
1.lang_beginner	.0313231	.0130637	2.40	0.016	.0057188	.0569274
1.age_35_49	-.0160792	.0028995	-5.55	0.000	-.0217621	-.0103963
1.age_50_64	-.0179551	.0029337	-6.11	0.000	-.0237115	-.0121986
1.temporary	.0030602	.0036967	0.83	0.408	-.0041851	.0103055
1.parttime	.0474033	.0029889	15.89	0.000	.0416251	.0533414
1.size_1_9	.0327235	.0028556	11.46	0.000	.0271267	.0383204
1.size_50_more	-.0348976	.0026078	-13.38	0.000	-.0400088	-.0297865

Note: dy/dx for factor levels is the discrete change from the base level.

Note: Regression on full sample (migrants, natives, EU-mobile workers, identified based on country of birth). Analysis limited to population aged 20-64. Excludes Bulgaria, Hungary, Malta, Poland and Slovenia, whose EU-LFS data do not provide country of birth for people born outside Europe. The deviation from zero shows the difference with respect to the reference group in parenthesis: migrant and EU mobile workers (people born in the country of residence), towns and suburbs, and rural areas (cities), primary and tertiary education (secondary education), foreign education which indicates highest level of education achieved abroad and no formal education (highest level of education achieved in country of residence), female (male), residing for less than nine years or residing for 10 years or more (born in the country of residence), proficient language skills comprising advanced and intermediate language skills or poor language skills comprising basic, hardly any, and no language skills (mother tongue), aged 35-49 and aged 50-64 (aged 20-34), temporary job (permanent job), part-time job (full-time job), firms with less than 10 employees and firms with 50 or more employees (firms with 10 to 49 employees). *** significant at 1%, ** significant at 5%, * significant at 10%, no * = not significant.

Source: EU-LFS 2021.

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Figure A.2

Migrants are more likely to be employed in occupations with persistent labour shortages, even when controlling for lower-skilled occupations

Factors connected to the probability of employment in labour shortage occupations vs non-labour shortage occupations, 2021, EU

Average marginal effects
Model VCE: Robust

Number of obs = 339,560

Expression: Pr(1socc), predict()
dy/dx wrt: 1.migrant 1.eu_mobile 1.town 1.rural 1.low_education 1.high_education 1.foreign_edu
1.no_formal_edu 1.low_skilled 1.female 1.resid_below_9y 1.resid_10y_more
1.lang_advanced 1.lang_beginner 1.age_35_49 1.age_50_64 1.temporary 1.parttime
1.size_1_9 1.size_50_more

	Delta-method		z	P> z	[95% conf. interval]	
	dy/dx	std. err.				
1.migrant	.0451327	.0101298	4.46	0.000	.0252787	.0649867
1.eu_mobile	.0259125	.0104513	2.48	0.013	.0054283	.0463967
1.town	-.0084289	.0024416	-3.45	0.001	-.0132143	-.0036434
1.rural	-.0207811	.0026154	-7.95	0.000	-.0259072	-.0156555
1.low_education	.025032	.0029884	8.38	0.000	.0191748	.0308892
1.high_education	-.0114992	.0025288	-4.55	0.000	-.0164555	-.0065429
1.foreign_edu	.0299496	.006513	4.60	0.000	.0171844	.0427148
1.no_formal_edu	-.0010249	.0180312	-0.06	0.955	-.0363654	.0343156
1.low_skilled	.2753999	.0022557	122.09	0.000	.2709788	.2798211
1.female	-.024306	.0022188	-10.95	0.000	-.0286548	-.0199572
1.resid_below_9y	.0097927	.007805	1.25	0.210	-.0055049	.0250903
1.resid_10y_more	-.0067937	.0062169	-1.09	0.274	-.0189786	.0053911
1.lang_advanced	.0070631	.007892	0.89	0.371	-.0084049	.0225312
1.lang_beginner	.0274342	.0121151	2.26	0.024	.0036889	.0511794
1.age_35_49	-.0104145	.0027871	-3.74	0.000	-.0158771	-.0049518
1.age_50_64	-.0096832	.0028285	-3.42	0.001	-.0152269	-.0041395
1.temporary	-.0104581	.0034852	-3.00	0.003	-.0172888	-.0036273
1.parttime	.0386317	.0028207	13.70	0.000	.0331032	.0441602
1.size_1_9	.0246751	.0026591	9.28	0.000	.0194634	.0298868
1.size_50_more	-.0188879	.0025232	-7.49	0.000	-.0238333	-.0139426

Note: dy/dx for factor levels is the discrete change from the base level.

Note: Regression on full sample (migrants, natives, EU mobile workers, identified based on country of birth). Analysis limited to population aged 20-64. Excludes Bulgaria, Hungary, Malta, Poland and Slovenia, whose EU-LFS data do not provide country of birth for people born outside Europe. The deviation from zero shows the difference with respect to the reference group in parenthesis: migrant and EU mobile workers (people born in the country of residence), towns and suburbs, and rural areas (cities), primary and tertiary education (secondary education), foreign education which indicates highest level of education achieved abroad and no formal education (highest level of education achieved in country of residence), low-skilled occupations with skill levels '1, 2 and 4' and '2' (high-skilled occupations with skill levels '3', '3 and 4' and '4'), female (male), residing for less than nine years or residing for 10 years or more (born in the country of residence), proficient language skills comprising advanced and intermediate language skills or poor language skills comprising basic, hardly any, and no language skills (mother tongue), aged 35-49 and aged 50-64 (aged 20-34), temporary job (permanent job), part-time job (full-time job), firms with less than 10 employees and firms with 50 or more employees (firms with 10 to 49 employees). *** - significant at 1%, ** significant at 5%, * significant at 10%, no * = not significant.

Source: EU-LFS 2021.

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Figure A.3

Migrants are less likely to be employed

Factors connected to the probability of being employed vs being not employed, 2021, EU

Average marginal effects
Model VCE: Robust

Number of obs = 483,264

Expression: Pr(employed), predict()
dy/dx wrt: 1.migrant 1.eu_mobile 1.town 1.rural 1.low_education 1.high_education 1.foreign_edu
1.no_formal_edu 1.female 1.resid_below_9y 1.resid_10y_more 1.lang_advanced
1.lang_beginner 1.age_35_49 1.age_50_64

	Delta-method		z	P> z	[95% conf. interval]	
	dy/dx	std. err.				
1.migrant	-.0203096	.0085145	-2.39	0.017	-.0369977	-.0036214
1.eu_mobile	.0488033	.0082595	5.91	0.000	.0326149	.0649917
1.town	.012073	.002195	5.50	0.000	.0077708	.0163752
1.rural	.0218862	.0023483	9.32	0.000	.0172837	.0264887
1.low_education	-.1345236	.0027824	-48.35	0.000	-.139977	-.1290702
1.high_education	.1195175	.0021283	56.16	0.000	.1153461	.1236888
1.foreign_edu	-.0176072	.0056657	-3.11	0.002	-.0287118	-.0065025
1.no_formal_edu	-.1895671	.0136193	-13.92	0.000	-.2162605	-.1628737
1.female	-.1014725	.0018847	-53.84	0.000	-.1051665	-.0977785
1.resid_below_9y	-.0681434	.0073391	-9.28	0.000	-.0825278	-.0537589
1.resid_10y_more	-.0179518	.0057433	-3.13	0.002	-.0292084	-.0066952
1.lang_advanced	-.0156467	.0071353	-2.19	0.028	-.0296315	-.0016618
1.lang_beginner	-.0890004	.01106	-8.05	0.000	-.1106777	-.0673232
1.age_35_49	.1375396	.0022918	60.01	0.000	.1330477	.1420314
1.age_50_64	.0088526	.0023267	3.80	0.000	.0042924	.0134129

Note: dy/dx for factor levels is the discrete change from the base level.

Note: Regression on full sample (migrants, natives, EU mobile workers, identified based on country of birth). Analysis limited to population aged 20-64. Excludes Bulgaria, Hungary, Malta, Poland and Slovenia, whose EU-LFS data do not provide country of birth for people born outside Europe. The deviation from zero shows the difference with respect to the reference group in parenthesis: migrant and EU mobile workers (people born in the country of residence), towns and suburbs, and rural areas (cities), primary and tertiary education (secondary education), foreign education which indicates highest level of education achieved abroad and no formal education (highest level of education achieved in country of residence), female (male), residing for less than nine years or residing for 10 years or more (born in the country of residence), proficient language skills comprising advanced and intermediate language skills or poor language skills comprising basic, hardly any, and no language skills (mother tongue), aged 35-49 and aged 50-64 (aged 20-34). *** significant at 1%, ** significant at 5%, * significant at 10%, no * = not significant.

Source: EU-LFS 2021.

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Figure A.4

Migrating for employment reasons increases the probability of being employed

Factors connected to the probability of being employed vs being not employed for migrants, 2021, EU

Average marginal effects
Model VCE: Robust

Number of obs = 37,906

Expression: Pr(employed), predict()
dy/dx wrt: 1.town 1.rural 1.low_education 1.high_education 1.foreign_edu 1.no_formal_edu 1.female
1.resid_more_10_years 1.lang_advanced 1.lang_beginner 1.age_35_49 1.age_50_64
1.reason_empl

	Delta-method		z	P> z	[95% conf. interval]	
	dy/dx	std. err.				
1.town	-.0025758	.0088282	-0.29	0.770	-.0198707	.0147271
1.rural	.0071625	.011279	0.64	0.525	-.014944	.0292689
1.low_education	-.0805608	.0101801	-7.91	0.000	-.1005135	-.0606081
1.high_education	.0977283	.0091475	10.68	0.000	.0797996	.115657
1.foreign_edu	-.0405878	.0088149	-4.60	0.000	-.0578648	-.0233109
1.no_formal_edu	-.1352609	.0238633	-5.67	0.000	-.1820321	-.0884898
1.female	-.1521784	.0077907	-19.53	0.000	-.1674478	-.1369089
1.resid_more_10_years	.0796085	.0104644	7.61	0.000	.0590986	.1001184
1.lang_advanced	-.0226743	.0091415	-2.48	0.013	-.0405914	-.0047572
1.lang_beginner	-.1507334	.0137509	-10.96	0.000	-.1776847	-.1237822
1.age_35_49	.0687274	.0100278	6.85	0.000	.0490733	.0883816
1.age_50_64	-.0260057	.0112236	-2.32	0.021	-.0480036	-.0040079
1.reason_empl	.1453038	.009227	15.75	0.000	.1272192	.1633884

Note: dy/dx for factor levels is the discrete change from the base level.

Note: Regression on full sample (migrants, natives, EU mobile workers, identified based on country of birth). Analysis limited to population aged 20-64. Excludes Hungary, Malta, Poland and Slovenia, whose EU-LFS data do not provide country of birth for people born outside Europe. The deviation from zero shows the difference with respect to the reference group in parenthesis: towns and suburbs, and rural areas (cities), primary and tertiary education (secondary education), foreign education which indicates highest level of education achieved abroad and no formal education (highest level of education achieved in country of residence), female (male), residing for less than nine years or residing for 10 years or more (born in the country of residence), proficient language skills comprising advanced and intermediate language skills or poor language skills comprising basic, hardly any, and no language skills (mother tongue), aged 35-49 and aged 50-64 (aged 20-34), employment as the main reason for migration (other reasons such as family reasons, education or training, retirement or international protection, as the main reason for migration). *** significant at 1%, ** significant at 5%, * significant at 10%, no * = not significant.

Source: EU-LFS 2021.

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Figure A.5

Migrants are more likely to work in non-standard forms of employment

Factors connected to the probability of non-standard forms of employment vs full-time permanent employment, 2021, EU

Average marginal effects
Model VCE: Robust

Number of obs = 599,516

Expression: Pr(prec), predict()
dy/dx wrt: 1.migrant 1.eu_mobile 1.lsocc 1.low_skilled 1.town 1.rural 1.low_education
1.high_education 1.foreign_edu 1.no_formal_edu 1.female 1.resid_below_9y
1.resid_10y_more 1.lang_advanced 1.lang_beginner 1.age_35_49 1.age_50_64 1.size_1_9
1.size_50_more

	Delta-method				
	dy/dx	std. err.	z	P> z	[95% conf. interval]
1.migrant	.0306938	.0107508	2.86	0.004	.0096225 .051765
1.eu_mobile	-.0225667	.0110015	-2.05	0.040	-.0441292 -.0010041
1.lsocc	.0179914	.0024001	7.50	0.000	.0132873 .0226954
1.low_skilled	.0361986	.0023923	15.13	0.000	.0315098 .0408874
1.town	-.0011343	.0022112	-0.51	0.608	-.0054681 .0031995
1.rural	-.0270637	.0024678	-10.97	0.000	-.0319005 -.0222269
1.low_education	.0553603	.0030258	18.30	0.000	.0494299 .0612908
1.high_education	-.0163424	.0024247	-6.74	0.000	-.0210947 -.0115902
1.foreign_edu	.0277633	.0076601	3.62	0.000	.0127498 .0427768
1.no_formal_edu	.1196777	.026244	4.56	0.000	.0682404 .1711149
1.female	.2261325	.0019382	116.67	0.000	.223337 .2299313
1.resid_below_9y	.0353608	.008658	4.08	0.000	.0183915 .0523301
1.resid_10y_more	.0032299	.0061537	0.52	0.600	-.0088312 .0152909
1.lang_advanced	.0022661	.0094915	0.24	0.811	-.016337 .0208692
1.lang_beginner	.0612171	.015226	4.02	0.000	.0313747 .0910595
1.age_35_49	-.1069228	.0023209	-46.07	0.000	-.1114716 -.102374
1.age_50_64	-.1095568	.0022854	-47.94	0.000	-.1140362 -.1050775
1.size_1_9	.1216949	.0028989	41.98	0.000	.1160131 .1273767
1.size_50_more	-.0468709	.0022057	-21.25	0.000	-.0511939 -.0425478

Note: dy/dx for factor levels is the discrete change from the base level.

Note: Regression on the full sample (migrants, natives, EU mobile workers, identified based on country of birth). Analysis limited to population aged 20-64. Excludes Bulgaria, Hungary, Malta, Poland and Slovenia, whose EU-LFS data do not provide country of birth for people born outside Europe. The deviation from zero shows the difference with respect to the reference group in parenthesis: migrant and EU mobile workers (people born in the country of residence), labour shortage occupations (non-labour shortage occupations), low-skilled occupations with skill levels '1, 2 and 4' and '2' (high-skilled occupations with skill levels '3', '3 and 4' and '4'), towns and suburbs, and rural areas (cities), primary and tertiary education (secondary education), foreign education which indicates highest level of education achieved abroad and no formal education (highest level of education achieved in country of residence), female (male), residing for less than nine years or residing for 10 years or more (born in the country of residence), proficient language skills comprising advanced and intermediate language skills or poor language skills comprising basic, hardly any, and no language skills (mother tongue), aged 35-49 and aged 50-64 (aged 20-34), firms with less than 10 employees and firms with 50 or more employees (firms with 10 to 49 employees). *** significant at 1%, ** significant at 5%, * significant at 10%, no * = not significant.

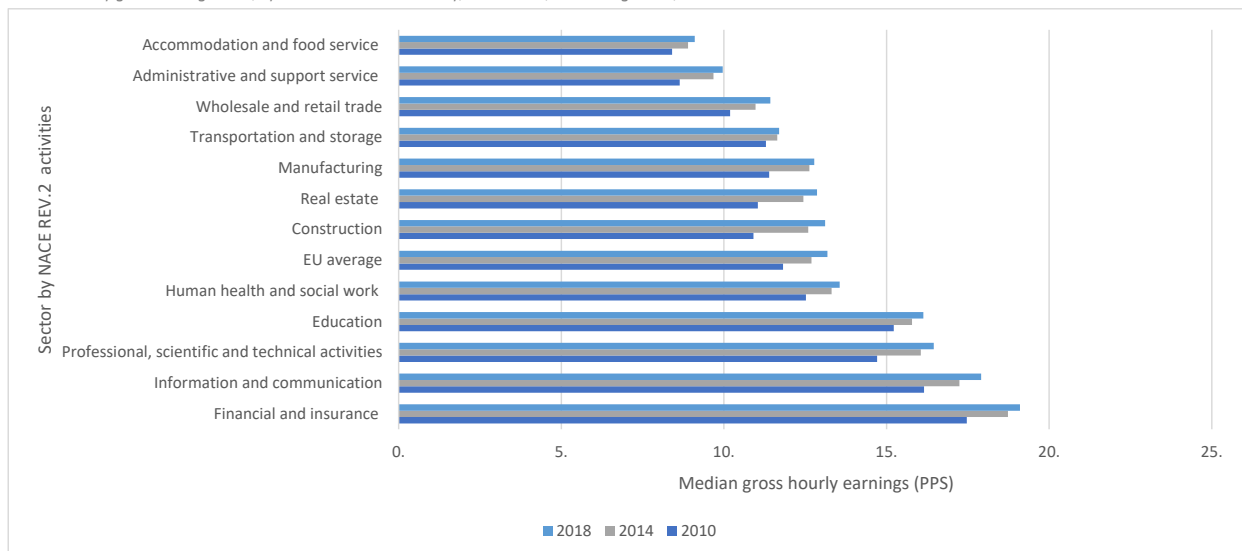
Source: EU-LFS 2021.

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Chart A.4

Sectors with persistent labour shortages had both above and below EU average median hourly earnings

Median hourly gross earnings (PPS), by sector of economic activity, 2010-2018, NACE 1-digit level, EU-27



Note: Size classes in number of employees is for 10 employees or more. Includes a selection of economic sectors, together with shortage sectors.

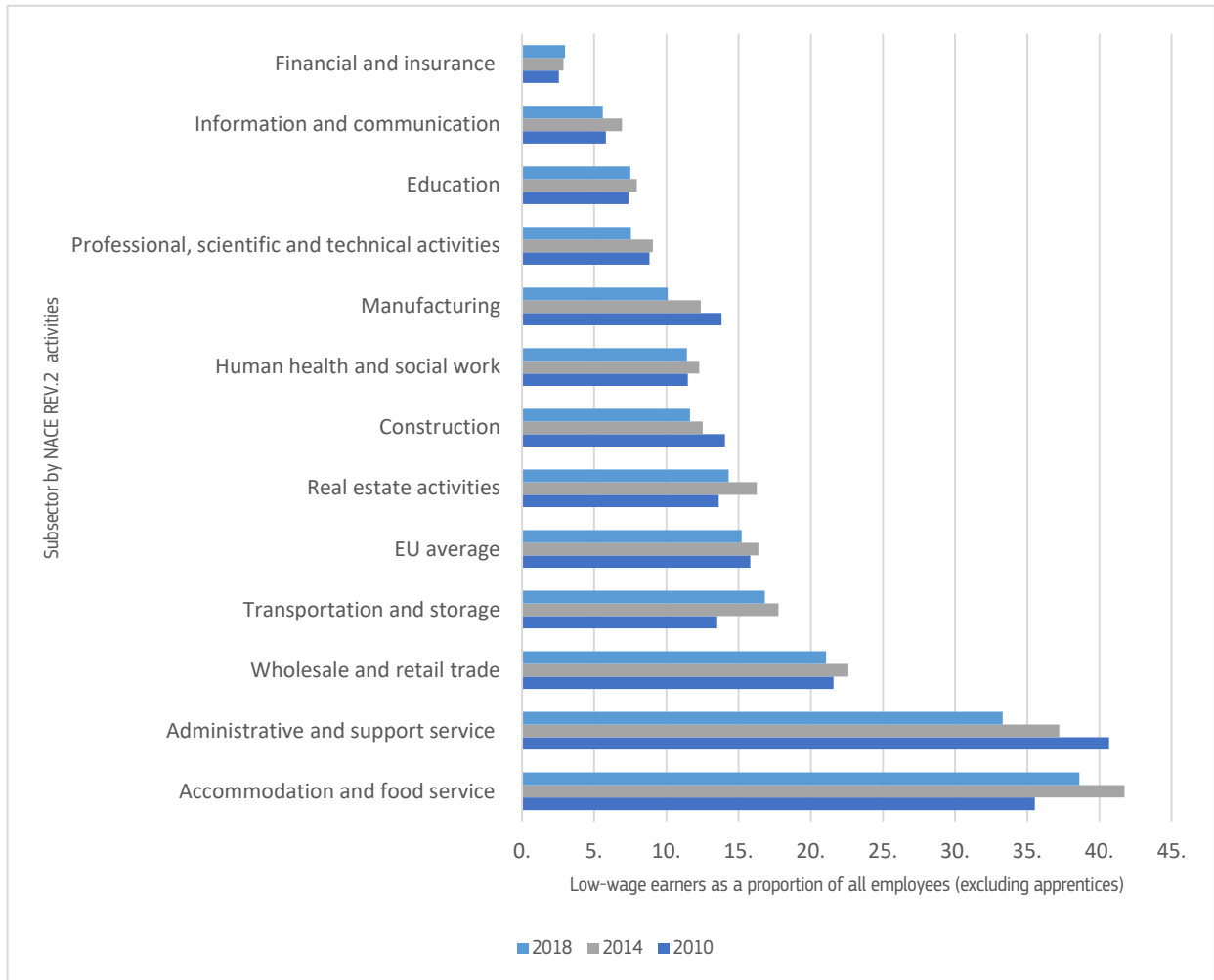
Source: SES [EARN_SES_PUB2N]

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Chart A5

Share of low-wage earners was above the EU average in two shortage sectors

Low-wage earners as a proportion of all employees (excluding apprentices), by economic activity, 2010-2018, NACE 1-digit level, EU-27



Note: Size classes in number of employees is for 10 employees or more. Includes a selection of economic activity sectors, together with shortage sectors.

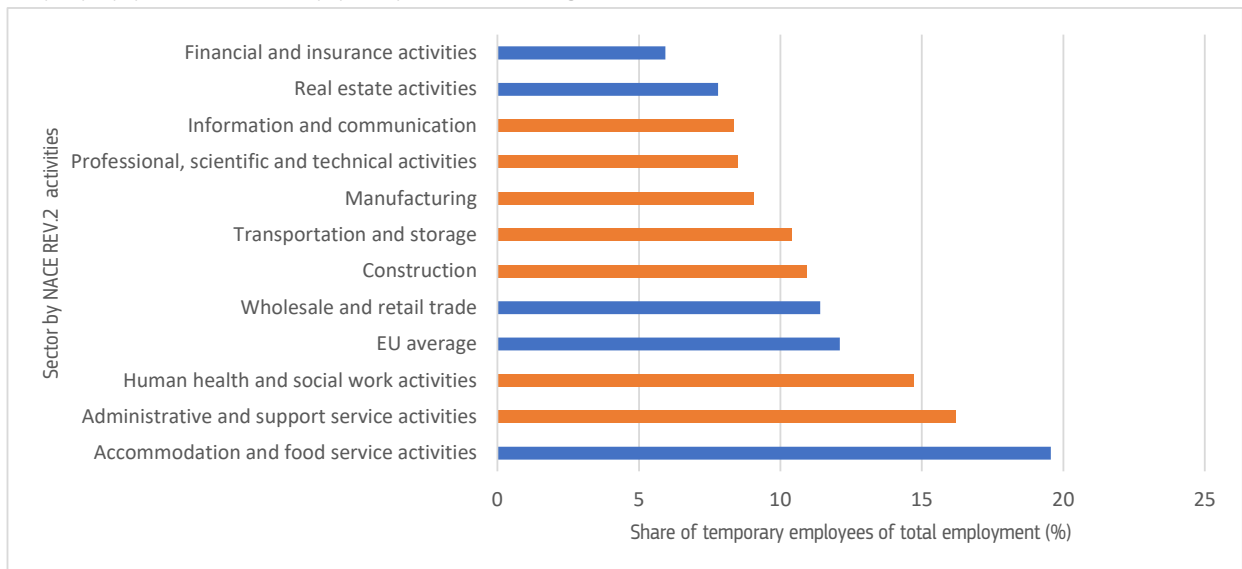
Source: SES [EARN_SES_PUB1N]

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Chart A6

High shares of temporary employment in some shortage sectors

Temporary employees as a share of total employment, by sector, 2021, NACE 1-digit level, EU-27



Note: Includes a selection of economic activity sectors, together with shortage sectors.

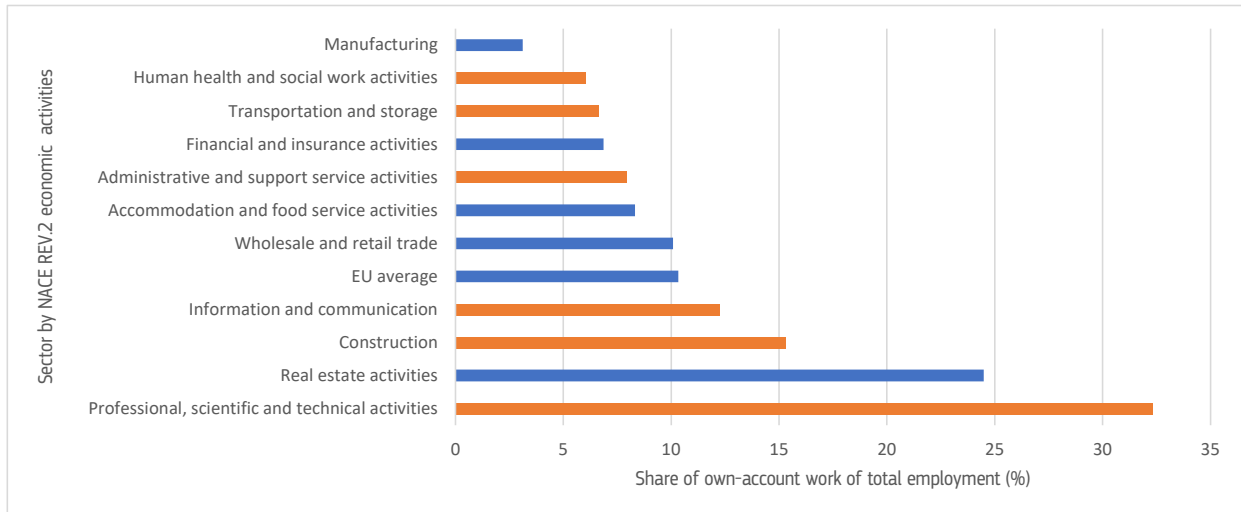
Source: EU-LFS 2021.

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Chart A.7

Solo self-employment is more common in some shortage sectors.

Own-account workers as a share of total employment and job vacancy rate (%), by sector, 2021, NACE 1-digit level, EU-27.



Source: EU- LFS 2021.

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Policies to support labour market participation and address skills shortages

1. INTRODUCTION ⁽²⁹²⁾

This chapter presents an overview of the key policies and reform measures that could alleviate increasingly acute labour and skills shortages in the EU. Labour shortages could be addressed by: improving the financial incentives for work for some population groups, e.g. reviewing tax-benefit systems; removing barriers to entering the workforce, e.g. expanding childcare access to help mothers to engage in paid work; ⁽²⁹³⁾ improving the matching between job requirements and candidates' education, experience, and skills; and promoting targeted temporary and/or permanent labour migration of third-country nationals to bridge labour shortages.

The tax-benefit system is the key policy tool available to governments to influence people's financial incentives to work. Section 2. describes the effects of a number of tax reforms that could incentivise people to participate more in the labour market. Section 2.1. compares three possible tax-cut scenarios with the same direct, short-term fiscal cost of 0.2% of GDP: 1) an across-the-board personal income tax (PIT) cut; 2) a targeted PIT cut for low-income earners; and 3) introduction or extension of income tax credits for low-income earners. Results reveal that targeted tax reforms have a significantly larger impact on labour supply, and therefore on the economy in general, than across-the-board PIT cuts. Such measures promote access to inclusive labour markets as also highlighted in the 2023 Council Recommendation on adequate minimum income. Two additional simulations demonstrate the work disincentives for secondary earners created by family taxation schemes in some Member States (e.g. Belgium, Spain).

The provision of adequate and affordable early childhood education and care (ECEC) can contribute to addressing labour shortages by increasing women's readiness to engage in paid work. Availability of accessible, affordable, and high-quality ECEC remains limited in several Member States, especially for children under three years of age. Section 2.2. uses newly available data to analyse several factors limiting childcare participation in the EU. It highlights that while net childcare costs (NCC) have decreased significantly compared to women's median full-time earnings, formal childcare remains very expensive in a number of Member States. It also shows that while childcare (and primary education) is often within easy driving distance, it is considerably more difficult to reach on foot. Finally, it presents simulations that show that improving childcare participation would have a significant impact on mothers' labour market activity.

⁽²⁹²⁾ This chapter was written by Jakub Caisl, Jose Victor Cremonesi Giarola, Katarina Jaksic, Gabor Katay, Anna Lalova and Nora Wukovits-Votzi, with contributions from Vanda Almeida, Claire Hoffmann, Sebastian Königs, Ana Moreno Monroy, Anne Lauringson, and Theodora Xenogiani from the OECD; and Ana Agundez Garcia, Michael Christl, Tryfonas Christou, Hugo Cruces, Francesca Crucitti, Silvia De Poli, Francesco Figari, Abián García-Rodríguez, Adrian Hernandez, Nicholas Lazarou, Edlira Narazani, Silvia Navarro Berdeal, Fidel Picos, Simone Salotti and Hannes Serruys from the JRC.

⁽²⁹³⁾ Other barriers to employment are outside the scope of this report, such as disability or access to long-term care.

Improving skills anticipation and upskilling/reskilling to match the demand in the labour market helps to address labour shortages. Section 3. gives an overview of the methods used to anticipate future labour market needs, as well as the policy instruments available at EU and national level to support skills development in sectors currently experiencing the greatest labour shortages. It then presents the impact evaluation of specific vocational training programmes in two Member States (Lithuania and Finland). The section assesses the regional economic effects of hypothetical policies that would successfully reduce skills mismatches in a number of European regions and explores the influence of travel time/distance to PES on skills matching.

Targeted labour migration policy could contribute to reducing labour shortages and boosting the economy. Section 3.4. evaluates the long-term macroeconomic impact of a hypothetical scenario in which half of the current excess labour shortages in six Member States (Austria, France, Germany, Poland, Spain and Sweden) compared to the 2011 levels (i.e. before the labour shortage measure started to steadily increase in the EU) would be addressed by targeted labour migration.

Finally, Section 3.5. highlights the importance of social dialogue and the role of social partners in tackling labour and skills shortages. It shows that social partners are key actors in providing tailored training, improving working conditions, collaborating with PES, and facilitating adult learning opportunities.

2. SUPPORTING LABOUR MARKET PARTICIPATION

Labour market participation can be increased by encouraging people to participate more in the labour market, or by removing barriers to entry into paid work. This section presents two key policy areas that can be used to improve people's financial incentives to work and to facilitate their (re-)entry into the labour market. It presents the impacts of a set of hypothetical reforms of direct taxation of labour income and shows how such reforms could be used effectively to increase labour market activity rates of some selected population groups. This is followed by a detailed analysis of the affordability and accessibility of childcare facilities in the EU and their effects on mothers' labour supply.

2.1. Tax-benefit systems supporting activation ⁽²⁹⁴⁾

Targeted decreases in tax on labour can be effective in fostering labour market participation and helping to address labour shortages. In a simple model framework, individuals choose between working (or actively seeking employment) or staying out of the labour force on the basis of their (potential) net income from work, i.e. the amount that they keep (or would keep if they worked) after deductions of income tax, social security contributions, and other deductions, the (means-tested) benefits they would lose when accepting a job, and their preference for labour or leisure. Consequently, if the net income that an individual can earn increases, their willingness to work (and therefore to give up part of their leisure time) may also increase.

The impact of a labour tax cut on people's labour force participation varies considerably across population groups. Typically, the population groups whose employment is most responsive to financial incentives of the tax and benefit system are those with lower levels of education, low-wage earners, secondary earners in the household (mainly women), mothers of young children, and older people. As these groups typically have relatively low labour market participation rates (see Chapter 2), the tax system is a key policy tool to activate those with fewer incentives to work.

The impact of a labour tax cut largely depends on the details of the reform. Table 3.1 and Table 3.2 present the effects of various hypothetical PIT reforms on individuals' labour force participation decisions for five Member States: Austria, Hungary, Italy, Belgium and Spain. Five tax reforms are considered. In the first across-the-board PIT cut scenario, the tax rates of all individuals with positive tax liabilities are reduced by the same pp. In the second scenario, the PIT cut is concentrated on low-income earners: a new lower PIT bracket is introduced to reduce the marginal tax rate for individuals earning below 80% of the median wage. ⁽²⁹⁵⁾ The average tax paid by higher-income earners is also affected, as all taxpayers see part of their income falling within the first bracket. ⁽²⁹⁶⁾ In the third scenario, a monthly lump sum Earning Income Tax Credit is introduced, up to 80% of the median monthly wage, adjusted for hours worked per week. The Earning Income Tax Credit corresponds to a specific amount by which the total tax liability is reduced. It is refundable, i.e. it leads to negative tax liabilities if the original tax paid is lower than the amount of the tax credit itself. In this scenario, the Earning Income Tax

⁽²⁹⁴⁾ This subsection is based on work carried out by JRC-Seville.

⁽²⁹⁵⁾ The upper threshold of the new bottom bracket is set at the level of the tax base of a person with 80% of the median income (and no other income), living alone.

⁽²⁹⁶⁾ In a simple tax system without tax credit, the first euro earned is taxed at the same marginal rate for all individuals, independent of their total income.

Box 3.1: Estimating the labour supply effects of tax reforms

The estimates are obtained using EUROLAB,⁽¹⁾ the JRC's multidimensional discrete choice model of labour supply. Participation rates and hours of work are computed by means of the unconditional probabilities (not participating, working part-time, full-time or more than full-time), by indexing incomes of EU-SILC 2020 to 2022 levels and calculating counterfactual opportunity sets of individuals by applying the baseline and reform scenarios to the updated input data using the EUROMOD microsimulation model.⁽²⁾

⁽¹⁾ EUROLAB is an econometric labour supply/demand model that estimates the impact of fiscal policy reforms on labour supply decisions and employment (Narazani et al., 2022).

⁽²⁾ EUROMOD is the tax-benefit microsimulation model for the EU. Information available here (Sutherland and Figari, 2013).

Credit is phased out by a rate of 5%, i.e. the tax credit for which the taxpayer is eligible is gradually reduced as their income increases above the threshold of 80% of the median income. After a certain income level, individuals do not benefit from this reform at all. In the fourth scenario, the joint taxation system in Belgium and Spain – whereby pooled earnings of couples are considered when determining married individuals' tax rates and tax liability – is completely abolished. The fifth and final scenario combines the previous reform with the across-the-board PIT cut scenario. With the exception of the fourth (abolition of joint taxation) scenario, all reforms are calibrated such that the static (i.e. short-term, without possible behavioural changes in individuals' labour choices) budgetary cost of the reform is 0.2% of GDP.

Targeted tax reforms have a significantly larger positive impact on labour supply (and thus on the economy in general) than across-the-board PIT cuts. The PIT cut for low-income earners targets a population group that is more responsive to the increase in net revenue than the general reduction in tax burden for all individuals. As a consequence, the aggregate labour market participation increases significantly more in this scenario than in the across-the-board PIT cut scenario. On average, across countries and considering all people, the PIT cut for low-income earners increases the aggregate participation rate 4 pp more than the across-the-board PIT cut scenario (Table 3.1, Table 3.2). The smallest difference is observed for Spain, where the income tax paid by low-income earners is already very small. The additional labour force primarily comes from lower income earners (first two income quintiles and people with (at most) primary education; see the corresponding lines in the two tables), but the distributional impact of the reform also depends on the pre-reform tax system. In terms of the increase in participation rates, the overall impact of the introduction/extension of an Earning Income Tax Credit is up to eight times higher than an across-the-board PIT cut, and up to four times higher than the PIT cut for low-income earners. The advantage of the Earning Income Tax Credit compared to the second scenario is that the reform does not affect the average tax rate of high-income earners. It is therefore less costly for the government to reduce the tax paid by low-income earners by the same amount as in the second scenario, i.e. a larger reduction in the average tax rate for low-income earners can be achieved for the same budgetary cost. Overall, this analysis highlights the potential to improve labour market participation of low-income earners by targeted tax reforms, as outlined in the 2023 Council Recommendation on adequate minimum income ensuring active inclusion.⁽²⁹⁷⁾

⁽²⁹⁷⁾ See [https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32023H0203\(01\)&from=EN](https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32023H0203(01)&from=EN).

Table 3.1

Targeted tax reforms have a significantly larger positive impact on labour supply

Long-term impact of tax reforms on participation rates (pp change), Austria, Hungary, Italy

	AT			HU			IT		
	Across-the-board PIT cut	PIT cut for low-income earners	Earning Income Tax Credit	Across-the-board PIT cut	PIT cut for low-income earners	Earning Income Tax Credit	Across-the-board PIT cut	PIT cut for low-income earners	Earning Income Tax Credit
All people	0.04	0.09	0.38	0.08	0.13	0.39	0.13	0.17	0.57
Primary education	0.06	0.13	0.81	0.14	0.21	0.87	0.15	0.21	0.81
Secondary education	0.05	0.09	0.40	0.10	0.15	0.39	0.13	0.17	0.52
Tertiary education	0.04	0.07	0.23	0.02	0.05	0.15	0.10	0.13	0.36
Men	0.04	0.08	0.34	0.08	0.13	0.33	0.15	0.20	0.62
Women	0.05	0.10	0.42	0.09	0.13	0.45	0.11	0.15	0.52
1st income quintile	0.06	0.14	0.91	0.22	0.34	1.17	0.13	0.20	1.04
2nd income quintile	0.06	0.14	0.50	0.13	0.19	0.31	0.14	0.21	0.74
3rd income quintile	0.05	0.09	0.26	0.08	0.10	0.14	0.13	0.17	0.44
4th income quintile	0.04	0.06	0.15	0.06	0.08	0.11	0.12	0.15	0.35
5th income quintile	0.01	0.02	0.07	-0.02	0.01	0.06	0.11	0.13	0.31
Short-term net fiscal cost (% of GDP)	-0.20	-0.20	-0.20	-0.20	-0.20	-0.20	-0.20	-0.20	-0.20

Note: EUROMOD is the tax-benefit microsimulation model for the EU. For more details on EUROMOD, see <https://euromod-web.jrc.ec.europa.eu/> and (Sutherland, 2013). Simulations use data from EU-SILC 2020 (income reference period 2019, updated to 2022). Labour supply reactions (Narazani, 2021)...

Source: JRC simulations, based on EUROMOD version xx15.0+ and EUROLAB model simulations.

[Click here to download table.](#)

Table 3.2

Joint taxation of couples creates a significant disincentive for secondary income earners to work

Long-term impact of tax reforms on participation rates (pp change), Belgium, Spain

	BE					ES				
	Across-the-board PIT cut	PIT cut for low-income earners	Earning Income Tax Credit	Abolition of joint taxation	Abolition of joint taxation + PIT cut	Across-the-board PIT cut	PIT cut for low-income earners	Earning Income Tax Credit	Abolition of joint taxation	Abolition of joint taxation + PIT cut
All people	0.07	0.07	0.21	0.13	0.24	0.09	0.16	0.50	0.36	0.54
Primary education	0.10	0.12	0.47	0.09	0.26	0.08	0.17	0.72	0.26	0.42
Secondary education	0.07	0.09	0.27	0.12	0.24	0.10	0.18	0.58	0.37	0.56
Tertiary education	0.06	0.05	0.12	0.14	0.24	0.10	0.15	0.33	0.42	0.62
Men	0.08	0.09	0.26	0.05	0.19	0.09	0.17	0.49	0.09	0.28
Women	0.05	0.05	0.16	0.21	0.29	0.10	0.15	0.51	0.64	0.81
1st income quintile	0.09	0.13	0.61	0.00	0.14	0.03	0.05	0.93	0.03	0.11
2nd income quintile	0.09	0.11	0.31	0.11	0.23	0.07	0.14	0.67	0.35	0.51
3rd income quintile	0.09	0.10	0.21	0.15	0.26	0.12	0.27	0.44	0.56	0.81
4th income quintile	0.08	0.08	0.14	0.17	0.28	0.14	0.24	0.24	0.53	0.80
5th income quintile	0.06	0.05	0.08	0.20	0.28	0.08	0.13	0.15	0.33	0.48
Short-term net fiscal cost (% of GDP)	-0.20	-0.20	-0.20	0.15	-0.20	-0.20	-0.20	-0.20	0.24	-0.20

Source: JRC simulations, based on EUROMOD version xx15.0+ and EUROLAB model simulations.

[Click here to download table.](#)

Joint taxation of couples creates a significant disincentive for secondary income earners to work. ⁽²⁹⁸⁾

Under such a system, as in Belgium and Spain, a married secondary earner typically faces an income tax schedule with significantly higher rates than they would face as an unmarried individual and is therefore discouraged from working. ⁽²⁹⁹⁾ Consequently, a move away from the joint system could lead to an increase in secondary earners' – typically women's – labour supply. ⁽³⁰⁰⁾ In Belgium, this tax change would see women's participation rate increase by 0.21 pp, while men's labour market participation would increase by only 0.05 pp. A similar pattern emerges in Spain, with the participation rate for women increasing by 0.64 pp, compared to 0.09 pp for men. The positive impact is even higher for wealthier households (3rd quintile of the income distribution and above in Belgium; 3rd and 4th quintiles in Spain; see the bottom lines of Table 3.2) because in a progressive tax system the tax rate applied on the secondary earners' first euro earned is higher if the income of the primary earner is higher. These reforms would also generate additional revenue for the government, even in the first year of implementation, with a budgetary impact of 0.15% of GDP for Belgium and 0.24% for Spain. That additional revenue could be used to fund PIT cuts to create additional incentives for work. As an illustration, the last columns in Table 3.2 show the effects of the move from joint taxation coupled with an across-the-board PIT cut. The static budgetary cost of the reform matches the cost of the reforms presented in the first three scenarios. These two reforms combined generate the highest positive impact on the labour market and therefore on the economy.

⁽²⁹⁸⁾ The disincentive effect of family taxation is well documented. See for example (Alexander Bick, 2017).

⁽²⁹⁹⁾ Joint taxation is optional in both Belgium and Spain. The optional nature of joint taxation schemes extends married people's choices, but the disincentive effect of the system remains valid under this more complicated tax system.

⁽³⁰⁰⁾ For the discussion on Germany, see Country Report 2020 here.

Box 3.2: OECD NCC indicator

The OECD NCC indicator ⁽¹⁾ is an estimate of the amount that parents pay for formal childcare, less all childcare and related benefits, fee reductions and tax concessions, plus any impact of childcare use on other benefits and taxes (e.g. loss of homecare allowance for parents who do not use formal childcare). It is calculated using the OECD TaxBEN model, by comparing the net income of one family that utilises childcare and an otherwise similar family that does not (e.g. uses unpaid informal care).

The standard NCC indicator focuses on children aged two and three years old, as these are the ages when childcare provision is most needed, and Member States' paid parental leave typically finishes by the age of two.

The COVID-19 pandemic and resulting methodological adjustments in data collection limit the analysis to the period 2012-2019, with a separate discussion of the dynamics post-2020. Four household types are examined: low-income (20th percentile) and median-income single mothers (50th percentile), and low-income and median-income mothers in a couple, all employed and with two pre-school children aged two and three.

⁽¹⁾ OECD (2021).

2.2. Access and affordability of childcare services to support labour market activation

2.2.1. Net childcare costs (NCC)

The provision of childcare is one of the key elements in removing entry barriers to the labour force and tackling labour shortages. There is evidence that quality childcare provision has a positive impact on women's participation in the labour market and on child development across age and socioeconomic groups. ⁽³⁰¹⁾ Adequate childcare supply boosts women's employment, reduces child poverty, and provides positive fiscal returns in the longer term. ⁽³⁰²⁾ Comprehensive ECEC services affect employment from both the demand and supply sides, as they lessen parents' (particularly mothers') need to reduce their labour market participation ⁽³⁰³⁾ and mitigate employers' concerns about possible reduced employee productivity on return to work after welcoming a child.

A household's decision to use formal childcare is driven by the accessibility, affordability, and availability of ECEC services, as well as parental leave rights and cultural expectations. Women's involvement in the labour market increases as the number of available daycare slots rises. ⁽³⁰⁴⁾ In addition, the uptake of ECEC grows as the quality of services increases and information barriers linked to access (e.g. financial and cultural barriers, regional inequalities, language) are lowered. ⁽³⁰⁵⁾ Key EU-level actions for childcare are outlined in the European Care Strategy and the Council Recommendation on early childhood education and care. New 2030 ECEC participation targets are set at 45% ⁽³⁰⁶⁾ of children aged 0-2 ⁽³⁰⁷⁾ and 96% of children from the age of three to compulsory school age, mirroring the targets set in the European Education Area initiative. In addition, the European Child Guarantee aims to guarantee free ECEC to all children at risk of poverty or social exclusion.

On average, NCC decreased between 2012 and 2019, as a proportion of women's median full-time earnings. The highest decrease was recorded for single-parent households with median earnings and for couples with low earnings (-4.4 pp). Significant NCC declines were estimated in Czechia and Poland for the four household types considered. ⁽³⁰⁸⁾ In Latvia, the declines were significant for low-earning and median-earning single parents (Chart 3.1). The exceptions were Romania, Slovakia, Spain and Hungary, where the NCC rate

⁽³⁰¹⁾ Other measures such as flexible working arrangements are outside the scope of this analysis but may have positive impacts on participation.

⁽³⁰²⁾ (Narazani et al., 2022); (International Labour Office, 2022); (Ferragina, 2020).

⁽³⁰³⁾ (Kleven, Landais and Sogaard, 2019).

⁽³⁰⁴⁾ (Hank and Kreyenfeld, 2003); (Del Boca, 2015).

⁽³⁰⁵⁾ (European Commission, 2022e); (Westhoff et al., 2022).

⁽³⁰⁶⁾ The Council Recommendation on early childhood education and care: the Barcelona targets for 2030 provide for exemptions for Member States that have not yet reached the 2002 target. Those Member States whose average participation in the period 2017-2021 was below 20% will have to increase by 90%, while Member States whose average participation was 20-33% will have to increase by 45%, with a limit of 45%.

⁽³⁰⁷⁾ The policies for very young children (<1 year old) are outside the scope of the OECD NCC indicator.

⁽³⁰⁸⁾ Four household types: low-income (20th percentile) and median-income single mothers (50th percentile), and low-income and median-income mothers in a couple, all employed and with two pre-school children aged two and three.

increased across family types. Between 2019 and 2022, EU-level NCC indicators decreased by 1.3 pp on average across the selected household types

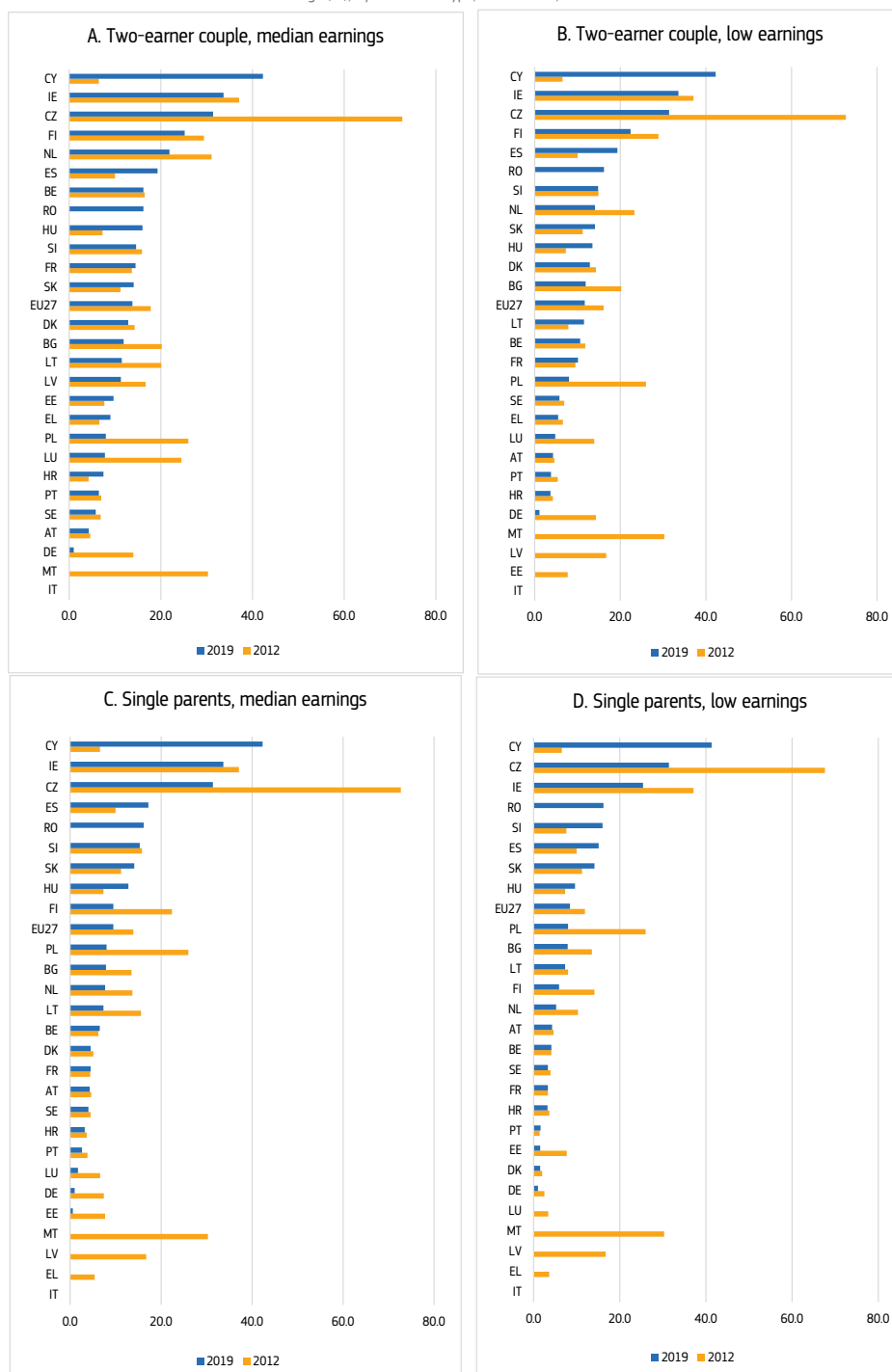
NCC vary considerably across the Member States. Based on 2019 data, NCC in Malta, Italy and Germany are very low or close to zero due to heavily subsidised childcare fees. Childcare costs are also comparatively low in Denmark and Sweden. Despite improvements in Czechia, NCC remain more than one-third of women’s median earnings. Even higher levels are recorded in Cyprus, where childcare is primarily provided through private facilities. The cost for median-earning couples in Ireland remains significantly high (Chart 3.1).

Lower NCC may foster higher ECEC participation and labour market participation of women. Looking at NCC rates, ECEC participation, and employment of mothers with two children over time (2012-2019), a

Chart 3.1

Affordability of childcare varies across household types and countries, ranging from zero to more than one-third of women’s median earnings

Member States’ NCC as a share of women’s median full-time earnings (%), by household type, 2012-2019, EU



Note: Data for Croatia, Cyprus missing in 2012. Earliest data in 2015 (Croatia) and 2018 (Cyprus) selected.

Source: OECD TaxBEN model 2021.

[Click here to download chart.](#)

negative relationship can be posited between NCC and ECEC participation and between NCC and employment. ⁽³⁰⁹⁾ All EU countries that reduced their NCC over the period saw a rise in ECEC participation and employment. The nature of the data analysed, varying granularity of the indicators, and the existence of other confounding variables limit the extent to which country-level findings may be generalised.

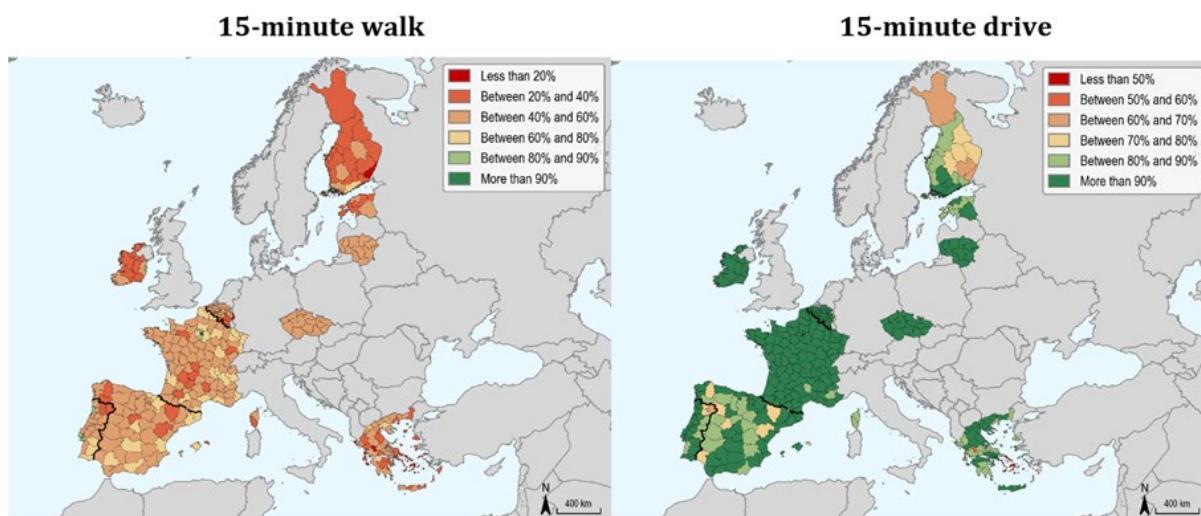
2.2.2. Geographical inequalities in accessibility of ECEC and primary education ⁽³¹⁰⁾

Geographical accessibility of ECEC providers and primary schools influence parents' decisions to work. Other important factors are availability (e.g. opening hours or capacity), cost, and quality issues. For parents of young children and for single parents in particular, the ease and flexibility of access to childcare determines decisions on taking up employment, as well as the amount of hours worked. Parents often need to bring young children to ECEC facilities and primary schools in the morning and pick them up in the afternoon, with long commutes likely to reduce the time available for paid work. In case of non-compulsory ECEC, long commutes may even induce parents not to use ECEC at all, severely limiting their options to combine childcare with paid work. This section presents early results on the geographical accessibility of ECEC facilities ⁽³¹¹⁾ and primary schools across small regions ⁽³¹²⁾ in a range of Member States ⁽³¹³⁾ from ongoing research by the OECD. ⁽³¹⁴⁾

Chart 3.2

In most regions, primary schools are not easily accessible on foot but are within a 15-minute drive

Share of population with access to a primary school within a 15-minute walk or drive, by TL3 region, 2022 or latest year available



Note: Preliminary results for EU countries with available data. Island regions of Azores and Madeira (Portugal) and the special autonomous regions Ceuta and Melilla (Spain) not included. Estimates do not consider capacity or entry criteria – distance calculated to the closest school available either via walking or driving. Driving time estimates do not consider traffic congestion and thus constitute lower bounds of people's actual driving times.

Source: OECD calculations, based on primary schools' location data obtained from several sources.

[Click here to download chart.](#)

In most regions, many children cannot reach a primary school within a 15-minute walk (Chart 3.2, left panel). In about one in two regions, less than half of the total population has access to a primary school within a 15-minute walk. Access tends to be lower in remote regions, particularly on islands (e.g. Euboea in Greece, Menorca in Spain) and in regions with low population density (e.g. Lapland in Finland, Evrytania in central Greece). Access by driving is far higher (Chart 3.2, right panel). Classifying regions into low (30-50% of population have access), medium (50-80% have access) and high (more than 80% have access) accessibility, around 98% of the population live in regions with high accessibility of primary schools within a 15-minute drive. Similar to walking, regions with lower access by driving are often remote or have low population density.

⁽³⁰⁹⁾ (European Commission, 2023d).

⁽³¹⁰⁾ This section presents preliminary findings from an OECD analysis of geographical accessibility of essential services across EU regions.

⁽³¹¹⁾ Two types of ECEC institutions are considered: early childcare (typically attended by children between 0 and 3/4 years old) and pre-primary education or kindergarten (typically attended by children between 3/4 and 5/6 years old).

⁽³¹²⁾ Analysis at the level of small (TL3) regions, which are consistent with the Nomenclature of Territorial Units for Statistics (NUTS) 3 classification adopted by Eurostat.

⁽³¹³⁾ For ECEC services: Belgium, Estonia, Finland, France, Greece and Spain (for Estonia, France, Greece and Spain, the data only include pre-primary (i.e. kindergarten) education facilities). For primary schools: Belgium, Czechia, Estonia, Finland, France, Greece, Ireland, Lithuania, Portugal and Spain.

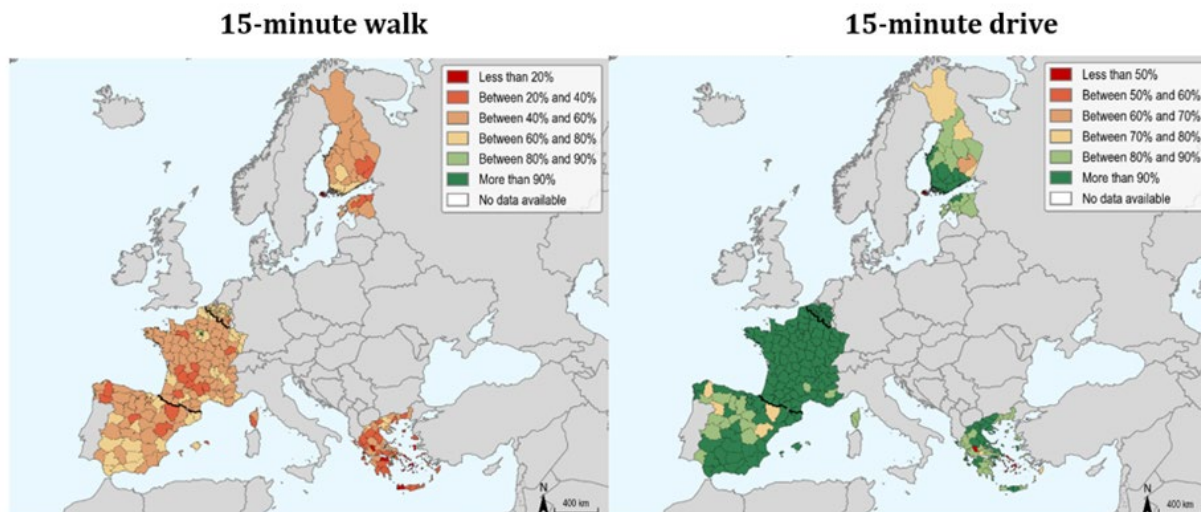
⁽³¹⁴⁾ This research is an outcome of a significant data collection effort drawing on various sources, including direct correspondence with national authorities and web scraping of information provided on public authority websites. Road networks from OpenStreetMap are used to determine the area reachable within a 15-minute and a 30-minute walk or drive from each service location point. These data are intersected with population data for each TL3 region from the Global Human Settlement population grid to give the population share within a 15-minute and a 30-minute walk or drive of a given service, for each TL3 region.

Similar conclusions can be drawn for ECEC services,⁽³¹⁵⁾ although access seems to be somewhat greater than for primary schools (Chart 3.3). Around 80% of people live in regions with medium accessibility of an ECEC facility within a 15-minute walk, while around 98% of the population live in regions with high accessibility within a 15-minute drive.

Chart 3.3

In most regions, ECEC facilities are not easily accessible on foot but are within a 15-minute drive

Share of population with access to an ECEC facility within a 15-minute walk or drive, by TL3 region, 2022 or latest year available, 2022 or latest year available



Note: Preliminary results for EU countries with available data. Primary schools: island regions Azores and Madeira (Portugal) not included. Primary schools and ECEC: special autonomous regions Ceuta and Melilla (Spain) not included. ECEC: data not available for German-speaking municipalities in Belgium (i.e. excludes *Bezirk Verviers – Deutschsprachige Gemeinschaft*). For Estonia, France, Greece and Spain only pre-primary education is covered in the ECEC services location data. Estimates do not consider capacity or entry criteria – distance is calculated to the closest ECEC provider available either via walking or driving. Driving time estimates do not consider traffic congestion and thus constitute lower bounds of people's actual driving times.

Source: OECD calculations, based on ECEC facilities location data obtained from several sources.

[Click here to download chart.](#)

The share of people living close to an ECEC facility or primary school is far higher in metropolitan than non-metropolitan regions.⁽³¹⁶⁾ The accessibility of ECEC and primary education tends to be highest in capital regions. For example, in Paris (France), 99% of people live within a 15-minute walk of an ECEC facility, while in Brussels (Belgium), 88% of people live within a 15-minute walk of a primary school. Regions with lower access tend to have lower population density, such as Haute-Vienne in France, where only 47% of people live within a 15-minute walk of an ECEC facility, or Pirkanmaa in Finland, where only 46% of people live within a 15-minute walk of the closest primary school.

Access can vary greatly between metropolitan regions for both primary schools and ECEC facilities, with some regions having low access and others almost perfect access (Chart 3.4, left panel and Chart 3.4, right panel, respectively). Even among metropolitan regions, comparisons across countries can be difficult because of differences in country size, share of population living in metropolitan regions, and types of institutions covered (i.e. kindergarten only, or including early childcare). This makes it useful to focus only on countries that are somewhat comparable, such as France and Spain (Box 3.3), two large countries for which the available ECEC data currently cover institutions at ISCED-02 (kindergarten) level only.

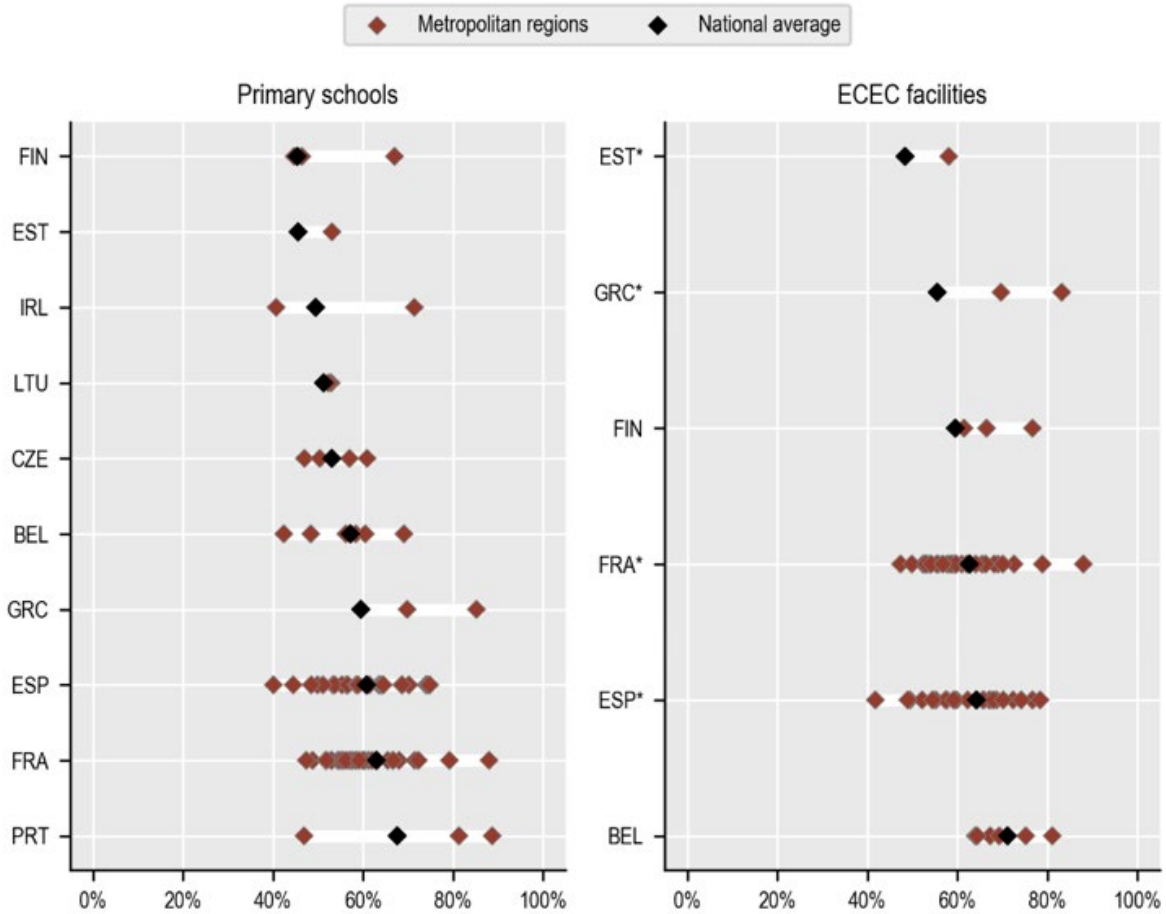
⁽³¹⁵⁾ Analysis includes private and public institutions.

⁽³¹⁶⁾ The OECD metropolitan/non-metropolitan typology for TL3 regions controls for the presence or absence of metropolitan areas and the extent to which the latter are accessible by the population living in each region. According to such typology, 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. Non-metropolitan regions are further distinguished into three types based on the size of the FUA that is most accessible to the regional population: i) near a midsize/large FUA if more than half of the population lives within a 60-minute drive from a midsize/large FUA (more than 250 000 inhabitants) or if the TL3 region contains more than 80% of the area of a midsize/large FUA; ii) near a small FUA if that region does not have access to a midsize/large FUA and at least half of its population has access to a small FUA (50 000- 250 000 inhabitants) within a 60-minute drive, or contains 80% of the area of a small FUA; and iii) remote, otherwise.

Chart 3.4

Accessibility of primary schools and ECEC services on foot varies substantially across metropolitan regions

Share of population with access to a primary school and ECEC facility within a 15-minute walk, for metropolitan TL3 regions, 2022 or latest year available



Note: Preliminary results for EU countries with available data. Countries sorted by national average in ascending order. Primary schools: island regions Azores and Madeira (Portugal) not included. Primary schools and ECEC: special autonomous regions Ceuta and Melilla (Spain) not included. For countries with * (Estonia, France, Greece and Spain), only pre-primary education is covered in ECEC services location data. Estimates do not consider capacity or entry criteria – distance calculated to the closest school/facility available either via walking or driving. Driving time estimates do not consider traffic congestion and thus constitute the lower bound of estimates of people's actual driving times.

Source: OECD calculations, based on primary schools and ECEC facilities location data obtained from several sources.

[Click here to download chart.](#)

In most countries considered, the share of the population able to access a primary school or an ECEC provider within a 15-minute walk is higher in regions where children⁽³¹⁷⁾ account for a larger population share. Further analysis is needed to determine the extent to which this finding reflects the response to local demand, i.e. the deliberate placing of ECEC facilities or primary schools in regions with many young children. An alternative explanation could be that the population share of children is greater in regions with high population density, where the coverage by ECEC services and primary schools is also higher.

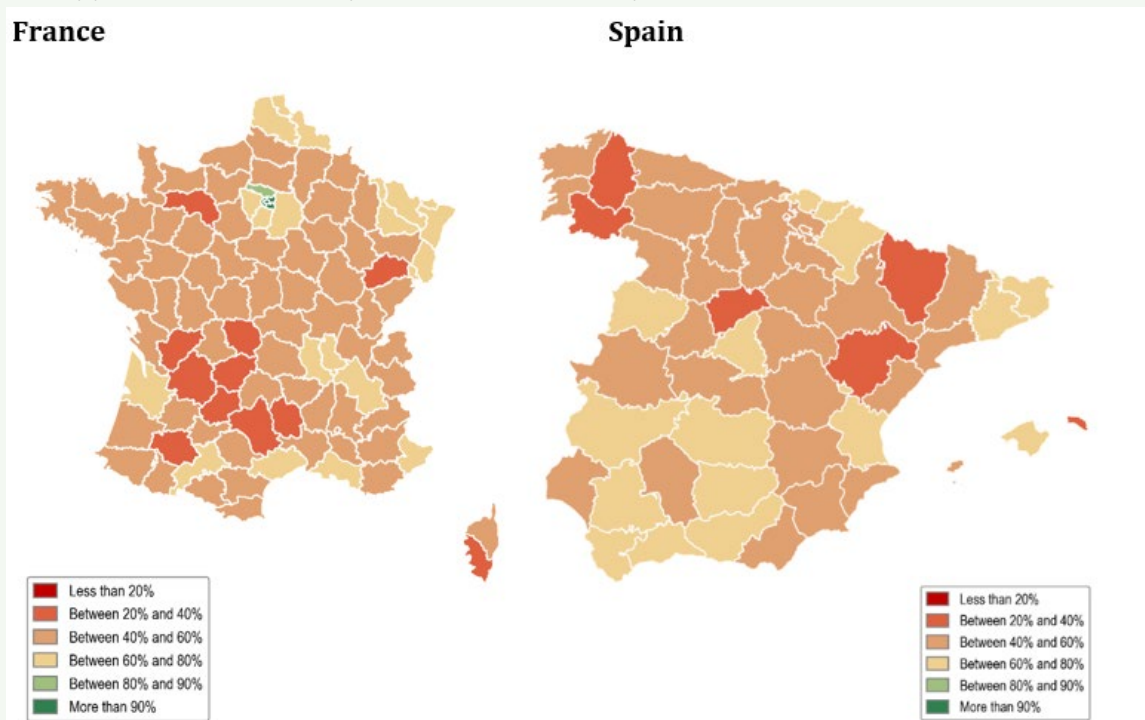
⁽³¹⁷⁾ 5-9 year olds for primary schools; 0-4 year olds for ECEC.

Box 3.3: Geographical accessibility of ECEC facilities in France and Spain

Chart 1

ECEC facilities are not easily accessible on foot in most regions of France and Spain

Share of population with access to an ECEC facility within a 15-minute walk, 2022 or latest year available



Note: Preliminary results for France and Spain. Special autonomous regions Ceuta and Melilla (Spain) not included. For both countries, only pre-primary education is covered. Estimates do not consider capacity or entry criteria – distance is calculated to the closest facility available either via walking or driving. Driving time estimates do not consider traffic congestion and thus constitute the lower bound of people's actual driving times.

Source: OECD calculations, based on ECEC facilities location data obtained from several sources.

In both France and Spain, accessibility of ECEC facilities on foot is generally low (Chart 3.3). In Spain, 14% of the population has medium accessibility within a 15-minute walk of the nearest facility, as does 20% of the population in France (corresponding to 25% of all regions in Spain and 45% in France). However, there seem to be differences in accessibility among metropolitan regions between the two countries. In France, 4 out of 35 metropolitan regions have high walking accessibility of ECEC institutions. In Spain, no region reaches this level: the metropolitan region of Madrid has the highest accessibility, with 78% of the population living within a 15-minute walk of an ECEC facility. At the lower end, in a number of regions in both countries, only about one-third of the population live within a 15-minute walking distance of the nearest ECEC facility. The lowest values are found in Lozère in the south of France and Creuse in central France (31% and 33%, respectively) and the two Galician regions of Lugo and Orense in Spain (28% and 35%, respectively). All of these are non-metropolitan regions, but the two Spanish regions are close to a small city, whereas the two French regions are remote.

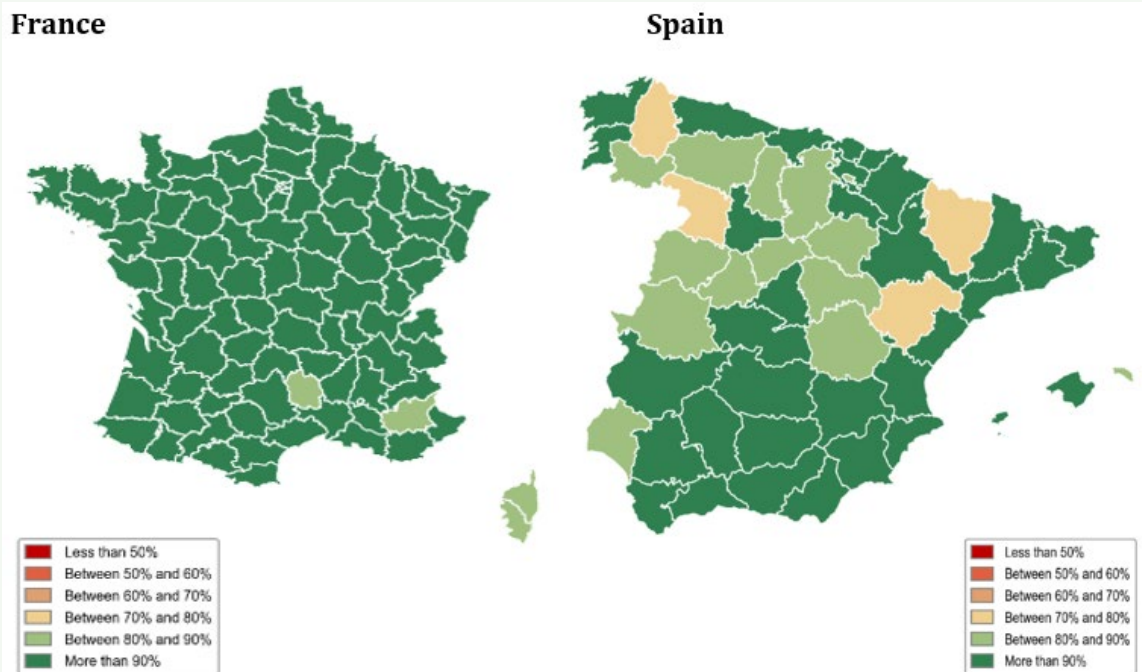
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Box (continued)

Chart 2

ECEC facilities are very accessible by car throughout France but less so in many Spanish regions

Share of population with access to an ECEC facility within a 15-minute drive, 2022 or latest year available



Note: Preliminary results for France and Spain. Special autonomous regions Ceuta and Melilla (Spain) not included. For both countries, only pre-primary education is covered. Estimates do not consider capacity or entry criteria – distance is calculated to the closest facility available either via walking or driving. Driving time estimates do not consider traffic congestion and thus constitute the lower bound of estimates people's actual driving times.

Source: OECD calculations, based on ECEC facilities location data obtained from several sources.

Disparities in the accessibility of ECEC facilities by driving are more significant (Chart 3.3). In France, all people live in regions with high accessibility of an ECEC facility within a 15-minute drive. By contrast, in Spain, four regions (Huesca, Teruel, Lugo and Zamora) experience less than high accessibility.

2.2.3. Effects of improving accessibility of childcare services

The Council Recommendation establishing a European Child Guarantee points to high ECEC costs as a barrier to participation, especially for children from low-income families. The Council Recommendation on the revision of the Barcelona targets identifies low-income mothers as particularly receptive to financial incentives. As education is a major factor in intergenerational income mobility, improving access to ECEC for these children is essential. ⁽³¹⁸⁾ The Recommendation sets a new ECEC participation target of 45% for children below three years of age. ⁽³¹⁹⁾

An increase in formal childcare provision to reach the targeted 45% ECEC participation rate would significantly increase the participation of mothers from low-income families in the labour market. The expected changes in labour participation rates of mothers living in households in the lower half of the income distribution is assessed using an extension of the combined EUROMOD-EUROLAB behavioural microsimulation model that accounts for childcare options. The model simulates the impact of additional (fully taken) childcare slots to achieve 45%, 50% and 55% ECEC participation targets, while keeping the childcare fees per child unchanged, in Austria, Hungary, and Italy (Table 3.3). In these simulations, the decision of work or stay out of the labour market is endogenous. The availability of additional child-care slots impacts the budget constraint of the relevant households, thereby influencing mothers' labour supply. The methodology is described in Box 3.4). Reaching the target of 45% is expected to increase participation of mothers living in households in the lower half of the income distribution by between 5 pp (Italy) and 17 pp (Austria) (see the second row of Table 3.3). The impact on labour supply is smaller in Italy, where formal childcare take-up and labour

⁽³¹⁸⁾ (European Commission, 2022e).

⁽³¹⁹⁾ Exemptions for Member States that have not yet reached the 2002 target: those whose average participation in the period 2017-2021 was below 20% will have to increase by 90%, while those whose average participation was 20-33% will have to increase by 45%, with a limit of 45%.

Box 3.4: Method of estimating the impacts of increasing the availability/take-up of childcare slots

The analysis is based on the childcare extension of EUROLAB, a discrete choice labour supply model that accounts for childcare options. The EUROLAB childcare extension uses EUROMOD to construct the counterfactual choices of labour supply alternatives (zero working hours, part-time, and full-time) and childcare options (public, private, informal, mother) and derive the corresponding budget sets. EUROMOD is extended with information on childcare fees for subsidised and unsubsidised childcare services.

The empirical analysis ⁽¹⁾ here follows four steps:

- Run EUROMOD and simulate the budget constraints for each counterfactual choice set;
- Estimate the parameters characterising women's preferences for childcare and labour supply for each country;
- Draw on these parameters to simulate the effect on the labour supply of mothers of an increase in formal childcare availability, assuming that additional childcare slots are fully taken to achieve 45%, 50% and 55% participation targets, and keeping childcare fees per child unchanged;
- Use estimated coefficients assigned to childcare dummies to capture the availability of subsidised and unsubsidised childcare choices. These dummies are interpreted to reflect availability of childcare types not captured by the systematic part of the utility function. Based on this interpretation, the modified coefficient assigned to the public childcare dummy interacted with the dummy identifying children at the lower half of income distribution in order to increase the availability of formal childcare for these children according to the three participation targets – 45%, 50% and 55%.

⁽¹⁾ See Narazani et al. (2022) for a detailed description of the empirical model and imputation method of childcare fees.

participation of mothers are already relatively high. ⁽³²⁰⁾ Reaching a more ambitious target of 55% would have a stronger impact on labour participation rates, particularly in Austria (25 pp). ⁽³²¹⁾

Table 3.3

Increasing ECEC participation significantly increases the labour market activity of mothers in low-income households

Effect of improving access to childcare services, Austria, Hungary, Italy

	AT			HU			IT		
	45%	50%	55%	45%	50%	55%	45%	50%	55%
Childcare slots participation target	45%	50%	55%	45%	50%	55%	45%	50%	55%
Change in participation rate (pp)	17	21	25	10	12	13	5	9	12
Additional ECEC expenditure (% of GDP)	-0.105	-0.127	-0.148	-0.135	-0.160	-0.186	-0.018	-0.033	-0.047
Net fiscal effect (% of GDP)	-0.025	-0.030	-0.036	-0.015	-0.018	-0.021	-0.006	-0.010	-0.013

Note: Barcelona target of 45% participation in ECEC for children under three. The table also presents the impacts of higher targets of 50% and 55%. EUROLAB runs on the underlying simulation results from EUROMOD on the budget sets. This analysis relies on EU-SILC 2016, which contained an ad hoc module with information on the affordability of childcare services (needed to distinguish subsidised or free formal childcare from unsubsidised care).

Source: JRC simulations, based on EUROMOD version xx15.0+ and EUROLAB model.

[Click here to download table.](#)

The budgetary costs of additional childcare placements required to reach the new target of formal childcare coverage are mitigated by the additional PIT and social security contributions from the increase in women's participation in the labour market. The static budgetary costs of additional childcare placements range between 0.018% of GDP (Italy) and 0.135% (Hungary). Reaching a target of 55% of ECEC

⁽³²⁰⁾ The participation rate of the target population of mothers in low-income families is 43.5% in Italy, compared to 30.2% in Austria and 20.7% in Hungary. Given the exemptions (Member States whose average participation in the period 2017–2021 is below 20% will have to increase it by 90%; and those whose average participation in the same period is between 20 and 33% will have to increase by 45% with a limit to 45%; see footnote ()), neither Austria nor Hungary will have to reach the 45% target by 2030. Based on the Recommendation, the two countries will have to increase ECEC participation by 45%, i.e. to the level of 43.8% for Austria and 30% for Hungary. The simulations in this section assess the effect of reaching the ultimate goal of 45% for all three countries.

⁽³²¹⁾ These estimated labour supply effects represent changes in the desired number of working hours or activity/inactivity status and disregard the demand side of the labour market or the possibility of a mismatch between desired labour supply and available jobs. When the demand side and labour market frictions are considered, final employment and the corresponding tax revenue effects should be somewhat lower.

participation would require one-and-a-half or two times more investment (Table 3.3, second row).⁽³²²⁾ However, these costs are mitigated by the government revenue generated by the increased employment of mothers.⁽³²³⁾ The net budgetary effects – which also take into account the second-round budgetary impacts triggered by substantial increases in participation and working hours of mothers – range from 0.006% of GDP (Italy) to 0.025% (Austria) and 0.015% (Hungary).

3. ASSESSMENT OF POLICIES TO ADDRESS SKILL SHORTAGES AND IMPROVE MATCHING

The 2023 European Year of Skills⁽³²⁴⁾ promotes concrete actions to boost the competitiveness of European companies and realise the full potential of the digital and green transitions in a socially fair and just manner. It promotes skills policies and investments to address labour shortages and facilitate a better-skilled and more adaptable workforce in the EU. It focuses on promoting investment in training and upskilling, improving skills mismatches, matching people’s preferences and skillsets with labour market demand, especially in the context of the green and digital transitions, and attracting skilled workers from outside the EU.

The 2023 European Year of Skills will give a new impetus to the European Skills Agenda.⁽³²⁵⁾ This five-year framework for EU skills policy cooperation aims to help businesses and individuals to develop and apply skills for sustainable competitiveness, social fairness, and resilience. It foresees 12 actions to support upskilling and reskilling for jobs through the Pact for Skills, including strengthening skills intelligence and supporting individuals in lifelong learning pathways. It also sets objectives to be achieved by 2025 in adult participation in learning,⁽³²⁶⁾ including low-qualified adults, improving access to learning experiences for the unemployed, and basic digital skills. The European Pillar of Social Rights action plan sets a target of at least 60% of all adults participating in training by 2030.⁽³²⁷⁾ The European Skills Agenda is supported by EU funding, chiefly from the European Social Fund Plus (ESF+) (EUR 61.5 billion), the Recovery and Resilience Facility (RRF) (EUR 19 billion) Erasmus (EUR 16.2 billion), InvestEU (EUR 4.9 billion), and the European Globalisation Adjustment Fund (EUR 1.1 billion), as well as the European Solidarity Corps and Digital Europe.

Table 3.4
European Skills Agenda: actions

1. Pact for Skills	2. Skills Intelligence	3. EU support for strategic national upskilling action
4. Council Recommendation on vocational education and training	5. European universities initiative and upskilling scientists	6. Skills to support the green and digital transitions
7. Increasing STEM graduates and fostering entrepreneurial and transversal skills	8. Skills for Life	9. Initiative on individual learning accounts
10. A European approach to micro-credentials	11. New Europa Platform	12. Improving the enabling framework for Member States' and private investment in skills

Source: European Skills Agenda – Employment, Social Affairs & Inclusion – European Commission (europa.eu)
Click here to download table.

This section presents the analysis of the overall impact of improved skills matching, followed by an assessment of some specific policies contributing to better matching: vocational training and lifelong learning, and access to PES. This is complemented by the presentation of the Pact for Skills in key sectors experiencing shortages, skills intelligence, and skills governance arrangements across the EU, together covering four key actions of the European Skills Agenda (Table 3.4).

⁽³²²⁾ Calculations based on 2016 Eurostat statistics on public expenditure on early education per pupil/student: EUR 7 267 for Austria, EUR 2 832 for Hungary, and EUR 4 775 for Italy. The total budgetary cost of the reform is calculated as the expenditure per pupil/student times the number of children affected for each country. The estimates are presented in Table 3.3 as a percentage of GDP, for easier comparability with other reforms.

⁽³²³⁾ Additional budgetary revenues could be generated from employing additional childcare personnel to reach the simulated formal childcare targets, and additional indirect tax revenues stemming from the increased consumption. These are not taken into account here.

⁽³²⁴⁾ European Skills Agenda available here.

⁽³²⁵⁾ 2023 European Year of Skills available here.

⁽³²⁶⁾ The European Skills Agenda sets objectives to be achieved by 2025, based on well-established quantitative indicators:

Participation of adults aged 25–64 in learning during the last 12 month: (in %): 50%

Participation of low-qualified adults 25–64 in learning during the last 12 months: (in %): 30%

Share of unemployed adults aged 25–64 with a recent learning experience: (in %): 20%

Share of adults aged 16–74 with at least basic digital skills: (in %): 70%

⁽³²⁷⁾ European Pillar of Social Rights action plan available here.

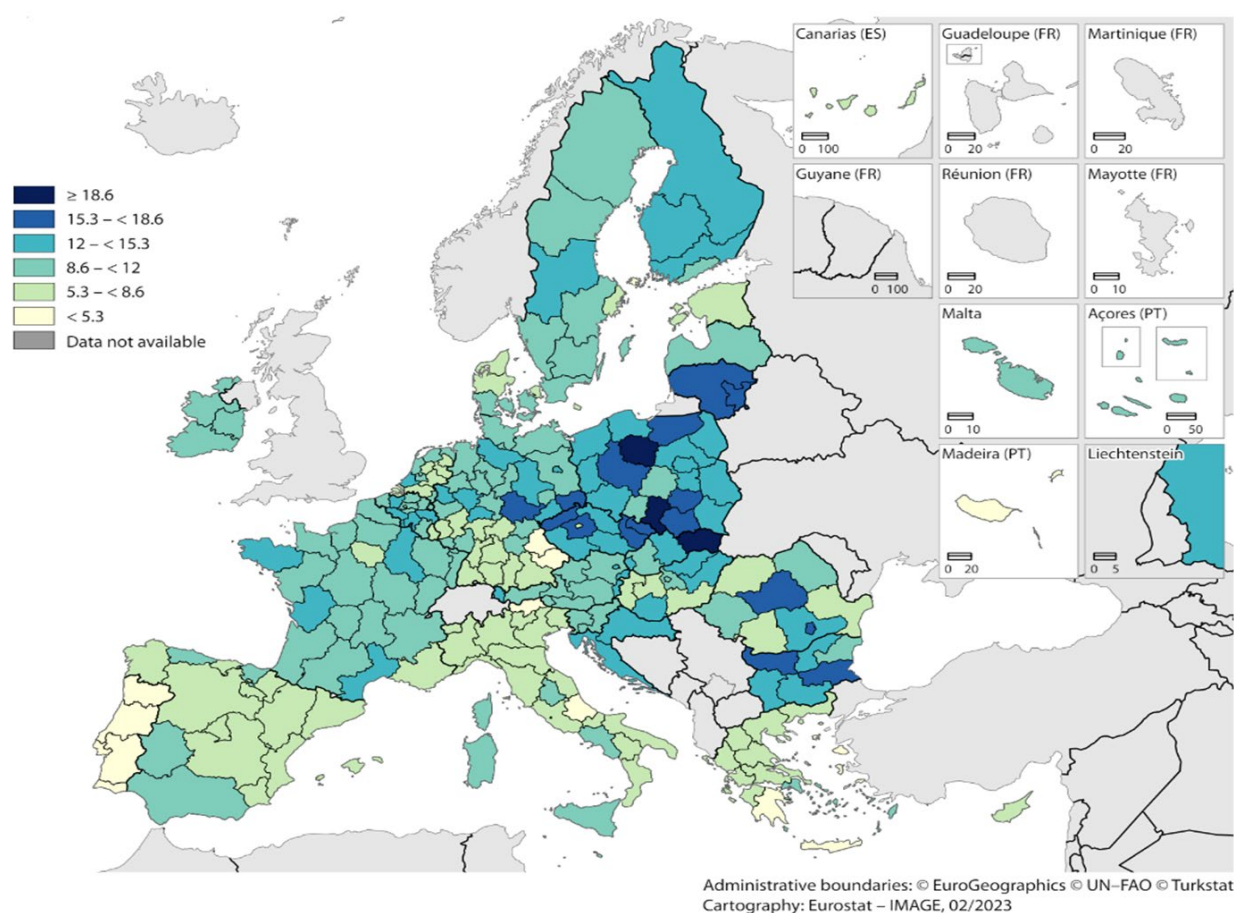
3.1. Macroeconomic effects of improvements in skills matching at regional level ⁽³²⁸⁾

Skills mismatches vary considerably across European regions. The regional distribution of the indicator of mismatch between individuals available for work (unemployed people) and the available jobs (vacancies) in 2017, the base year for this analysis, is presented in Chart 3.5.⁽³²⁹⁾ The macroeconomic skills mismatch indicators are relative dispersion measures of employment and unemployment rates across skills groups. If there is a high discrepancy between the employment and unemployment rates across skills groups in a given region, the indicator has a high value, suggesting a significant skills mismatch between labour supply and demand in that region. The median value for the skills mismatch indicator for the NUTS 2 regions of the EU was 9.63, with a maximum of 21.93 (Slovakia: SK04 – Východné Slovensko) and a minimum of 1.99 (Finland: FI20 – Åland). Skills mismatches are typically more pronounced in Central and Eastern European countries and less evident in southern Europe.

Chart 3.5

Reducing the skills mismatch indicator stimulates the economy

Macroeconomic skills mismatch indicator, 2017, NUTS 2 regions of the EU



Source: Updated macroeconomic skills mismatch indicator (based on Kiss and Vandeplass, 2015).
[Click here to download chart.](#)

⁽³²⁸⁾ This subsection presents JRC analysis. The main findings are also published in (Christou, 2023).

⁽³²⁹⁾ Original version of the mismatch indicators was proposed by (Kiss and Vandeplass, 2015). The updated indicators are available yearly for 2012-2021 and for most NUTS 2 regions; in the regions where no indicator is available, the country average is used; 2017 data are used for consistency with the RHOMOLO model used in the analysis.

Box 3.5: Simulation of the long-term impact of improvements in skills-matching on GDP in NUTS 2 regions

Based on an earlier analysis of different dimensions of skills mismatch and their theoretical and empirical relationship with productivity, the macroeconomic effects of reducing skills mismatch at regional level are simulated using the spatial dynamic Computable General Equilibrium (CGE) RHOMOLO model, ⁽¹⁾ calibrated with 2017 data. ⁽²⁾

This exercise uses the updated version of the skills mismatch indicators developed by the European Commission. ⁽³⁾ It focuses on the macroeconomic skills mismatch indicator, measuring skills mismatches between individuals available for work (unemployed people) and available jobs (vacancies). This indicator is available yearly for the 2012-2021 period and for most NUTS 2 regions; in the regions where no indicator is available, the country average is used.

The analysis uses a previously estimated non-causal relationship between the macroeconomic skills mismatch and indicators of productivity, including TFP. ⁽⁴⁾ The estimated elasticity allows the linking of improvements in skills-matching and macroeconomic performance in the RHOMOLO model, through its effect on TFP. The analysis assumes that the elasticity between the indicator and TFP is equal to -0.01, which corresponds to an intermediate value of the various specifications used in the earlier analysis (fixed effects vs random effects; full sample vs EU-15 vs EU-13; ⁽⁵⁾ and different dependent variables). As the regression is estimated in log-linear terms, this elasticity implies that a 1 pp reduction in the macroeconomic skills mismatch indicator would result in a 1% increase in TFP.

⁽¹⁾ Lecca et al. (2020).

⁽²⁾ García-Rodríguez et al. (2023).

⁽³⁾ Kiss and Vandeplas (2015).

⁽⁴⁾ Thum-Thyssen and Vandeplas (2019).

⁽⁵⁾ EU-15: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden (and then-Member State, UK); EU-13: Bulgaria, Croatia, Cyprus, Czechia, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, Slovenia.

Policies to reduce skills mismatches can have a positive impact on the economies of the regions in which they are applied. Drawing on the literature linking skills mismatches and productivity, the analysis simulated the impact of a policy that successfully reduces skills mismatches in a number of EU regions. ⁽³³⁰⁾ The first scenario assesses the macroeconomic impact of a permanent 1 pp reduction in the skills mismatch indicator for all EU regions. The territorial distribution of the long-term GDP impact related to this scenario is shown in Chart 3.6. This reduction in skills mismatch is assumed to produce a 1% permanent increase in total factor productivity (TFP) for all regions. ⁽³³¹⁾ All regions benefit from the increase in TFP. The increase in productivity makes labour and capital more valuable, and firms gradually start to increase both production factors, leading to more investment and an improvement in the labour market. Rising demand for labour leads to higher wages, with now-richer households increasing their consumption, further stimulating the economy. In addition, the all-around improvements in technology enhance trade and lead to lower prices.

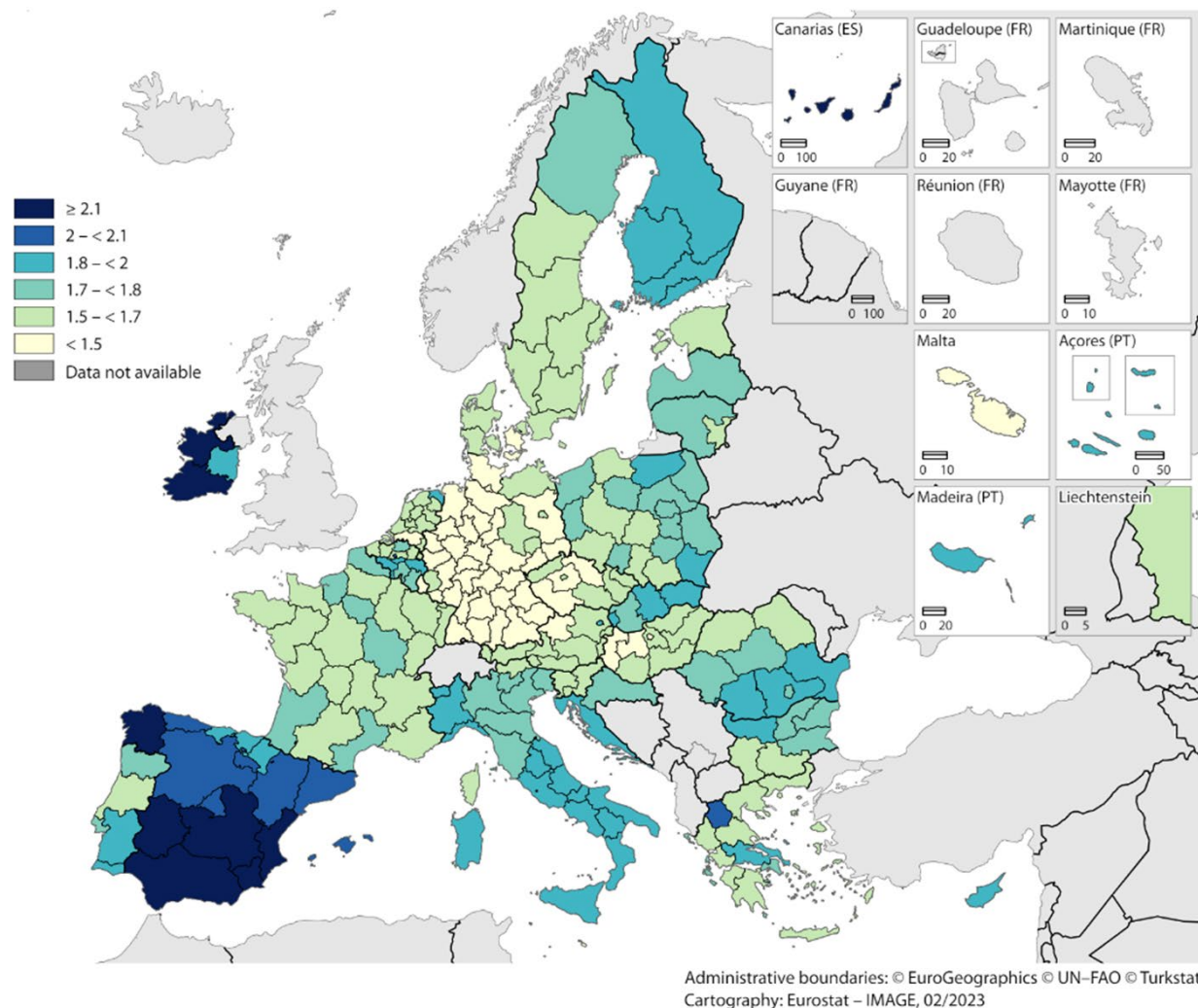
⁽³³⁰⁾ The RHOMOLO model cannot provide an explicit assessment of a specific policy to reduce skill mismatches, thus the analysis shows the macroeconomic effects of any policy that successfully reduces skills mismatches in a number of European regions. The estimated economic impacts can serve as a reference point when analysing the cost-effectiveness of such a policy. See Chart 3.5 for the methodology.

⁽³³¹⁾ (Thum-Thyssen, 2019).

Chart 3.6

Policies to reduce skills mismatches can have a positive impact on the economies of the regions

Long-term impact of 1 pp improvement in skills-matching on GDP (%), NUTS 2 regions



Source: JRC calculations, based on RHOMOLO model.

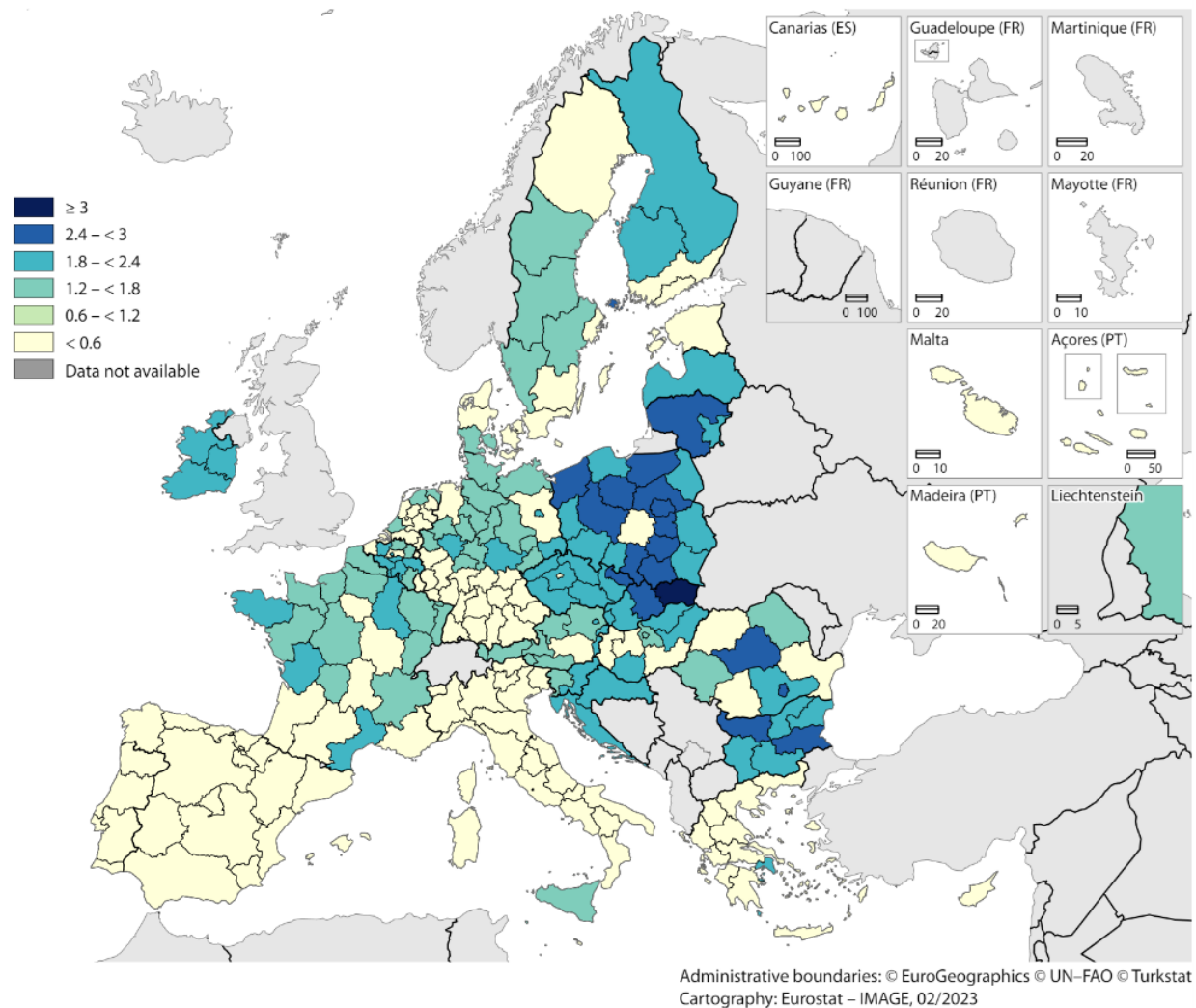
[Click here to download chart.](#)

Economic linkages mean that reducing skills mismatches in a subset of regions will also have a positive effect in other regions. This is illustrated in the second simulated scenario, which assesses the impact of a permanent 10% reduction in the macroeconomic skills mismatch indicator in regions where the indicator was above the EU median of 9.63 in 2017. Under this scenario, regions just above the median of 9.63 would see a permanent 0.96 pp reduction, on average. For example, the indicator in Slovakia (SK04 - Východné Slovensko) moves permanently from 21.93 in 2017 to 19.78 (Chart 3.7). The economic mechanisms activated by the policy intervention are the same as in the first scenario, with the shock distributed unevenly across the regions. The shocks are bigger in those regions with larger skills mismatches, which consequently enjoy greater economic benefits in the longer term. The regions targeted by the intervention (those with macroeconomic skills mismatch indicators initially above the median) see an average long-term GDP increase of 1.96%, ranging from +1.38% to +3.55%. Regions not targeted by the intervention would also see increases in their GDP, as the additional economic activity in the target regions increases the demand for intermediate outputs and final products from their trade partners. The average GDP increase in non-targeted regions is about 0.16%, with an overall increase in long-term EU GDP of 0.85%.

Chart 3.7

Regions not targeted by a skills mismatch intervention also see GDP growth

Long-term impact of 10% improvement in skills-matching on GDP (%), NUTS 2 regions



Source: JRC calculations, based on RHOMOLO model.

[Click here to download chart.](#)

3.2. Geographical inequalities in accessibility of PES ⁽³³²⁾

PES play a crucial role in connecting jobseekers with employers. They help to match supply and demand in the labour market by providing information, job search assistance, and placement. They also maintain connections with local employers to provide information and help with hiring processes. While PES offer an increasing share of their services online, ⁽³³³⁾ the physical availability of PES support within easy reach remains essential for many workers. This applies particularly to jobseekers with low digital skills and other forms of disadvantage, including older jobseekers, those with health problems, or possibly a low level of education. Some aspects of PES services may also prove difficult to provide online. Accordingly, the geographical location of PES centres has a role in the quality of job search support and can influence local labour supply.

⁽³³²⁾ This section presents preliminary findings from the OECD analysis of geographical accessibility of essential services across EU regions.

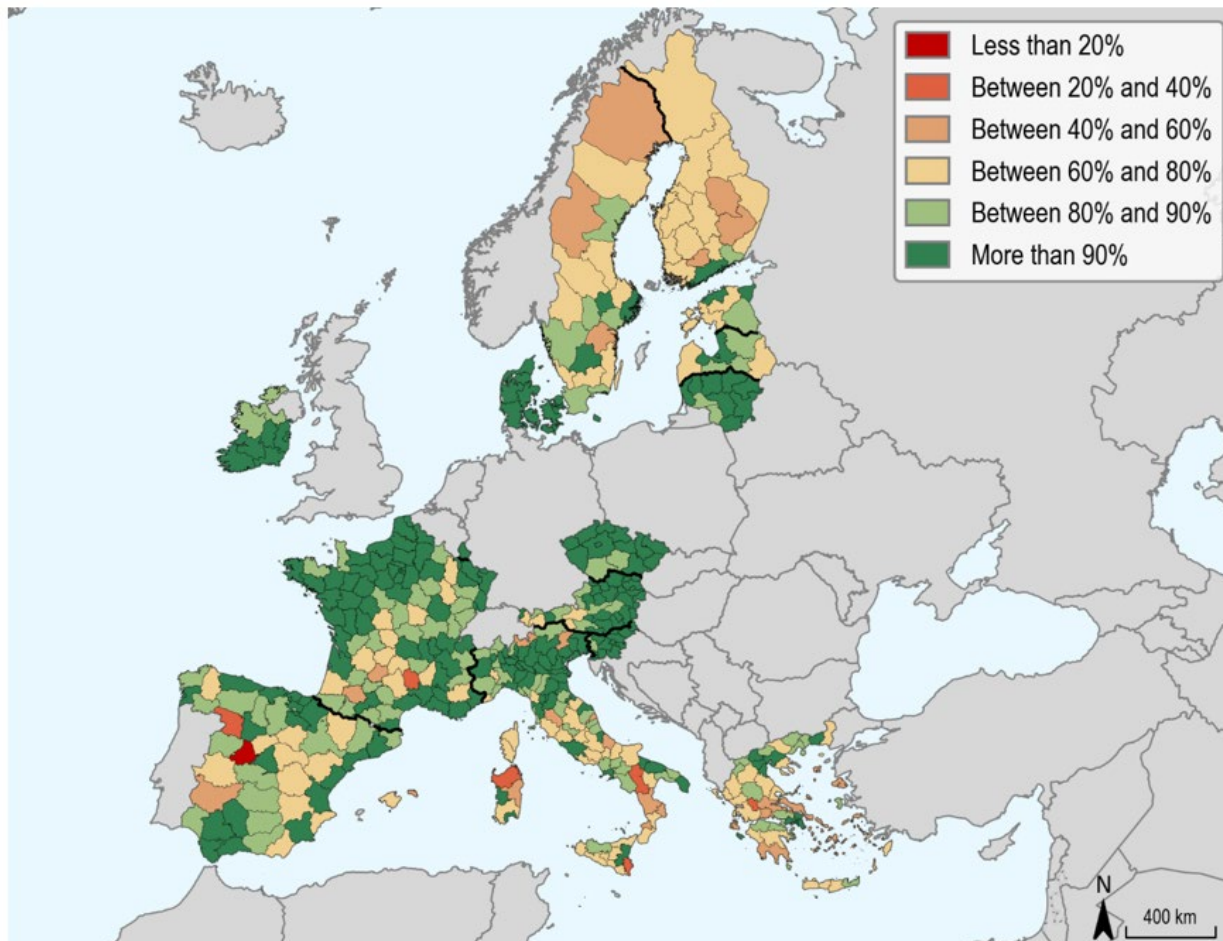
⁽³³³⁾ Digitalisation of PES support increased during the COVID-19 crisis in many OECD countries (OECD, 2022b). Digital advancements are most evident in labour market services (job search support and counselling) and training, with initiatives towards greater digital or remote delivery in over 70% of OECD countries (OECD, 2022d) (OECD, 2020b).

In most regions, ⁽³³⁴⁾ PES centres are within easy driving distance for a large share of the population (Chart 3.8). ⁽³³⁵⁾ In the countries covered, close to 70% of the population lives in regions with high accessibility of PES centres within a 30-minute drive. ⁽³³⁶⁾ However, a number of countries show some variation in the accessibility of PES centres, with accessibility lower in remote regions (e.g. Fuerteventura, one of Spain's Canary Islands, or Sassari in Sardinia, Italy) or in regions with low population density (e.g. Avila, a Province northwest of Madrid in Spain, or Lozère, a département in the south of France). For those who cannot easily access PES by car, public transport may offer an important alternative. ⁽³³⁷⁾ Only a small share of people live in regions in which a majority of people are within a 15-minute walk of a PES centre.

Chart 3.8

PES centres are within a short drive in most regions

Share of population with access to a PES centre within a 30-minute drive, by TL3 region, 2022 or latest year available



Note: Preliminary results for EU countries with available data. Excludes island regions Åland (Finland), Gotland (Sweden), Mayotte (France), Eivissa y Formentera and the special autonomous regions Ceuta and Melilla (Spain). Driving time estimates do not consider traffic congestion and thus constitute the lower bound of people's actual driving times.

Source: OECD calculations, based on PES location data obtained from various sources.

[Click here to download chart.](#)

There are strong urban-rural differences in the geographical accessibility of PES offices (Chart 3.9).

Across metropolitan regions, a very large majority (96%) of the population live in regions with high accessibility of PES centres within a 30-minute drive (top-left panel). In non-metropolitan regions, the share of people within driving distance of a PES centre is generally lower. These differences may reflect a combination of lower number of centres per capita, lower population density, and less developed transport infrastructure. More specifically, only 69% of people in non-metropolitan regions with access to a small FUA (bottom-left panel) and 46% of people in non-metropolitan remote regions (bottom-right panel) live in regions with high accessibility.

⁽³³⁴⁾ PES location data cover regions in the following countries: Austria, Czechia, Denmark, Estonia, Finland, France, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Slovenia, Spain and Sweden.

⁽³³⁵⁾ See section 2.2.2. for underlying methodology and data.

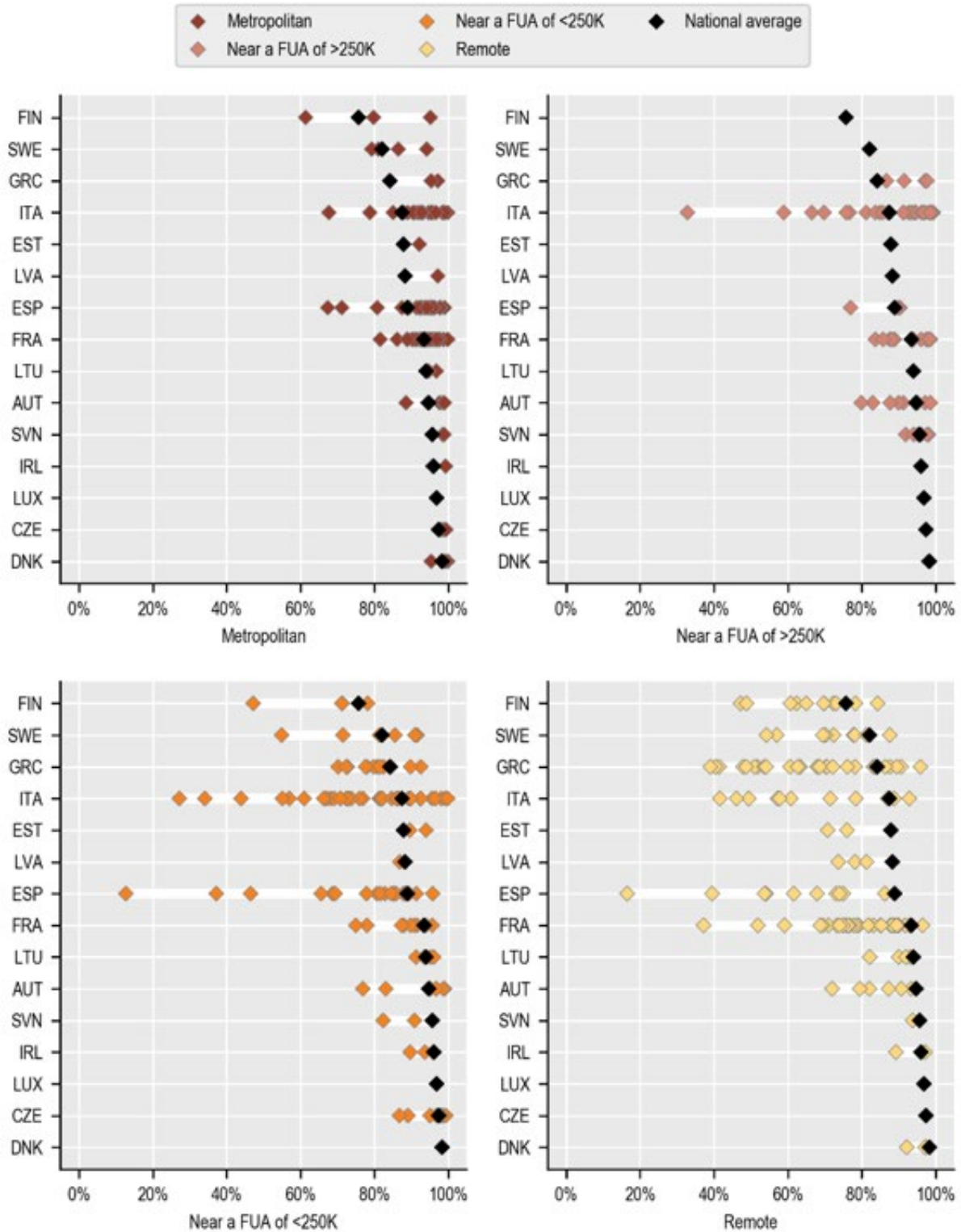
⁽³³⁶⁾ For PES, a 30-minute drive seems an appropriate benchmark. In most OECD countries, jobseekers – or other users – will need to physically visit PES offices relatively rarely.

⁽³³⁷⁾ Note however that there are no reliable data on public transport infrastructure and services at granular geographical level.

Chart 3.9

Accessibility of PES centres is high in metropolitan regions but can vary substantially between non-metropolitan regions

Share of population with access to a PES centre within a 30-minute drive, by TL3 region and level of access to cities, 2022 or latest year available



Note: Preliminary results for EU countries with available data. Countries sorted by national average in ascending order. Excludes island regions Åland (Finland), Gotland (Sweden), Mayotte (France), and Eivissa y Formentera and special autonomous regions Ceuta and Melilla (Spain). Driving time estimates do not consider traffic congestion and thus constitute the lower bound of people's actual driving times.

Source: OECD calculations, based on PES location data obtained from several sources.

[Click here to download chart.](#)

The accessibility of PES centres varies between non-metropolitan regions within countries. Variation is highest in large countries like France, Italy and Spain. In the Spanish province of Fuerteventura, for example, only 17% of people live within a 30-minute drive of a PES centre, compared to 86% in La Palma. In France, only 37% of people in Lozère are within a 30-minute drive of a PES centre, compared to 97% of the population in the

Deux-Sèvres département in the west of the country. Variation in access between nonmetropolitan regions is also high in countries with low population density, such as Sweden and Finland.

Low accessibility of PES services within close distance can potentially reduce the efficiency of matching labour supply and demand at regional level. This warrants further analysis, however. A simple correlation analysis finds no clear relationship between accessibility of PES centres and regional unemployment, highlighting the role of other drivers. ⁽³³⁸⁾ The relationship between access to PES and unemployment rates is not straightforward. In practice, PES locations in most countries reflect institutional factors and constraints, alongside local labour market characteristics. Other contexts to consider include the diversity of PES models, their respective services, ⁽³³⁹⁾ users' profiles, and the degree of digitalisation of PES services. Cooperation with local partners in the delivery of services is another essential factor, particularly in supporting vulnerable clients. Many PES compensate for the lack of a strong territorial network through partnerships with locally anchored organisations, providing outreach to inactive people, activation services, or upskilling and reskilling opportunities.

3.3. What works and for whom? Training programmes to help address skills shortages

Training programmes are key to addressing skills shortages by enabling upskilling and reskilling throughout the working life. Policies that better align skills demand and supply by training jobseekers or people at risk of unemployment can help to address labour and skills shortages. It is important, therefore, to ensure that training provision is tied to skills demands in the labour market.

Counterfactual impact evaluations can improve the effectiveness of training design. A 2023 European Commission report ⁽³⁴⁰⁾ emphasised that the effectiveness of training measures should always be evaluated, including their long-term impact. ⁽³⁴¹⁾ Evaluations of training frequently focus on the effects of programmes on employment outcomes, with some also looking at additional outcomes such as earnings, occupational mobility, health, and social inclusion. Recently, the European Commission published a synthesis of individual ESF and Youth Employment Initiative (YEI) counterfactual impact evaluations in the Member States in the 2007-2013 and 2014-2020 programming periods. ⁽³⁴²⁾ Overall, it found that ESF and YEI interventions in the EU are effective, with around 40% of estimates for training programmes ⁽³⁴³⁾ having significant positive effects on employment outcomes, and the average effect sizes of training programmes increasing over time. ⁽³⁴⁴⁾ This section presents the findings of counterfactual impact evaluations of training programmes in Lithuania and Finland, carried out in the context of a joint OECD-European Commission project (Box 3.6.). ⁽³⁴⁵⁾

⁽³³⁸⁾ These include features of the regional economy and labour market, other geographical factors, and possibly the scope and quality of PES services provided.

⁽³³⁹⁾ An overview of PES responsibilities is included in the European Network of Public Employment Services' 2022 PES capacity report, available [here](#).() An overview of PES responsibilities is included in the European Network of Public Employment Services' 2022 PES capacity report, available [here](#).

⁽³⁴⁰⁾ (European Commission, 2023j).

⁽³⁴¹⁾ Lock-in effects are common across training programmes and are expected where people are studying to accumulate skills. This accumulation can be significant over time and effects should be studied over the longer term to ensure that benefits are properly captured.

⁽³⁴²⁾ (European Commission, 2022h).

⁽³⁴³⁾ These are made up of 'vocational training', 'mentoring' and 'other training'. The report found that 20-25% display negative significant effects.

⁽³⁴⁴⁾ Previous research highlighted that time horizons are an important factor in the assessment of skills training, with education and training programmes (so-called human capital programmes) found to have more significant impacts two-three years after completion (Card, Domnisoru and Taylor, 2018).

⁽³⁴⁵⁾ (OECD, 2020a).

Box 3.6: OECD-European Commission joint project on counterfactual impact evaluation

Between 2020 and 2024, the OECD and the European Commission are undertaking a joint project on counterfactual impact evaluation through the use of linked administrative and survey data. Within the context of the project, vocational training programmes in Lithuania and Finland have been evaluated, focusing on employment, earnings, and occupational mobility outcomes. Overall, the project has a dual aim: to improve the effectiveness of active labour market policies (ALMPs) based on the results of the counterfactual impact evaluations; and to strengthen the countries' capacity for evidence-based policy-making. It builds on previous European Commission work, including guidelines for advanced counterfactual impact evaluation methods and tailored guidelines for national authorities evaluating the impact of the ESF. ⁽¹⁾

Countries employ a variety of ALMPs to address gaps in labour market opportunities and improve jobseekers' employability. Accurately evaluating these policies can help to identify what works and for whom. Counterfactual impact evaluations can provide reliable evidence on the causal impacts of training programmes. Experimental approaches are often considered when evaluating the impact of a policy or programme, as entities are randomly assigned to the treatment and control groups. In situations where it is not possible to conduct randomised control trials, quasi-experimental counterfactual impact evaluations can mimic the process of randomisation by constructing a control group that is as close as possible to the treatment group, in order to isolate the causal effects of training on labour market outcomes.

Evaluations – particularly counterfactual impact evaluations – provide valuable information for making informed policy choices, establishing the accountability of public expenditure, and building support for continued deployment of measures in the longer-term. A key requirement for such evaluations is the use of rich data of good quality, which can be obtained by linking different registers, or through surveys.

⁽¹⁾ European Commission (2019a); European Commission (2020c); European Commission (2020e).

In Lithuania, employer involvement in the vocational training programme was associated with more positive employment effects. ⁽³⁴⁶⁾ Individuals can participate in voucher-based training through agreement with the PES or through a tripartite agreement involving a future employer. The evaluation, in the context of the OECD-European Commission project, found that the programme had a positive effect on employment and income after nine months, and that it persisted after three years. More positive effects were found for jobseekers with an employer agreement, suggesting a favourable role of employer involvement. In Lithuania, employers can choose the vocational training programmes individuals undertake, provided they have made a commitment to hire the individuals on completion of their training. The report highlights that employer involvement is favourable not only in terms of employment outcomes but also in potentially helping employers to address local skills shortages. The evaluation found that persistent negative effects of vocational training on occupational mobility ⁽³⁴⁷⁾ – which analyses the occupations that individuals enter into constructed as a 'job ladder' – were recorded for those aged 30-50. However, positive effects were recorded for women aged 30-50, while jobseekers under 30 years of age were also found to experience upward occupational mobility.

The voucher system allows Lithuania to offer a large selection of training programmes, with a lower administrative burden. The evaluation found that the voucher system could play a role in helping to address local skills shortages more quickly and effectively. Within the system, jobseekers could select from accredited training providers and many different programmes, with the duration of training lasting an average of 2.8 months. The OECD report highlighted that in the 2014-2020 period, jobseekers enrolled in 2 000 different types of courses, with vouchers offering a quick and versatile means of addressing skills demands. The evaluation also found particularly strong positive employment effects of training among women over 50 and among participants with lower skills levels (Chart 3.10).

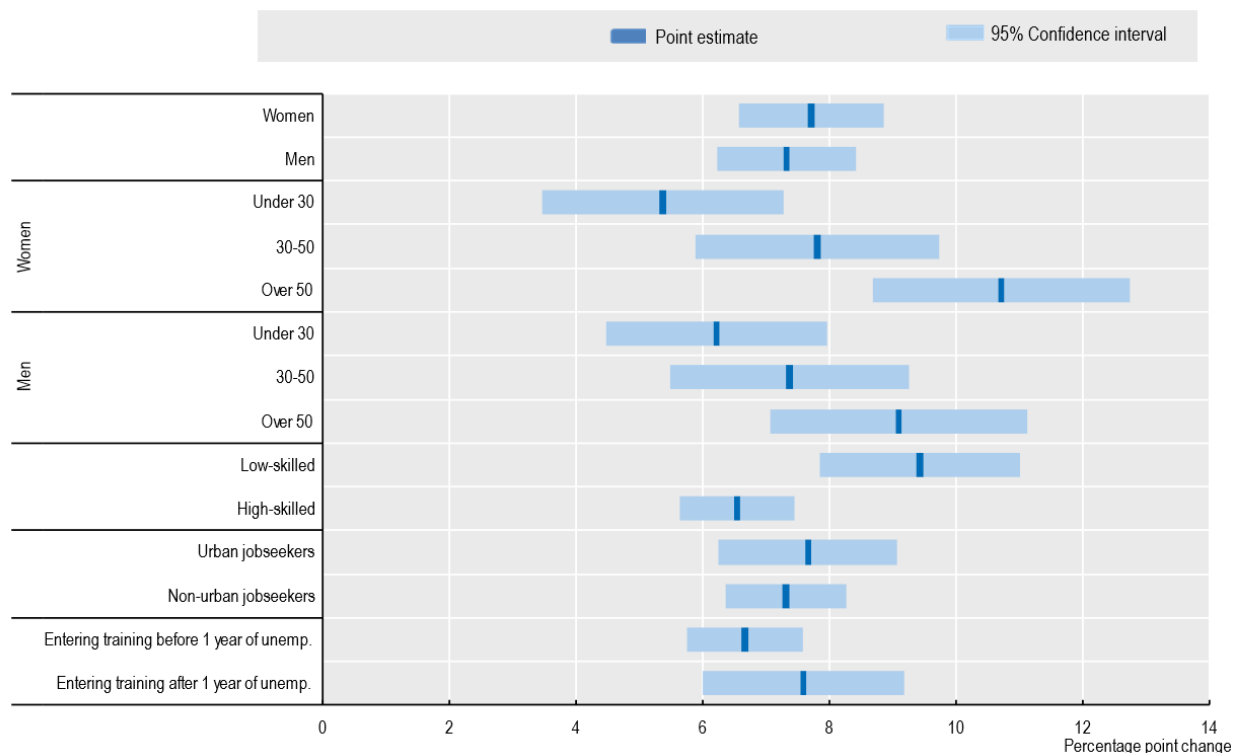
⁽³⁴⁶⁾ The (OECD, 2022c) report evaluates a voucher-based training programme for jobseekers, where different courses and accredited training providers can be selected. It can be read here.

⁽³⁴⁷⁾ In order to provide a tractable measure of occupational mobility, the analysis relies on an occupational index, which is calculated from observed wages. The analysis maps the occupation of individuals entering employment onto an occupational index, which can be interpreted as a 'job ladder'.

Chart 3.10

Strong positive employment effects of vocational training for certain subgroups in Lithuania

Percentage point change in employment probability at 24 months (%), by gender, age, skill level



Source: OECD (2022c).

[Click here to download chart.](#)

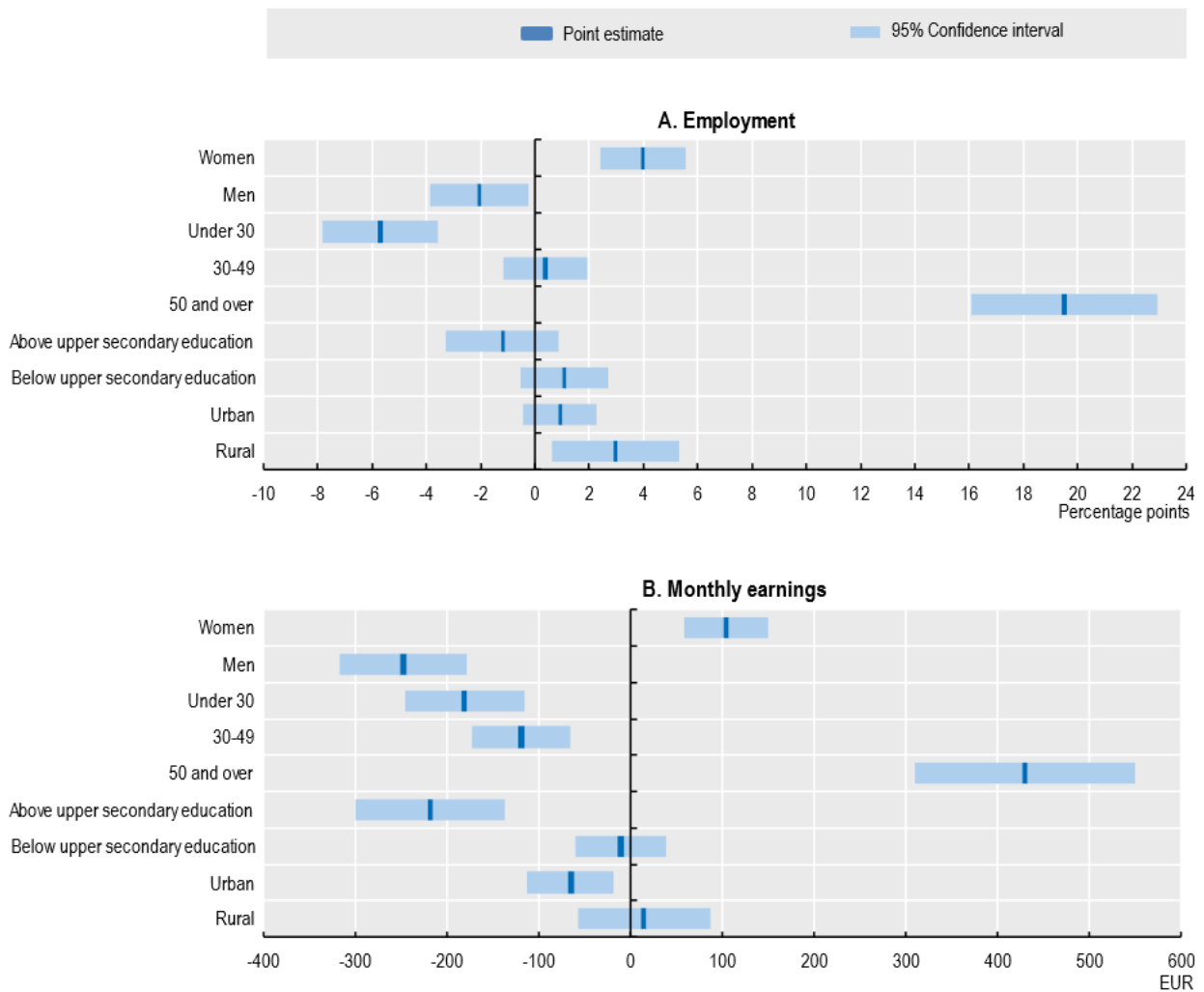
In Finland, both self-motivated training (SMT) and short-term labour market training (LMT) programmes were found to have a positive effect on employment, with longer LMT courses proving more effective. ⁽³⁴⁸⁾ The evaluation addressed the two main types of training – SMT and LMT programmes – offered to jobseekers. ⁽³⁴⁹⁾ SMT was found to have a small positive effect on employment three years after the start of the programme and LMT after two years, with no positive effects for earnings, on average. However, positive impacts on earnings were found for certain subgroups, notably women and older jobseekers, who exhibited larger gains in employment and income (Chart 3.11). Longer LMT courses were found to be more effective in increasing the likelihood of employment and earnings. For both SMT and LMT, training supported individuals to change occupation, ⁽³⁵⁰⁾ but was not associated with upward occupational mobility overall, although some impacts were found for subgroups. Both types of training resulted in a more equal distribution of occupations, with participants moving towards the middle of the distribution of occupations and the share of low-quality occupations reducing considerably. ⁽³⁵¹⁾

⁽³⁴⁸⁾ (OECD, 2023a).⁽³⁴⁹⁾ SMT allows jobseekers to study degree-level programmes while retaining their unemployment benefits for up to two years; short-term LMTs are vocational courses of shorter duration, with the PES deciding who participates.⁽³⁵⁰⁾ Occupational mobility was analysed by looking at occupational distribution by market value.⁽³⁵¹⁾ Low-quality occupations are defined in terms of observed wages, based on the occupational index.

Chart 3.11

Positive employment and earning effects of SMT in Finland are particularly strong for women and over-50s

Change in employment probability (%), by jobseeker characteristics (gender, age, and skill level), four years after the first observation



Source: OECD (2023a).

[Click here to download chart.](#)**In Finland, the provision of LMT courses is linked to systems for skills assessment and anticipation.**

Skills assessment and anticipation are important tools for addressing skills shortages in both the short and long term (Box 3.7). Finland has a high share of vacancies in highly skilled occupations – in order to ensure that the provision of training is in line with skills needs, forecasting and the anticipation of local development needs takes place within the PES system and involves local PES offices. The evaluation found that workers in some industries with lower labour shortages are more likely to participate in retraining through vocational training. By contrast, labour shortages exist in the restaurant and construction industries, yet workers still sought to retrain. This may be due to the comparatively poor pay and conditions in these industries. ⁽³⁵²⁾

⁽³⁵²⁾ (OECD, 2023a). Limited duration seasonal employment is also more common in certain sectors, such as accommodation and food services and construction (see Chapter 2 Section 7.. In addition, fixed-term employment can constitute a stepping-stone to more permanent contracts, particularly for young people.

Box 3.7: Anticipating and assessing skills needs in Estonia

The national Skills Assessment and Anticipation exercise (OSKA) in Estonia provides insights into the integration of systematic information on occupational demand and supply to ensure targeted training courses and education. ⁽¹⁾

Established in 2015 and funded primarily by an ESF grant, OSKA is a system of applied research on the labour and skills required in the country. It reviews past trends at national and sectoral level and assesses how various drivers of change will affect future skills demand in sectors of the economy such as ICT and healthcare. ⁽²⁾

Within OSKA, analyses are based on labour market and education statistics and are compiled in cooperation with employers, policy makers, and representatives of VET and higher education institutions. OSKA is used systematically by the Estonian Unemployment Insurance Fund (EUIF) to guide the provision of training programmes to prevent unemployment and to provide guidance for employment counsellors referring jobseekers for training. The EUIF also has an Occupational Barometer (based on Finland's Occupational Barometer), which measures short-term supply and demand in different occupations.

⁽¹⁾ OECD (2021).

⁽²⁾ Cedefop (2022d).

3.4. Building labour market resilience: anticipating and matching skills policies

Skills intelligence meaningfully blends quantitative and qualitative information on labour market needs and skills, allowing skills anticipation. Several tools and methods ⁽³⁵³⁾ are already in place across the Member States ⁽³⁵⁴⁾ that allow for methodologically accurate and relevant skills anticipation outputs (Table 3.5).

The main approaches use skills assessments/surveys and labour market indicators to map the current state of skills demand and supply. Skills forecasts typically apply an economic model where skills are proxied by occupations and/or qualifications. These provide expected developments of future skills demand and supply, based on assumptions informed by past trajectories. Technological and skills foresight activities are used to gain a better understanding of the possible futures that may lie ahead for societies, economies and labour markets. Including more qualitative methodologies allows for exploration of the steps needed to move towards the desired future. Less traditional methods are then necessary to deepen understandings of the implications of technological change and emerging skill needs. These include explorations of automated skills intelligence methods that use Big Data and AI-driven analyses (e.g. those building on online job advertisements), as well as patent data, scientific databases, and online course websites. ⁽³⁵⁵⁾

A growing number of Member States apply skills anticipation methods in their policy-making cycles (Table 3.5). ⁽³⁵⁶⁾ At least one skills anticipation method is used in each Member State, with some also implementing complementary methods. Skills forecasts remain the backbone of skills intelligence generation in most countries, run at national, regional, or even sectoral level, either regularly or periodically. 2019's Skills Forecast continues to serve skills intelligence needs in Member States without their own regular forecasts, as well as complementing national sources by allowing harmonised comparison of information across Member States.

⁽³⁵³⁾ Cedefop, in collaboration with the ILO and the European Training Foundation (ETF), published a series of methodological guides to anticipating and matching skills and jobs, targeting EU policy makers and decision makers (Cedefop, 2021c), (Cedefop, 2021b), (Cedefop, 2021d).

⁽³⁵⁴⁾ Cedefop's online skills-matching tool offers a collection of policy instruments from Member States that use information on labour market trends and anticipated skills needs to inform and shape upskilling or other skills-matching policies for the current and future world of work.

⁽³⁵⁵⁾ (Cedefop, 2021b).

⁽³⁵⁶⁾ See Cedefop's matching skills database here for an overview of Member States' policy instruments.

Table 3.5
Tools for carrying out skills assessment and anticipation

Type of activity	Data collected
Descriptive statistics/stock-taking	Estimates of overall demand and supply of skills and technology use, often based on collating data from various sources (e.g. sector skill studies)
Quantitative forecasting	Forecasting or projecting future demand for skills, typically using econometric modelling
Skills and jobs surveys (questionnaire surveys)	Assessments of demand/supply of skills and technology use, usually with an assessment of the extent to which demand and supply are in balance
Graduate tracer studies	Using matched administrative datasets or surveys to track people through education and the labour market to see how the former influence the latter
Qualitative research	Use of non-quantitative techniques to gather in-depth information about current and future skill demand/supply and technology trends (e.g. via company case studies, use of focus groups)
Foresight	Critical thinking about the future of skills supply/demand and technology trends, using participatory methodologies
Big Data	Use of web sourcing, combined with text mining and machine learning approaches, to collect and classify data about skills, vacancies, technologies, etc.

Source: (Cedefop, 2021)

[Click here to download table.](#)

The global market is increasingly volatile and vulnerable to a wide range of factors and shocks, which may have prompted the recent uptake of foresight methods. Several Member States have expanded their foresight capacity to support their understanding of emerging skills needs in different scenarios/futures. As part of the shift towards more sophisticated approaches, Big Data-powered skills intelligence is rapidly expanding and is now broadly applied by PES. Some Member States resort to employer surveys to map sectoral trends, while graduate tracking or tracing surveys are a growth area to enable the understanding of skills supply and education-to-work transitions.

There is room for innovation and better addressing of local needs. This is true both of countries with skills intelligence systems in development and also those at a more mature stage. Next-generation skills intelligence needs to be more user-centred, focus on transitions (green, digital, others), and provide better insight into the links between all forms of learning and skills.

3.5. Building skills anticipation and intelligence into skills governance systems

Many factors affect skills needs, including the digital and green transitions, and no single tool or method can fully anticipate labour market and skill trends. Rather, combining different methods gathers in-depth information on the current state of play, as well as the expected skills demand and supply necessary for well-founded investment and other policy decisions (Chart 3.8).

Numerous stakeholders have a role in designing a holistic skills anticipation approach. National/regional/local authorities, such as ministries and linked organisations, often lead the production and use of skills anticipation outputs at a strategic level, while social partners drive skills anticipation exercises in many Member States and can also operate as ambassadors for the use of relevant outputs in policy-making. Other important stakeholders include research institutes and education and training providers. It is widely recognised that the availability of skills anticipation methods in a country/region/sector can enhance effective matching of people to jobs, provided it is part of a comprehensive skills governance approach. ⁽³⁵⁷⁾

Several relevant workstreams provide skills intelligence at the EU level. For instance, Cedefop documents recent trends in employers' demands based on a large-scale collection and analysis of online vacancies (Skills-OVATE tool). ⁽³⁵⁸⁾ In addition, Cedefop's Skills Forecast offers quantitative projections of future trends in employment, by sector and occupational group (see Chapter 2, Section 2.2.). A specific European Green

⁽³⁵⁷⁾ (European Commission, 2015); Cedefop skills governance country reviews. [Access the website here](#); (Pouliakas and Ranieri, 2018).

⁽³⁵⁸⁾ Skills-OVATE offers detailed information on the jobs and skills employers demand based on online job advertisements in 28 European countries. [Access the tool here.](#)

Box 3.8: Governance of skills anticipation and matching

Cedefop approaches skills governance as ‘the process of involvement of stakeholders from the public, private and third sector, from different economic sectors and geographical units, in generating, disseminating and using LMSI [labour market and skills intelligence] to appropriately steer a wide array of policies for the purposes of balancing skill supply and demand and providing an informed basis for further economic development via targeted skills investments.’⁽¹⁾ Skills governance covers a wide range of skills anticipation and matching issues: skills needs at the entry point into the labour market; the utilisation of workers’ skills in the labour market; and future skills supply/demand trends to support the transformation of the labour market and the employability of the workforce from a lifecycle perspective.

⁽¹⁾ Cedefop’s approach builds on definitions from the European Commission (2015) and the OECD (2016).

Deal skills scenario explores the expected effects on sectors and occupations relevant for the green transition, as well as opportunities and challenges in providing effective and timely upskilling and reskilling opportunities (see Chapter 2, Section 3.1.). Other relevant EU initiatives on skills intelligence include the ELA’s work on labour shortages⁽³⁵⁹⁾ and the European Commission’s AMEDI⁽³⁶⁰⁾ and AMEDI+⁽³⁶¹⁾ projects.

An integrative approach to skills governance may be challenging, as it necessitates generating, analysing and disseminating skills intelligence gathered through skills anticipation methods. Lack of funds or human resources expertise, weak coordination among the organisations involved, and poor statistical infrastructure are some of the key barriers reported by Member States.⁽³⁶²⁾ Use of skills anticipation outputs in steering the design of policies in education and training, employment, activation, migration, and the environment implies an openness to negotiation between key actors. It also relies on well-designed dissemination of the outputs to diverse audiences through targeted communication approaches and tailored formats. Continuous feedback loops between education and training systems and the labour market, as well as other policy areas, bridges information gaps and identifies synergies and complementarities to inform policy cycles. Finally, national specificities in the ability to tackle information asymmetries, as well as coordination failures among key stakeholders, also determine the effectiveness of a skills governance approach.⁽³⁶³⁾

3.6. Selected examples of targeted support for skills development at EU level

Under the European Skills Agenda, the Pact for Skills and the associated Blueprint Skills Alliances support large-scale skills partnerships in all strategic industrial ecosystems. The Pact for Skills mobilises public and private organisations to work together on effective upskilling and reskilling to support the green and digital transitions, innovation, and competitiveness. The Pact includes companies, workers, national, regional and local authorities, social partners, industry organisations, VET providers, chambers of commerce, and employment services. The first partnerships were launched in 2020 and now cover all 14 trans-European industrial ecosystems within the New Industrial Strategy for Europe.⁽³⁶⁴⁾ The associated Blueprint for Sectoral Cooperation on Skills, first introduced by the Skills Agenda for Europe 2016, is a key initiative to create strategic approaches and foster cooperation on concrete skills development solutions in industrial ecosystems. This section presents some of the most relevant partnerships for the sectors experiencing labour or skills shortages, i.e. the digital, healthcare, construction, energy intensive industries, and renewable energy sectors. Overall, Centres of Vocational Excellence (CoVE) and the roll-out of individual learning accounts (ILAs) contribute to upskilling and reskilling of the workforce, improving skills-matching.

Under the Pact for Skills, the skills partnership for the digital ecosystem⁽³⁶⁵⁾ will contribute to reaching the targets of the Digital Decade.⁽³⁶⁶⁾ It will address the aim of equipping 80% of people with

⁽³⁵⁹⁾ See, for example, (ELA, 2023).

⁽³⁶⁰⁾ Assessing and Monitoring Employment and Distributional Impacts (AMEDI) of the European Green Deal, 2020-2023 (more information available here).

⁽³⁶¹⁾ Assessing distributional impacts of geopolitical developments and their direct and indirect socioeconomic implications, and socioeconomic stress tests for future energy price scenarios (AMEDI+), 2023-2026 (more information available here).

⁽³⁶²⁾ (Pouliakas and Ranieri, 2018).

⁽³⁶³⁾ Idem.

⁽³⁶⁴⁾ Tourism, mobility-transport-automotive, aerospace & defence, construction, agri-food, energy intensive industries, textile, creative & cultural industries, digital, renewable energy, electronics, retail, proximity & social economy, and health.

⁽³⁶⁵⁾ Launched in July 2022.

basic digital skills, achieving gender convergence, and having 20 million ICT specialists employed in the EU by 2030. It will design and implement an ecosystem-wide upskilling and reskilling framework, seek synergies with existing initiatives such as Upskilling Pathways, and use existing best practices and guidance to build on – and potentially expand – existing initiatives, tools and resources (e.g. blueprints, digital skill-up resources). It is supported by the Blueprints for Sectoral Cooperation on Skills in Digital Fields (digitalisation of the energy-value chain, blockchain, cybersecurity and software services). These projects have revised existing job profiles specific to the ecosystem, identified new emerging profiles, and developed relevant training modules and curricula.

In light of current and expected increases in labour shortages in healthcare, the Pact for Skills partnership for the health ecosystem aims to address skills needs and build resilience across the complex network of health systems. ⁽³⁶⁷⁾ Launched in December 2022, it covers:

- Skills to support the digital and green transitions in the health sector, for both existing and emerging occupations;
- Interdisciplinary skills and skills to enhance the integration of care across patient pathways, and health promotion and disease prevention in health-relevant sectors;
- Communication and other skills, including patient engagement, leadership, and advocacy;
- Change management and organisational skills to engage the health workforce in co-creating innovation across the health ecosystem.

This health ecosystem partnership builds on the Blueprint Alliance for a Future Health Workforce Strategy on Digital and Green Skills (BeWell), which started in 2022. It creates comprehensive curricula and training programmes for all health professionals and health workers in emerging occupations.

The Pact for Skills partnership in construction aims to reach three million workers in the next five years. The construction sector is experiencing labour shortages and these are expected to persist, linked to the need to enhance the energy efficiency of buildings in order to reduce carbon emissions (see Chapter 2). The Plan intends to upskill and reskill at least 25% of the construction industry workforce in the next five years. This will require systematic anticipation of skills needs and/or the validation and recognition/certification of skills acquired in the workplace. ⁽³⁶⁸⁾ In this context, the All.Construction Blueprint aimed to improve skills intelligence and address short-term and medium-term skills needs. ⁽³⁶⁹⁾ Implemented by a consortium of 24 partners from 12 European countries between 1 January 2019 and 31 March 2023, it mapped current and future skills needs and available training, and then developed new training content focusing on digital, energy efficiency and circular economy relevant skills, new curricula, and a sectoral skills strategy.

Sectoral associations have established a large-scale skills partnership for energy-intensive industries. These include, for example, the Cross-Sectoral Blueprint for a Sustainable Process Industry (SPIRE-SAIS), and associations in cement, minerals, steel, aluminium, water, engineering, and chemicals working within the European Steel Skills Alliance (ESSA Blueprint). ESSA has nine national/regional rollouts of its own training system, designed in line with specific national/regional demands and solutions. The EU platform 'steelHub' for companies, training providers and individual learners ensures the ongoing adjustment of sectoral skills and strategies. A common database of professional profiles has been developed for the steel sector, as well as a sectoral skills matrix. SPIRE-SAIS has developed a common job profile selection for industrial symbiosis and energy efficiency. It has also identified new skills (including digital skills) and developed a framework for training courses, measures, arrangements, tools and activities for integration within VET, company, and association training programmes.

A large-scale Pact for Skills partnership for renewable energy was launched in March 2023, as announced in the REPowerEU plan. Renewable energy sectors are expected to expand considerably (see Chapter 2, section 3.). The partnership will provide an understanding of the sector and skills analytics, while promoting quality careers in line with the values of the Just Transition and reinforcing the sector's attractiveness to workers.

⁽³⁶⁶⁾ See Europe's Digital Decade: digital targets for 2030 here.

⁽³⁶⁷⁾ Additional relevant actions in the healthcare sector: Projects funded under the EU4Health Work Programme; Joint Action 'HEROES'; Meteor Project; AHEAD; Tashi; ROUTE-HWF; OASES project.

⁽³⁶⁸⁾ Pact for Skills in construction available here.

⁽³⁶⁹⁾ All.Construction Blueprint available here.

Box 3.9: Skills as one of the pillars of the European Green Deal Industrial Plan

The European Green Deal Industrial Plan proposes that the green transition must be people-centred and inclusive if it is to ensure equitable and just outcomes, generate quality jobs, and leave no-one behind. The green transition will amplify demands for new skills at all levels, while projected job losses (particularly in carbon-intensive industries) will require large-scale upskilling and reskilling of the workforce.

Skills are one of the four pillars of the European Green Deal Industrial Plan, alongside faster access to sufficient funding, open trade for resilient supply chains, and a predictable and simplified regulatory environment. That simplification is already in motion with the NZIA, which seeks to establish a framework of measures for strengthening Europe's net-zero technology products manufacturing ecosystem (see Chapter 2, Box 2.4).

The European Green Deal Industrial Plan includes the InnoEnergy Skills Institute. The Institute aims to train 100 000 people directly and contribute to the training of a further 700 000 people indirectly through a network of 150 local training providers and 100 train-the-trainer courses, a heat pump skills partnership, raw materials academy, and net-zero industry academies. These academies will design and roll out, via Member States' education and training providers, on a voluntary basis, upskilling and reskilling programmes for the green transition in strategic industries and for manufacturing of clean energy technologies, such as raw materials, hydrogen, nuclear and solar technologies. The European Commission will initiate an academy to offer online and offline training in sustainable construction, with a focus on the use of biobased materials, circularity, and digital technologies.

In February 2023, the European Commission presented the European Green Deal Industrial Plan to enhance the competitiveness of Europe's net-zero industry and accelerate the transition to climate neutrality. Its goal is to provide a more supportive environment for scaling-up EU manufacturing capacity for the net-zero technologies and products required to meet Europe's ambitious climate targets. Equipping workers with the right skills will be essential to successful implementation of the plan (Box 3.9).

CoVE are transnational collaborative networks that can contribute to alleviating labour shortages.

The centres aim to drive innovation and excellence in VET, bringing together a wide range of local and regional partners, including VET providers, employers, research centres, and social partners, to co-create skills ecosystems. In doing so, they facilitate close links between VET and the labour market, matching supply and demand for skills. Aligned with the European Skills Agenda and the European Education Area, 100 CoVE will be established between 2021 and 2027, supported by Erasmus+ funding. At European level, several CoVE are currently operating in sectors identified as facing current or future shortages, including renewable energy, advanced manufacturing, and healthcare.

Rolling out ILAs facilitates the take-up of training and can help to respond to skills needs. Around half of the Member States are developing ILA schemes, and a scheme is already operational in France. The Netherlands has a similar scheme that incorporates some of the elements outlined in the Council Recommendation on individual learning accounts. The purpose of ILA is to provide direct financial support to individuals, including the unemployed and self-employed, for use in training activities. The ILA can also be used by workers in companies, in full coordination with their employer, to respond to specific skills needs. These schemes need to be accompanied by complementary measures on clear information, relevant opportunities, personalised guidance, and paid training leave for employed people.

4. REDUCING LABOUR AND SKILLS SHORTAGES THROUGH MIGRATION

In addition to the activation of underrepresented groups such as women, older workers and young people, targeted migration policy could help to reduce labour shortages and boost economic activity.

This section uses the European Commission's LMM to simulate the impact of a hypothetical scenario in which half of the excess labour shortages compared to 2011 levels would be addressed by targeted migration policies in six Member States (Austria, France, Germany, Poland, Spain and Sweden).⁽³⁷⁰⁾ 2011 was selected as a benchmark because labour shortages have been trending upward in Europe since then, according to both the BCS and job vacancy rates published by Eurostat (see Box 3.10 for methodological details). At EU level, the job vacancy rate increased from 1.4% in 2011 to 2.9% in 2022 (averages of the first three quarters, as data are not yet available for Q4 2022).

⁽³⁷⁰⁾ Countries selected based on data availability in the European Commission's LMM.

In a potential scenario in which half of the excess labour shortages compared to 2011 would be filled by legal labour migration, a considerable number of migrants would have to be attracted from their countries of origin. ⁽³⁷¹⁾ The number of migrants to be attracted would range from 0.11% of the current population in Poland (about 41 000 people) to 0.66% of the population in Austria (59 000 people). ⁽³⁷²⁾ Overall, about half of the unfilled job vacancies require medium-level (secondary) education, and about one-third of the vacancies are for highly educated people, while approximately one-sixth of the jobs require lower levels of education. While targeted migration could contribute to easing labour shortages, it is highly unlikely that this alone would be sufficient to address the issue, without also implementing other measures outlined in this report.

Targeted migration policy can enhance economic growth. The additional migrant workforce arriving in these countries creates added value, while increased production also requires more capital, triggering investment. Overall, the resulting GDP increase is proportional to the size of the labour migration inflow, but the distribution of migrants by education level also influences the economic impact: more educated immigrants are more productive and have a greater impact on GDP. The simulated labour migration policy would result in an increase of GDP of between 0.15% (Poland) and 0.91% (Austria). The capital stock, number of employees, and consumption would also increase proportionally to GDP. Average wages are not affected, but the wage distribution is influenced by the distribution of education levels of the newly arrived migrants. These results can also be interpreted as the opportunity cost of unaddressed labour shortage.

Table 3.6

Targeted labour migration has a positive impact on the economy

Halving excess labour shortages compared to 2011 levels through targeted labour migration policy

	DE	AT	PL	ES	FR	SE
No. of immigrants (thousands)	395	59	41	1	208	37
- low-educated	76	10	2	0	31	5
- medium-educated	212	30	24	1	85	16
- high-educated	107	19	15	0	92	17
Immigrants as a % of the population	0.48	0.66	0.11	0.00	0.31	0.36
- low-educated	0.68	0.64	0.06	0.00	0.18	0.29
- medium-educated	0.44	0.54	0.10	0.01	0.29	0.33
- high-educated	0.45	1.06	0.16	0.00	0.42	0.43
GDP	0.62	0.91	0.15	0.00	0.50	0.45
Capital stock	0.64	1.03	0.18	0.00	0.53	0.50
Employment	0.65	1.00	0.17	0.00	0.49	0.52
- low-educated	0.78	0.90	0.11	0.00	0.32	0.48
- medium-educated	0.62	0.95	0.16	0.01	0.50	0.51
- high-educated	0.66	1.20	0.21	0.01	0.58	0.55
Wage	0.00	-0.01	0.00	0.00	0.01	-0.04
- low-educated	-0.09	0.05	0.04	0.00	0.12	-0.03
- medium-educated	0.02	0.06	0.02	0.00	0.02	-0.02
- high-educated	-0.02	-0.23	-0.06	0.00	-0.08	-0.08
Consumption	0.63	0.85	0.15	0.00	0.54	0.42

Source: DG EMPL simulations, based on the LMM.

[Click here to download table.](#)

⁽³⁷¹⁾ With the exception of Spain, where labour shortages do not seem to be exceptionally high (vacancy rates broadly the same as 2011).

⁽³⁷²⁾ While these numbers represent a relatively small share of the population, massively attracting third-country nationals with the exact skills and connecting them with companies with a vacancy to fill is very challenging. The EU is not the preferred global destination for skilled migrants (see (European Commission, 2022a)).

Box 3.10: Method for assessing the impact of reducing labour shortages to 2011 level through targeted immigration policy

The analysis first calculated the number of additional people required to fill half of all additional vacancies in each of the six Member States and in each sector, based on job vacancy rates observed in 2011. As vacancy rates are available by sector/occupation for Hungary only, a simplifying assumption took the relative shares of vacancies in various occupations for each sector, based on the Hungarian data. As a next step, the distribution of the highest level of education required to fill a job vacancy in a given country, sector and occupation was taken from Eurostat's micro EU-LFS, based on observed employment shares. This gave the number of people (in this case, migrants), by education level, required to fill the desired number of vacancies for each country. Those numbers were then plugged into the LMM as a shock to the population. The results of the simulation are shown in Table 3.6.

5. ROLE OF SOCIAL PARTNERS IN ADDRESSING LABOUR AND SKILLS SHORTAGES

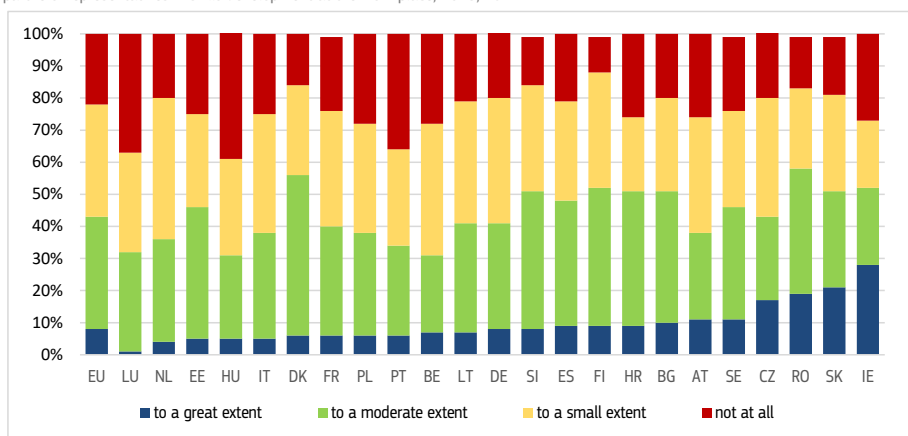
Fostering active involvement of social partners in policy-making is a key principle of the European Pillar of Social Rights and a common objective of the Member States. Social dialogue plays an important role in economic recovery and in alleviating labour market challenges in the wake of the energy crisis and the Russian war of aggression against Ukraine. Across the EU, social partners set skills development activities in some key sectors experiencing shortages, such as healthcare and construction. Collective bargaining helps to improve living and working conditions, such as wages, hours of work, access to training, leave entitlements, and health and safety measures. This section looks at the role of social partners in addressing the labour and skills challenges, including an overview of actions already in place.

Social partners play a key role in addressing labour and skills shortages by facilitating learning opportunities. Under various EU initiatives, social partners cooperate with other stakeholders in actions for skills development (see Section 3.3.), ensuring that the workforce is equipped with skills suited to their needs. ⁽³⁷³⁾ They can also use cooperation to address technological upgrading and multiskilling. For their part, workers are supported to progress along their career paths and achieve greater job security. ⁽³⁷⁴⁾ Evidence suggests that employees perceive their career prospects to be 28% higher if a trade union or works council is present in their company or organisation. This is linked to better training opportunities, among other factors. ⁽³⁷⁵⁾ In addition to training, social partners also put in place actions targeting retention of workers and integration of migrants to the labour market.

Chart 3.12

Trade unions have a positive impact on all workers' career prospects

Involvement of social partners' representatives in skills development at the work place, 2019, EU



Note: Data not available for Cyprus, Latvia and Malta.

Source: ECS 2019.

[Click here to download chart.](#)

⁽³⁷³⁾ (International Labour Office, 2022).

⁽³⁷⁴⁾ (Heyes and Rainbird, 2011).

⁽³⁷⁵⁾ (European Commission, 2019b).

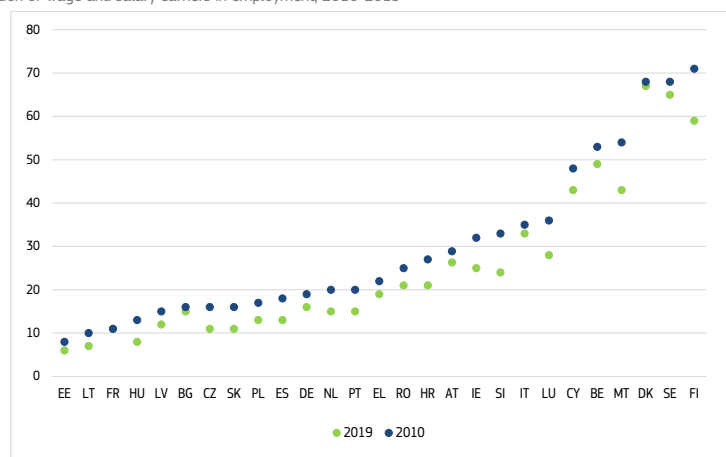
Despite adding value, social partners are only modestly involved in developing in-work training. In the period 2016–2019, employee representatives in 90% of establishments reported that in-work training took place in the establishments where they are represented. ⁽³⁷⁶⁾ However, the majority reported that they were involved only rarely, if at all, in determining skills needs at the work place (57%), although one-third reported being involved to a moderate extent (Chart 3.12). Representatives' influence on management decisions in respect of skills development is generally low, with only 8% reporting being involved to a great extent.

Declining membership poses a challenge to trade unions' and employers' organisations' ongoing role in skills development. Membership and its changes over time remain key to assessing trade unions' and employer organisations' strength. Trade union membership is declining in all Member States (Chart 3.13). ⁽³⁷⁷⁾ The drop is particularly notable in Finland (-12 pp) and Malta (-11 pp). The rapidly changing labour market environment, together with increases in non-standard work, migration, and labour mobility, all pose challenges to trade unions' ability to attract and successfully represent workers in those groups. ⁽³⁷⁸⁾ Membership of employers' organisations has remained stable in most of the Member States for which data are available.

Chart 3.13

Trade union membership rate declined in all Member States in the last decade

Net union membership as a proportion of wage and salary earners in employment, 2010–2019



Note: Latest available data from 2019, 2018 (Hungary, Czechia, Latvia, Romania, Slovakia), 2017 (Poland), 2016 (Bulgaria, Cyprus, France, Greece, Portugal), 2015 (Slovenia).

Source: OECD/AIAS database on Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts (ICTWSS) 2021.

[Click here to download chart.](#)

Promoting collective bargaining remains important to tackling labour and skills shortages, including by improving working conditions. Collective bargaining helps to attract new workers by improving employment conditions in a sector, contributing to more adequate minimum wage protection and general wage development. ⁽³⁷⁹⁾ For example, in Slovenia, the collective agreement in the paper industry sets a higher basic wage, making employment in the sector more attractive. Beyond actual wage increases, the Slovenian example is particularly innovative in that unions and employers agreed to work together to improve the sector's image. Collective bargaining also helps to retain workers by enabling them to acquire new skills, as in the motor vehicle manufacturing sector in the Netherlands. ⁽³⁸⁰⁾

The collective bargaining coverage rate is decreasing for most Member States. ⁽³⁸¹⁾ According to the Structure of Earnings Survey (SES), during the period 2010–2018, the collective agreement coverage significantly decreased for all sectors at NACE 2-digit level. However, in 2018, the difference in coverage rates did not significantly differ between the group of sectors that did/did not experience shortages (1 pp difference). Within the group of sectors experiencing shortages, some recorded a significantly higher share of workers not covered by an agreement at any level (national/industry/individual/local). This group includes architectural and engineering activities, ICT, and manufacture of fabricated metal products and furniture.

⁽³⁷⁶⁾ (Eurofound and Cedefop, 2020).

⁽³⁷⁷⁾ OECD and AIAS (2021), available here.

⁽³⁷⁸⁾ (European Commission, 2016b).

⁽³⁷⁹⁾ (European Commission, 2023a).

⁽³⁸⁰⁾ (Eurofound, 2022).

⁽³⁸¹⁾ OECD and AIAS (2021), available here.

At national level, social partners are well placed to design training and support Member States to strengthen the links between learning and labour market needs. In some countries, social partners are key stakeholders in designing measures to increase the labour market relevance of VET systems. Reform of those systems ideally needs to be aligned with labour market changes and respond to rapidly changing labour market demands. The involvement of social partners may ensure that the skillsets embodied in the training systems reflect real occupational needs. ⁽³⁸²⁾ Effective dialogue among social partners, PES, chambers of commerce, and governments is crucial in providing relevant labour market information, support, and training. In Portugal, the PES and social partners co-manage a network of 24 training centres. ⁽³⁸³⁾ In Denmark, adult vocational training (AMU) was established to provide an adequate response to labour market needs. AMU learning programmes are developed through tripartite agreements with social partners, which decide the learning outcomes and forms of assessment. ⁽³⁸⁴⁾ In the Netherlands, the Foundation for Cooperation on VET and the Labour Market facilitates interactions between different stakeholders involved in VET. ⁽³⁸⁵⁾ ⁽³⁸⁶⁾ The Foundation is responsible for keeping sectoral VET qualifications up to date and it advises the government on skill needs, qualifications, and examination structures. Similarly in Sweden, social partners play an active role in shaping training programmes. ⁽³⁸⁷⁾ However, their impact on policies varies across Member States, with some, such as Poland, reporting a decline in the quality of their involvement in social dialogue.

European cross-industry social partners acknowledge skills challenges and translate them into new priorities for the future. The 2022-2024 cross-industry work programme of the European social partners underlines the importance of a skilled workforce as one of the main assets of the European social and economic model. ⁽³⁸⁸⁾ The 2020 Framework Agreement on Digitalisation, agreed between European cross-industry social partners, encourages social partners to devise common strategies to respond to the digital transformation and commits trade unions and employers to promoting reskilling and upskilling. ⁽³⁸⁹⁾ ⁽³⁹⁰⁾

Across the EU, sectoral social partners have identified activities to develop skills in some key shortage sectors. Projects for skills identification and development have been initiated in the social services sector and the electricity sector. ⁽³⁹¹⁾ Social partners in the healthcare sector presented a framework of action to tackle labour shortages and qualification needs. ⁽³⁹²⁾ In the chemical, pharmaceutical, plastics and rubber industries sectors, social partners thoroughly analysed digital skills needs and adopted relevant curricula and frameworks for digital skills and competences. ⁽³⁹³⁾ In the education sector, social partners work together on recommendations to support life-long learning and to identify challenges, including in the context of digitalisation. ⁽³⁹⁴⁾ With the support of the European Commission, social partners implement multiple projects to promote quality and inclusive VET, upskilling and reskilling of professionals and managers, and skills for the green and digital transitions. ⁽³⁹⁵⁾ In Spain, the government and social partners signed the Agreement for Economic Reactivation and Employment, which aims to develop effective mechanisms for digital training and boost the green transition in all sectors. ⁽³⁹⁶⁾

In the context of demographic challenges and labour shortages, social partners support the integration of refugees and other migrants into the labour market. Business representatives have suggested prioritising the recognition of qualifications and skills assessment tools for third-country nationals. ⁽³⁹⁷⁾ In 2020, some organisations committed to further efforts in the protection and integration of migrants by strengthening existing integration networks. ⁽³⁹⁸⁾ At the end of 2022, the European Commission and

⁽³⁸²⁾ (OECD, 2022a).

⁽³⁸³⁾ PES Network Stakeholder Conference (2022), available here.

⁽³⁸⁴⁾ (Cedefop, 2022d)

⁽³⁸⁵⁾ Samenwerking Beroepsonderwijs Bedrijfsleven (SBB).

⁽³⁸⁶⁾ (OECD, 2022a).

⁽³⁸⁷⁾ (Kuczera and Jeon, 2019).

⁽³⁸⁸⁾ European Social Dialogue Work Programme 2022-2024, available here.

⁽³⁸⁹⁾ (European Trade Union Confederation (ETUC) et al., 2020).

⁽³⁹⁰⁾ (Eurofound, 2021).

⁽³⁹¹⁾ Federation of European Social Employers' projects available here.

⁽³⁹²⁾ (HOSPEEM-EPSU, 2022).

⁽³⁹³⁾ Social partners in the graphics sector designed a skills-related project targeting the younger generation, 'Print Your Future', available here.

⁽³⁹⁴⁾ Joint European Union Trade Union Committee for Education (ETUCE) and European Federation of Explosives Engineers (EFEE) statement on opportunities and challenges of digitalisation for the education sector (December 2021), available here.

⁽³⁹⁵⁾ DG EMPL database of projects.

⁽³⁹⁶⁾ (Eurofound, 2020)

⁽³⁹⁷⁾ (SME United, 2023)

⁽³⁹⁸⁾ ETUC Resolution for the integration of migrants and the consolidation of the UnionMigrantNet available here; ETUC Resolution on avenues of work for the ETUC in migration and asylum fields (2019-2023) available here.

Box 3.11: Measures to improve employment and working conditions at EU and national level

At EU level, regulations and policy initiatives have been introduced to limit or decrease exposure to demanding working conditions and promote access to more favorable and fairer working conditions regardless of employment status, as stipulated by the European Pillar of Social Rights. The analysis confirms the ongoing importance of a number of EU legislative initiatives on health and safety at work such as to address the occupational health and safety risks of workers including their exposure to carcinogens, improving the physical demands of the working environment and preventing violence and psychosocial risks at work, as well as promoting gender equality and fair remuneration (see Chapter 2, section 7).

The EU has introduced numerous initiatives and regulations to ensure fairer working conditions and quality jobs. Directive 2019/1151 on transparent and predictable working conditions introduced measures to prevent abusive practices in the use of on-demand and similar employment contracts. Recently, Directive 2022/2041 seeks to improve the adequacy of minimum wages and strengthen collective bargaining, so as to ensure fair wages and a decent standard of living for workers (based on a full-time employment relationship), with legislative proposals to improve the employment conditions of platform workers and protect workers from the risks related to the exposure of carcinogens at work.

At national level, a recent report ⁽¹⁾ found that in the healthcare and long-term care sectors, measures in certain EU countries to address labour shortages have focused on wages and working conditions as a way of improving the attractiveness of these sectors. By contrast, in the ICT sector, where wages and working conditions on average tend to be more favourable, policy measures have focused on skills: identifying current and future skills needs in ICT, developing curricula that match employers' requirements, and delivering training to a variety of target groups. In addition, measures also aim to attract labour to the ICT sector, in particular from underrepresented groups, such as women.

⁽¹⁾ Eurofound (2023).

European social and economic partners jointly reaffirmed their renewed commitment to the European Partnership for Integration, underlying the importance of integrating refugees and migrants effectively in the European labour market. ⁽³⁹⁹⁾ The cross-industry social partners worked closely together with the European Commission to develop a Talent Pool pilot ⁽⁴⁰⁰⁾ to help those fleeing the war in Ukraine to integrate into the EU labour market.

At EU level, new initiatives underline the importance of social partners in fostering better working conditions, ensuring adequate wages, and tackling skills shortages. In January 2023, the European Commission proposed a Council Recommendation to strengthen social dialogue at national level, ⁽⁴⁰¹⁾ and adopted a Communication on reinforcing social dialogue at EU level. These documents emphasised the importance of an enabling environment for bipartite and tripartite social dialogue, which can contribute to new or existing labour protection policies, such as the right to disconnect from work or protection against violence and harassment at work (Box 3.11). Recommendations include promoting higher coverage of collective bargaining at all appropriate levels, consultation and involvement of social partners in policy-making, and strengthening their capacity. The recently adopted European Commission Communication on harnessing talent in Europe's regions also acknowledges the need to enhance social partners' involvement in regions facing a talent development trap, ⁽⁴⁰²⁾ given the value they add to improving working conditions, wages, and skills and labour shortages.

6. CONCLUSIONS

Policies addressing labour shortages aim to increase labour supply in certain skills groups and areas of the labour market, or to improve the matching between labour supply and demand. Labour supply can be increased in different (complementary) ways: reducing taxes on labour income or other tax-benefit reforms; removing barriers to work, for example by facilitating access to childcare facilities; ensuring an active

⁽³⁹⁹⁾ Joint statement by the European Commission and Economic and Social Partners on a renewal of the European Partnership for Integration available here.

⁽⁴⁰⁰⁾ Accessible from the EURES website here.

⁽⁴⁰¹⁾ Proposal for a Council Recommendation on strengthening social dialogue in the European Union available here.

⁽⁴⁰²⁾ The talent development trap occurs in regions with insufficient numbers of skilled workers and university and higher-education graduates to offset the impact of the declining working age population due to depopulation and an ageing population.

inclusion approach that embeds conditions and effective support for benefit recipients who can work to re-integrate into the labour market; and making the EU more attractive for migrants in some specific skills groups and facilitating their temporary or permanent migration to the Union. Policies supporting efficient matching of labour supply and demand are crucial to addressing labour shortages and thus can have a significant positive impact on the economy. Developing skills intelligence to understand current and future skills needs, as well as access to effective PES, can also play an important role. Complementing these efforts with policies to improve working conditions can further mitigate shortages, particularly in occupations and sectors experiencing considerable job strain. This chapter presented several policies that could help to address labour shortages, although the various policy tools cannot be ranked in terms of their general effectiveness. In addition, the same objectives can often be achieved using a combination of policy measures.

Targeted tax reforms can effectively strengthen work incentives for some population groups. This increases their labour supply and can alleviate labour shortages in some sectors and occupations. In general, targeted tax reforms have a significantly larger impact on labour supply than across-the-board PIT cuts and as such promote active inclusion as also highlighted in the 2023 Council Recommendation on adequate minimum income. Moving from joint family to individual taxation could generate a significant increase in aggregate participation rates, especially among secondary earners – predominantly women – thus helping to increasing their participation.

Labour force participation can be significantly increased among some population groups by reducing barriers to work. For example, expanding ECEC access and making childcare more affordable for households could help to increase the ECEC participation levels towards the new 2030 ECEC participation target of 45%, as well as facilitating the labour market participation of mothers of young children. Simulations show that an increase in formal childcare provision to the targeted 45% participation rate would significantly increase the labour force participation of mothers in selected Member States.

Targeted labour migration policy is another potential way to reduce labour shortages in specific skills groups. Attracting third-country nationals with the right skills and facilitating labour matching between migrants and employers could add significant value to the workforce in the EU, helping to support economic activity and increase GDP. The population increase would also lead to more demand for goods, further boosting the economy. Smooth integration of these workers into the labour market and society requires rapid recognition of their qualifications attained abroad, as well as tailored support measures, such as language courses and upskilling or reskilling opportunities.

Better alignment of skills demand and supply through vocational training of jobseekers or people at risk of unemployment can also help to address labour and skills shortages. An evaluation of a voucher-based training programme in Lithuania found that involving employers in the choice of training available to individuals, combined with a commitment to hire people on completion of their training, can create favourable employment outcomes and help to address local skills shortages. An evaluation of two labour market programmes in Finland found that forecasting and anticipation of local development within the PES system can help to ensure that provision of training is in line with skills needs.

Social partners are key actors in tackling labour and skills shortages. They provide tailored training, improve working conditions and labour market relevance of adult learning opportunities, and collaborate with PES. Across the EU, social partners develop activities to address skills needs and labour shortages, including in key sectors such as healthcare, social services, and education. Strengthening the role of social partners in decision-making remains a common objective of the Member States, as well as a key principle of the European Pillar of Social Rights.

Overall, skills will be crucial to ensure EU competitiveness, support resilience and the green and digital transitions, and secure the future of the European welfare model. The 2023 European Year of Skills puts skills at the core of the policy agenda. The Pact for Skills and the Blueprint Skills Alliances, adopted under the European Skills Agenda, are important measures to understand and foster the supply of skills needed in key sectors, including the increasing demand for digital and green skills under the twin transition. To pave the way for successful and fair transition, Member States endorsed the EU 2030 and 2030 Digital Compass targets, according to which at least 60% of adults should participate in training and 80% should have at least basic digital skills. The Recommendations on individual learning accounts, and VET will also help people to update their skillsets. The Recommendation on effective active support to employment provides broader policy guidance on managing labour market transitions. Finally, there are measures that address other root causes of labour shortages, most notably the Directive on Adequate Minimum Wages, which has the potential to improve pay conditions in some shortage occupations.

References

Acemoglu, D. (2002), 'Technical change, inequality, and the labor market', *Journal of Economic Literature*, vol. 40, no 1 (Spring 2002), pp. 7-72.

Alexander Bick, a. N. (2017), 'Quantifying the Disincentive Effects of Joint Taxation on Married Women's Labor Supply', vol. 107, pp. 100-104.

Asikainen, T., Bitat, A., Bol, E., Czako, V., Marmier, A., Muench, S., Murauskaite-Bull, I., Scapolo, F. and Stoermer, E. (2021), 'The future of jobs is green', Publications Office of the European Union, Luxembourg, available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC126047>.

Autor, D. H., Levy, F. and Murnane, R. J. (2003), 'The skill content of recent technological change: An empirical exploration', *Quarterly Journal of Economics*, vol. 118, no 4 (Winter 2003), pp. 279-1333.

Barslund, M. (2022), *The Dynamics of ICT skills in EU Member States*, European Commission.

Benczur, P. G. (2011), 'Analysis of changes in the tax and transfer system with a behavioural microsimulation model', *MNB Bulletin*, vol. 6, Magyar Nemzeti Bank, pp. 15-27.

Bertoletti, A., Cannistra, M., Diaz Lema, M., Masci, C., Mergoni, A., Rossi, L. and Soncin, M. (2023a), 'The determinants of mathematics achievement: A gender perspective using multilevel random forest', *Economies*, vol. 11, no 2, JRC132496, pp. 32.

Bertoletti, A., Biagi, F., Di Pietro, G. and Karpinski, Z. (2023b), 'The effect of the COVID-19 disruption on the gender gap in students' performance: a cross-country analysis', *Large-scale assessments in education*, vol. 11, JRC130766, pp. 6.

Boniol, M., Mclsaac, M., Xu, L., Wuliji, T., Diallo, K. and Campbell, J. (2019), *Gender equity in the health workforce: analysis of 104 countries*, World Health Organisation.

Bowen, A. and Hancke, B. (2019), 'The social dimensions of "greening the economy": Developing a taxonomy of labour market effects related to the shift toward environmentally sustainable economic activities', *European Commission and LSE Consulting*, Publications Office of the European Union, Luxembourg, available at: <https://op.europa.eu/en/publication-detail/-/publication/24c67b4c-3293-11ea-ba6e-01aa75ed71a1>.

Cappelli, P. (2012), 'Why good people can't get jobs: the skills gap and what companies can do about it', Wharton School Press, Philadelphia.

Card, D., Domnisoru, C. and Taylor, L. (2018), 'The Intergenerational Transmission of Human Capital: Evidence from the Golden Age of Upward Mobility', *NBER Working Paper No. 25000*, vol. JEL No. I24..

Carlsson, M., Eriksson, S. and Rooth, D. (2023), 'Language proficiency and hiring of immigrants: Evidence from a new field experimental approach Europe', *IZA Discussion Paper Series*, no 15950.

Cedefop (2012), 'Green skills and environmental awareness in vocational education and training', no 24, Publications Office of the European Union, Luxembourg, available at: <https://www.cedefop.europa.eu/en/publications/5524>.

Cedefop (2015), 'Skill shortages and gaps in European enterprises: Striking a balance between vocational education and training and the labour market', *Cedefop reference series*, no 102, Publications Office of the European Union, Luxembourg, available at: <http://www.cedefop.europa.eu/en/publications/3071>.

Cedefop (2018), 'Insights into skill shortages and skill mismatch: Learning from Cedefop's European skills and jobs survey', *Cedefop reference series*, no 106, Publications Office of the European Union, Luxembourg, available at: <https://www.cedefop.europa.eu/en/publications/3075>.

Cedefop (2021a), 'The green employment and skills transformation: Insights from a European Green Deal skills forecast scenario', Publications Office of the European Union, Luxembourg, available at: <https://www.cedefop.europa.eu/en/publications/4206>.

Cedefop (2021b), 'Understanding technological change and skill needs: big data and artificial methods. Cedefop practical guide 2', Publications Office, Luxembourg, available at: <https://www.cedefop.europa.eu/en/publications/4198>.

- Cedefop (2021c), 'Understanding technological change and skill needs: skills surveys and skills forecasting. Cedefop practical guide 1', Publications Office, Luxembourg, available at: <https://www.cedefop.europa.eu/en/publications/4197>.
- Cedefop (2021d), 'Understanding technological change and skill needs: technology and skills foresight. Cedefop practical guide 3', Publications Office, Luxembourg, available at: <https://www.cedefop.europa.eu/en/publications/4199>.
- Cedefop (2022a), 'An ally in the green transition', *Cedefop briefing note*, Publications Office of the European Union, Luxembourg, available at: <https://www.cedefop.europa.eu/en/publications/9166>.
- Cedefop (2022b), *Challenging digital myths: First findings from Cedefop's second European skills and jobs survey*, Publications Office of the European Union, Luxembourg, available at: <https://www.cedefop.europa.eu/en/publications/9173>.
- Cedefop (2022c), 'Cities in transition', *Cedefop briefing note*, Publications Office of the European Union, Luxembourg, available at: <https://www.cedefop.europa.eu/en/publications/9172>.
- Cedefop (2022d), 'Microcredentials for labour market education and training, First look at mapping microcredentials in European labour-market-related education training and learning: take-up, characteristics and functions', available at: <https://www.cedefop.europa.eu/files/>.
- Cedefop (2022e), *Setting Europe on course for a human digital transition: New evidence from Cedefop's second European skills and jobs survey*, Publications Office of the European Union, Luxembourg, available at: <https://www.cedefop.europa.eu/en/publications/3092>.
- Cedefop (2022f), 'Too good to waste: Tapping the potential of vocational education and training in the waste management sector', *Policy brief*, Publications Office of the European Union, Luxembourg, available at: <https://www.cedefop.europa.eu/en/publications/9175>.
- Cedefop (2023a), 'Growing green: How vocational education and training can drive the green transition in agri-food', *Policy brief*, Publications Office of the European Union, Luxembourg, available at: <https://www.cedefop.europa.eu/en/publications/9181>.
- Cedefop (2023b), 'Skills in transition [temporary title] (forthcoming)', Publications Office, Luxembourg.
- Centeno, C., Karpinski, Z. and Urzi Brancati, C. (2021), *Supporting policies addressing the digital skills gap*, Publications Office of the European Union, Luxembourg, Luxembourg, available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC128561>.
- Chatzipanagi, A. et al. (2022), 'Clean Energy Technology Observatory: Photovoltaics in the European Union – 2022 Status Report on Technology Development, Trends, Value Chains and Markets', *JRC130720*, Publications Office of the European Union, Luxembourg, available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC130720>.
- Christou, T. C. (2023), *Improving regional macroeconomic skills matching: a RHOMOLO analysis.*, European Commission.
- Cirillo, V., Evangelista, R., Guarascio, D. and Sostero, M. (2021), 'Digitalization, routineness and employment: An exploration on Italian task-based data', *Research Policy*, vol. 50, no 7.
- Das, S. and Kotikula, A. (2019), 'Gender-based employment segregation: Understanding causes and policy interventions', *Jobs Working Paper*, vol. 26, World Bank.
- De Becker, E., Schoukens, P., Bruynseraede, C. and Dockx, A. (2022), 'Comparative report on social security', *Working Yet Poor project*, Horizon 2020, available at: https://kuleuven.limo.libis.be/discovery/search?query=any,contains,LIRIAS3738653&tab=LIRIAS&search_scope=lirias_profile&vid=32KUL_KUL:Lirias&offset=0.
- Del Boca, D. (2015), 'Childcare choices and child development', *IZA World of Labor*, Institute of Labor Economics (IZA), pp. 134-134.
- Di Iasio, V. and Wahba, J. (2023), 'Natives' attitudes and immigration flows to Europe', *IZA Discussion Paper Series*, no 15942.
- EIGE (2018), *Study and work in the EU: set apart by gender*, Publications Office of the European Union, Luxembourg, available at: <https://eige.europa.eu/publications/study-and-work-eu-set-apart-gender-report>.

EIGE (2020a), *Beijing + 25: the fifth review of the implementation of the Beijing Platform for Action in the EU Member States*, Publications Office of the European Union, Luxembourg, Luxembourg, available at: <https://eige.europa.eu/publications/beijing-25-fifth-review-implementation-beijing-platform-action-eu-member-states>.

EIGE (2020b), *Gender Equality Index 2020: Digitalisation and the future of work*, Publications Office of the European Union, Luxembourg, available at: <https://eige.europa.eu/publications/gender-equality-index-2020-digitalisation-and-future-work>.

ELA (2021), 'EURES report on labour shortages and surpluses 2021', Publications Office of the European Union, Luxembourg, available at: <https://www.ela.europa.eu/en/media/725>.

ELA (2023), 'EURES report on labour shortages and surpluses 2022', Publications Office of the European Union, Luxembourg, available at: <https://www.ela.europa.eu/en/labour-shortages-report>.

Elena-Bucea, A., Cruz-Jesus, F., Oliveira, T. and Coelho, P. S. (2021), 'Assessing the role of age, education, gender and income on the digital divide: Evidence for the European Union', *Information Systems Frontiers*, vol. 23 (Summer 2021), pp. 1007-1021.

Erickson, C. L. and Norlander, P. (2021), 'How the past of outsourcing and offshoring is the future of post-pandemic remote work: A typology, a model and a review', *Industrial Relations Journal*, vol. 53, no 1 (Winter 2022), pp. 71-89.

Eurofound (2020), 'Tripartite agreement for economic reactivation and employment', available at: https://static.eurofound.europa.eu/covid19db/cases/ES-2020-27_934..

Eurofound (2021), 'Tackling labour shortages in EU Member States', Publications Office of the European Union, Luxembourg, available at: https://www.eurofound.europa.eu/sites/default/files/ef_publication/field_ef_document/ef21006en.pdf.

Eurofound (2022), 'Moving with the times: Emerging practices and provisions in collective bargaining', Publications Office of the European Union, Luxembourg, available at: https://www.eurofound.europa.eu/sites/default/files/ef_publication/field_ef_document/ef21046en.pdf.

Eurofound (2023), 'Measures to tackle labour shortages: Lessons for future policy', Publishing Office of the European Union, Measures to tackle labour shortages: Lessons for future policy, available at: <https://www.eurofound.europa.eu/publications/report/2023/measures-to-tackle-labour-shortages-lessons-for-future-policy>.

Eurofound and Cedefop (2020), 'European Company Survey 2019: Workplace practices unlocking employee potential, European Company Survey 2019 series', Publications Office of the European Union, Luxembourg.

Eurofound and Joint Research Centre (2021), *European Jobs Monitor 2021: Gender gaps and the employment structure*, Publications Office of the European Union, Luxembourg, available at: <https://www.eurofound.europa.eu/publications/report/2021/european-jobs-monitor-2021-gender-gaps-and-the-employment-structure>.

European Central Bank (2022), 'The recent drivers of household savings across the wealth distribution', *ECB Economic Bulletin*, vol. Issue 3, Publications Office of the European Union, Luxembourg.

European Commission (2009), *Gender segregation in the labour market: Root causes, implications and policy responses in the EU*, Publications Office of the European Union, Luxembourg, available at: <https://op.europa.eu/en/publication-detail/-/publication/39e67b83-852f-4f1e-b6a0-a8fbb599b256/language-en>.

European Commission (2015), 'Skills governance in the EU Member States, Synthesis report for the EEPO', Publications Office, Luxembourg.

European Commission (2016a), 'Bottleneck vacancies 2015', Publications Office of the European Union, Luxembourg, available at: <https://op.europa.eu/mt/publication-detail/-/publication/60f0f7d4-9a98-11e6-9bca-01aa75ed71a1>.

European Commission (2016b), 'Employment and Social Developments in Europe Annual Review 2016', Publications Office of the European Union, Luxembourg, available at: <https://ec.europa.eu/social/main.jsp?langId=en&catId=89&newsId=2704&furtherNews=yes>.

European Commission (2017), 'A comparison of shortage and surplus occupations based on analyses of data from the European Public Employment Services and Labour Force Surveys', Publications Office, available at: <https://op.europa.eu/en/publication-detail/-/publication/28a5c10c-48fc-11e8-be1d-01aa75ed71a1/language-en>.

European Commission (2018), 'European Pillar of Social Rights', Publications Office, available at: <https://data.europa.eu/doi/10.2792/95934>.

European Commission (2019a), 'Advanced counterfactual evaluation methods : guidance document.', European Union Publications Office, available at: <https://op.europa.eu/en/publication-detail/-/publication/11968bbb-fac9-11e9-8c1f-01aa75ed71a1/language-en/format-PDF/source-114227212>.

European Commission (2019b), 'Employment and Social Developments in Europe Annual Review 2019: Sustainable growth for all: choices for the future of Social Europe', Publications Office of the European Union, Luxembourg, available at: <https://ec.europa.eu/social/main.jsp?catId=738&langId=en&pubId=8219>.

European Commission (2019c), *Final report of the High-Level Expert Group on the impact of the digital transformation of the EU labour markets*, Publications Office of the European Union, Luxembourg, available at: <https://digital-strategy.ec.europa.eu/en/news/final-report-high-level-expert-group-impact-digital-transformation-eu-labour-markets>.

European Commission (2020a), 'Analysis of shortage and surplus occupations 2020', Publications Office of the European Union, Luxembourg, available at: <https://op.europa.eu/en/publication-detail/-/publication/22189434-395d-11eb-b27b-01aa75ed71a1/language-en>.

European Commission (2020b), 'Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Action plan on integration and inclusion 2021-2027', *COM(2020) 758 final*, available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0758&qid=1632299185798>.

European Commission (2020c), 'Counterfactual impact evaluation of European Social Fund interventions in practice : guidance document for managing authorities', Publications Office, Luxembourg.

European Commission (2020d), 'Employment and Social Developments in Europe 2020: Leaving no one behind and striving for more: Fairness and solidarity in the European social market economy', Publications Office of the European Union, Luxembourg, available at: <https://ec.europa.eu/social/main.jsp?catId=738&langId=en&pubId=8342&furtherPubs=yes>.

European Commission (2020e), 'How to use administrative data for European Social Funds counterfactual impact evaluations : a step-by-step guide for managing authorities', Publications Office, Luxembourg.

European Commission (2020f), 'Impact assessment accompanying the document "Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Stepping up Europe's 2030 climate ambition – investing in", *SWD(2020) 176 final*, available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020SC0176>.

European Commission (2021), *Labour Market and Wage Developments in Europe, Annual Review 2021*, Publications Office of the European Union, Luxembourg, available at: <https://doi.org/10.2767/066622>.

European Commission (2022a), 'Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: attracting skills and talent to the EU - COM/2022/657'.

European Commission (2022b), 'Communication on better assessing the distributional impact of Member States' policies (COM(2022)494final)'.

European Commission (2022c), 'Council Recommendation of 16 June 2022 on ensuring a fair transition towards climate neutrality 2022/C 243/04', *OJ C 243*, pp. 35–51, available at: [https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32022H0627\(04\)](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32022H0627(04)).

European Commission (2022d), *Education and Training Monitor 2022: Comparative report*, Publications Office of the European Union, Luxembourg, Luxembourg, available at: <https://op.europa.eu/webpub/eac/education-and-training-monitor-2022/en/comparative-report/comparative-report.html#:~:text=The%20Education%20and%20Training%20Monitor%27s,context%20and%20possible%20policy%20levers>.

- European Commission (2022e), *Employment and Social Developments in Europe Annual Review 2022*, Publications Office of the European Union, Luxembourg, available at: <https://ec.europa.eu/social/main.jsp?catId=738&langId=en&pubId=8483&furtherPubs=yes>.
- European Commission (2022f), 'European Economic Forecast: Autumn 2022', Publications Office of the European Union, Luxembourg.
- European Commission (2022g), 'Labour market and wage developments in Europe: Annual Review 2022', Publications Office of the European Union, Luxembourg, available at: <https://data.europa.eu/doi/10.2767/128906>.
- European Commission (2022h), 'Meta-analysis of the ESF counterfactual impact evaluations: final report', Publication Office, available at: https://ec.europa.eu/social/main.jsp?langId=en&catId=22&furtherPubs=yes&pubId=8512&pk_source=newsletter&pk_medium=email&pk_campaign=eu_social_newsletter.
- European Commission (2022i), 'Special Eurobarometer 527: Fairness perceptions of the green transition', available at: <https://ec.europa.eu/social/main.jsp?langId=en&catId=89&newsId=10429&furtherNews=yes>.
- European Commission (2023a), 'Annual Report on Intra-EU Labour Mobility 2022', Publications Office of the European Union, Luxembourg, available at: <https://ec.europa.eu/social/main.jsp?langId=en&catId=89&furtherNews=yes&newsId=10545>.
- European Commission (2023b), 'Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions: A Green Deal Industrial Plan for the net-zero age', *COM(2023) 62 final*, available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52023DC0062&qid=1677776953226>.
- European Commission (2023c), 'Communication from the European Commission, the European Parliament, the Council, the Economic and Social Committee and the Committee of the Regions: Harnessing talents in Europe's regions', available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2023%3A32%3AFIN>.
- European Commission (2023d), 'Employment and Social Developments in Europe, Quarterly review. January 2023', Publications Office of the European Union, Luxembourg, available at: <https://op.europa.eu/en/publication-detail/-/publication/f952621a-a11e-11ed-b508-01aa75ed71a1/language-en>.
- European Commission (2023e), 'European Economic Forecast: Spring 2023', Publications Office of the European Union, Luxembourg.
- European Commission (2023f), 'European Economic Forecast: Winter 2023', Publications Office of the European Union, Luxembourg, available at: https://economy-finance.ec.europa.eu/document/download/22d2bcf9-3748-436d-987d-a11495a3a191_en?filename=ip194_en_1.pdf.
- European Commission (2023g), 'Investment needs assessment and funding availabilities to strengthen EU's Net-Zero technology manufacturing capacity', *SWD(2023) 68 final*, available at: https://single-market-economy.ec.europa.eu/publications/staff-working-document-investment-needs-assessment-and-funding-availabilities-strengthen-eus-net_en.
- European Commission (2023h), 'Proposal for a Regulation of the European Parliament and of the Council on establishing a framework of measures for strengthening Europe's net-zero technology products manufacturing ecosystem (Net Zero Industry Act)', *COM(2023) 161 final*, available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52023PC0161>.
- European Commission (2023i), *Quarterly Review of Employment and Social Developments in Europe (ESDE) - April 2023*, Publications Office of the European Union, Luxembourg, available at: <https://ec.europa.eu/social/main.jsp?catId=738&langId=en&pubId=8544&furtherPubs=yes>.
- European Commission (2023j), 'The Future of Social Protection and the Welfare State in the EU', Publications office, available at: <https://ec.europa.eu/social/BlobServlet?docId=26589&langId=en>.
- European Commission (2023k), 'The impact of demographic change – in a changing environment', available at: https://commission.europa.eu/system/files/2023-01/the_impact_of_demographic_change_in_a_changing_environment_2023.PDF.
- European Commission, Directorate-General for Research and Innovation (2022), 'Knowledge ecosystems in the new ERA – Using a competence-based approach for career development in academia and beyond', Publication Office of the European Union, available at: <https://data.europa.eu/doi/10.2777/150763>.

- European Investment Bank (2023), 'What drives firms' investment in climate change? Evidence from the 2022-2023 EIB Investment Survey', available at: <https://www.eib.org/en/publications/20230114-what-drives-firms-investment-in-climate-change>.
- European Migration Network (EMN); OECD (2021), 'mbrella Inform: The impact of COVID-19 in the migration area in EU and OECD countries', available at: <https://www.oecd.org/migration/mig/00-eu-emn-covid19-umbrella-inform-en.pdf>.
- European Parliament (2015), *Encouraging STEM studies for the labour market*, Publications Office of the European Union, Luxembourg, available at: <https://op.europa.eu/en/publication-detail/-/publication/125159ec-f256-4a9a-a690-f9b6a84013af>.
- European Trade Union Confederation (ETUC) et al. (2020), 'European Social Dialogue Work Programme 2022-2024', available at: https://www.buinessurope.eu/sites/buseur/files/media/reports_and_studies/2022-06-28_european_social_dialogue_programme_22-24_0.pdf.
- European Union Agency for Fundamental Rights (2022), *Roma Survey 2021 – Main results*, Publications Office of the European Union, Luxembourg, available at: <https://doi.org/10.2811/221064>.
- Eurostat (2023a), 'Beneficiaries of temporary protection at the end of the month by citizenship, age and sex – monthly data', *Statistics Explained*, available at: <https://ec.europa.eu/eurostat/statistics-explained/index.php?oldid=605154>.
- Eurostat (2023b), 'Excess mortality – statistics', *Statistics Explained*, available at: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Excess_mortality_-_statistics.
- Eurostat (2023c), 'Migration and migrant population statistics', *Statistics Explained*, available at: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Migration_and_migrant_population_statistics.
- Eurostat (2023d), 'Weekly death statistics', *Statistics Explained*, available at: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Weekly_death_statistics.
- Ferragina, E. (2020), 'Family policy and women's employment outcomes in 45 high-income countries: A systematic qualitative review of 238 comparative and national studies', *Social Policy & Administration*, pp. 1016-1066.
- Filomena, M. and Picchio, M. (2021), 'Are temporary jobs stepping stones or dead ends? A meta-analytical review of the literature', *IZA Discussion Paper*, vol. No. 14367, available at: <http://dx.doi.org/10.2139/ssrn.3851042>.
- Galuscak, K. a. (2019), 'ax-benefit systems and differences in aggregate labour force participation: Comparative evidence from the Czech Republic and Hungary', *Economic Systems*, vol. 43.
- Gillespie, B. J., Mulder, C. H. and Thomas, M. J. (2021), 'Migration for family and labour market outcomes in Sweden', *Population Studies*, vol. 75, no 2, pp. 209-219.
- Goenaga, X. et al. (2019), *The changing nature of work and skills in the digital age*, Publications Office of the European Union, Luxembourg, available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC117505>.
- Goulart, K., Rodríguez-Menés, J. and Caroz Armayones, J. (2022), 'Job descriptions from conception to recruitment: A qualitative review of hiring processes', *JRC Working Papers on Labour, Education and Technology 2022/06*, European Commission, Seville.
- Graham, H., Fuertes, V., Egdell, V. and Raeside, R. (2016), *Women in ICT and digital technologies: An investigation of the barriers to women entering, staying, and progressing in the sector, and actions to ameliorate this – Executive Summary*, Edinburgh Napier University, available at: <https://www.napier.ac.uk/research-and-innovation/research-search/outputs/women-in-ict-and-digital-technologies-an-investigation-of-the-barriers-to-women-entering>.
- Grundke, R., Marcolin, L., Nguyen, T. L. and Squicciarini, M. (2018), 'Which skills for the digital era? Returns to skills analysis', *OECD Science, Technology and Industry Working Papers, 2018/09*, OECD Publishing, Paris.
- Hank, K. and Kreyenfeld, M. (2003), 'A Multilevel Analysis of Child Care and Women's Fertility Decisions in Western Germany', *Journal of Marriage and Family*, no 65(3), pp. 584-596.
- Heyes, J. and Rainbird, H. (2011), *Bargaining for Training: Converging or Diverging Interests? in The Role of Collective Bargaining in the Global Economy*.

- Horbach, J. and Rammer, C. (2022), 'Skills shortage and innovation', vol. 29, no 6 (Summer 2022), pp. 734-759.
- Horemans, J. and Marx, I. (2017), 'Poverty and material deprivation among the self-employed in Europe: An exploration of a relatively uncharted landscape', *IZA Discussion Paper*, vol.No. 11007, available at: <http://dx.doi.org/10.2139/ssrn.3041803>.
- HOSPEEM-EPSU (2022), *Updated framework of action on recruitment and retention*.
- IMF (2022), 'Labour market tightness in advanced economies', *IMF Staff Discussion Notes*, no 2022/001.
- Inter-Agency Working Group on Work-based Learning: Cedefop, European Commission, European Training Foundation, ILO, OECD, UNESCO (2022), 'Work-based learning and the green transition', Publications Office of the European Union, Luxembourg, available at: <http://data.europa.eu/doi/10.2801/69991>.
- International Labour Office (2022), 'Social Dialogue Report 2022 : Collective bargaining for an inclusive, sustainable and resilient recovery', International Labour Office, Switzerland, available at: https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_842807.pdf.
- International Labour Office (2022), 'Costs and Benefits of Investing in Transformative Care Policy Packages: A Macrosimulation Study in 82 Countries', *ILO working paper 55*, International Labour Office.
- Kanas, A. and Steinmetz, S. (2021), 'Economic Outcomes of Immigrants with Different Migration Motives: The Role of Labour Market Policies', *European Sociological Review*, vol. 37, no 3 (Summer 2021), pp. 449-464.
- Kiss, A. and Vandeplass, A. (2015), *Measuring skills mismatch*, European Commission.
- Kleven, H., Landais, C. and Sogaard, J. E. (2019), 'Children and Gender Inequality: Evidence from Denmark', *American Economic Journal: Applied Economics*, no 11(4), pp. 181-209.
- Kratz, F. and Netz, N. (2018), 'Which mechanisms explain monetary returns to international student mobility?', *Studies in Higher Education*, vol. 43, no 2, pp. 375-400.
- Kuczera, M. and Jeon, S. (2019), 'Vocational Education and Training in Sweden', *OECD Reviews of Vocational Education and Training*, OECD Publishing, Paris, available at: <https://doi.org/10.1787/g2g9fac5-en>.
- Lens, D., Marx, I. and Vujic, S. (2018), 'Does migration motive matter for migrants' employment outcomes? The case of Belgium', *IZA Discussion Paper*, no 11906.
- Mariscal-De-Gante, A., Palencia Esteban, A., Grubanov-Boskovic, S. and Fernandez Macias, E. (2023), 'Feminization, ageing and occupational change in Europe in the last 25 years', *JRC Working Papers Series on Labour, education and technology*, JRC132328, available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC132328>.
- McNally, S. (2020), 'Gender differences in tertiary education: what explains STEM participation?', *IZA Policy Paper*, no 165.
- Menyhert, B. (2022), 'The effect of rising energy and consumer prices on household finances, poverty and social exclusion in the EU', *Publications Office of the European Union*, Publications Office of the European Union, available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC130650>.
- Migration Policy Group (2022), 'Higher educated ethnic minority members not immune to discrimination: Exploring the "discrimination paradox" across the European Union', available at: <https://www.migpolgroup.com/wp-content/uploads/2022/11/ExploringtheDiscriminationParadoxacrosstheEU.pdf>.
- Mihály Szoboszlai, Z. B. (2018), 'Assessment of the tax and transfer changes in Hungary between 2010 and 2017 using a microsimulation model', *MNB Occasional Papers 2018/135*, Magyar Nemzeti Bank (Central Bank of Hungary).
- Modestino, A. S., Shoag, D. and Balance, J. (2020), 'Upskilling: Do employers demand greater skill when workers are plentiful?', *Review of Economics and Statistics*, vol. 102, no 4, pp. 793-805.
- Muench, S., Stoermer, E., Jensen, K., Asikainen, T., Salvi, M. and Scapolo, F. (2022), 'Towards a green & digital future: Key requirements for successful twin transitions in the European Union', *JRC Science for Policy Report*, JRC129319, Publications Office of the European Union, Luxembourg, available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC129319>.

Narazani, E. C. (2021), 'EUROLAB: A Multidimensional Labour Supply-Demand Model for EU Countries', European Commission, Seville.

Narazani, E., Agúndez García, A., Christl, M. and Figari, F. (2022), 'Impact of alternative childcare policies on mothers' employment for selected EU countries,' *JRC Working Papers on taxation and Structural Reforms No 08/2022*, European Commission, Joint Research Centre, Seville.

OECD (2018), 'Catching up? Country studies on intergenerational mobility and children of immigrants', OECD Publishing, Paris, available at: <https://doi.org/10.1787/9789264301030-en>.

OECD (2019a), *OECD Skills Outlook 2019: Thriving in a digital world*, OECD Publishing, Paris, available at: https://www.oecd-ilibrary.org/education/oecd-skills-outlook-2019_df80bc12-en.

OECD (2019b), *PISA 2018 Results (Volume II): Where All Students Can Succeed*, OECD Publishing, Paris, available at: <https://www.oecd.org/publications/pisa-2018-results-volume-ii-b5fd1b8f-en.htm>.

OECD (2020a), 'Impact evaluation of labour market policies through the use of linked administrative data', Publications office, available at: https://www.oecd.org/els/emp/Impact_evaluation_of_LMP.pdf.

OECD (2020b), *OECD Employment Outlook 2020: Worker Security and the COVID-19 Crisis*, OECD Publishing, Paris, available at: <https://doi.org/10.1787/1686c758-en>.

OECD (2021a), 'Improving the Provision of Active Labour Market Policies in Estonia, Connecting People with Jobs', OECD Publishing, Paris, available at: <https://doi.org/10.1787/31f72c5b-en>.

OECD (2021b), 'Net Childcare Costs in EU Countries', OECD Publishing, Paris.

OECD (2022a), 'Governance and framework for social partners' involvement in vocational education and training | Engaging Employers in Vocational Education and Training in Brazil : Learning from International Practices', OECD Publishing, Paris, available at: <https://www.oecd-ilibrary.org/sites/da8d7e38-en/index.html?itemId=/content/component/da8d7e38-en>.

OECD (2022b), 'Harnessing digitalisation in public employment services to connect people with jobs', *OECD Policy Brief on Active Labour Market Policies*, available at: https://www.oecd.org/els/emp/Harnessing_digitalisation_in_Public_Employment_Services_to_connect_people_with_jobs.pdf.

OECD (2022c), 'Impact Evaluation of Vocational Training and Employment Subsidies for the Unemployed in Lithuania', OECD Publishing, Paris, available at: <https://www.oecd.org/els/emp/LTtechnicalNote-September2022.pdf>.

OECD (2022d), *OECD Employment Outlook 2022: Building Back More Inclusive Labour Markets*, OECD Publishing, Paris, available at: <https://doi.org/10.1787/1bb305a6-en>.

OECD (2022e), 'The post-COVID-19 rise in labour shortages', *OECD Economics Department Working Papers*, no 1721, OECD Publishing, Paris, available at: <https://doi.org/10.1787/e60c2d1c-en>.

OECD (2023a), 'Evaluation of active labour market policies in Finland', OECD Publishing, Paris, available at: <https://www.oecd.org/els/emp/LTtechnicalNote-September2022.pdf>.

OECD (2023b), 'Job creation and local economic development 2023: Bridging the great green divide', OECD Publishing, Paris, available at: <https://doi.org/10.1787/21db61c1-en>.

OECD (2023c), 'Labour and skills shortages in the agro-food sector', *OECD Food, Agriculture and Fisheries Paper*, no 189, OECD Publishing, Paris, available at: <https://www.oecd.org/publications/labour-and-skills-shortages-in-the-agro-food-sector-ed758aab-en.htm#:~:text=Labour%20and%20skills%20shortages%20are,wages%20and%20limited%20career%20prospects..>

OECD (2023d), *The impact of AI on the workplace: Main findings from the OECD AI surveys of employers and workers*, OECD Publishing, Paris, available at: https://www.oecd-ilibrary.org/social-issues-migration-health/the-impact-of-ai-on-the-workplace-main-findings-from-the-oecd-ai-surveys-of-employers-and-workers_ea0a0fe1-en;jsessionid=qd2iKMCxQhgyh8Y3Z00vOMwVAP9ZFDrL6m8Ff7H.ip-10-240-5-183.

Pelley, E. and Carnes, M. (2020), 'When a specialty becomes "women's work": Trends in and implications of specialty gender segregation in medicine', *Academic Medicine*, vol. 95, no 10, pp. 1499-1506.

- Ployhart, R. E., Schmitt, N. and Tippins, N. T. (2017), 'Solving the Supreme Prolem: 100 years of selection and recruitment at the Journal of Applied Psychology', *Journal of Applied Psychology*, vol. 102, pp. 291-304.
- Pomar, L., Favre, G., de Labrusse, C., Contier, A., Boulvain, A. and Baud, D. (2022), 'Impact of the first wave of the COVID-19 pandemic on birth rates in Europe: a time series analysis in 24 countries', *Human Reproduction*, vol. 37, pp. Pages 2921–2931..
- Pouliakas, K. and Ranieri, A. (2018), *Governance of Labor Market and Skills Intelligence as Driver of VET Reform*.
- Pouliakas, K. and Wruuck, P. (2022), 'Corporate training and skill gaps: did COVID-19 stem EU convergence in training investments?', *EIB Working Paper*, Luxembourg, available at: <https://www.eib.org/en/publications/economics-working-paper-2022-07>.
- Ryan, A. M. and Ployhart, R. E. (2014), 'A century of selection', *Annual Review of Psychology*, vol. 65, pp. 693-717.
- Saussay, A., Sato, M., Vona, F. and O'Kane, L. (2022), 'Who's fit for the low-carbon transition? Emerging skills and wage gaps in job and data', *FEEM Working Paper*, no 31, available at: <https://ssrn.com/abstract=4260227>.
- Schaeffer, M. (2019), 'Social mobility and perceived discrimination: Adding an intergenerational perspective', *European Sociological Review*, vol. 35, no 1, pp. 65-80.
- Shannon, G., Minckas, N., Tan, D., Haghparast-Bidgoli, H., Batura, N. and Mannell, J. (2019), 'Feminisation of the health workforce and wage conditions of health professions: an exploratory analysis', *Human Resources for Health*, vol. 17, no 72 (Winter 2019).
- SME United (2023), 'SMEUnited priorities to tackle labour and skills shortages in SMEs – European Year of Skills', available at: <http://20221208-smeunited-priorities-eyes-2023.pdf>.
- Spasova, S. and Wilkens, M. (2018), *The social situation of the self-employed in Europe*, European Trade Union Institute (ETUI) and European Social Observatory (OSE), Brussels.
- Steinmann, J. (2019), 'The paradox of integration: why do higher educated new immigrants perceive more discrimination in Germany?', *Journal of Ethnic and Migration Studies*, vol. 45, no 9, pp. 1377-1400.
- Sutherland, H. a. (2013), 'EUROMOD: the European Union tax-benefit microsimulation model', *International Journal of Microsimulation*, vol. 1, pp. 4-26.
- Telsnig, T. et al. (2022), 'Clean Energy Technology Observatory: Wind Energy in the European Union – 2022 Status Report on Technology Development, Trends, Value Chains and Markets', *JRC130582*, Publications Office of the European Union, Luxembourg, available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC130582>.
- Thebaud, S. and Charles, M. (2018), 'Segregation, stereotypes and STEM', *Social Sciences*, vol. 7, no 7 (Summr 2018), pp. 1-18.
- Thum-Thysen, A. V. (2019), *Skills mismatch & productivity in the EU*, Thum-Thysen, A., Vandeplass, A. (2019). Skills mismatch & productivity in the EU, Publications Office, European Commission, Directorate-General for Economic and Financial Affairs, available at: <https://data.europa.eu/doi/10.2765/954687>.
- Valenduc, G. (2011), 'Not a job for life? Women's progression, conversion and dropout in ICT professions', *International Journal of Gender, Science and Technology*, vol. 3, no 2, pp. 483-500.
- Verges Bosch, N., Freude, L., Samaranch, E. A. and Ramos, A. M. (2021), 'Women working in ICT: situation and possibilities of progress in Catalonia and Spain', *Gender, Technology and Development*, vol. 25, no 2 (Autumn 2021), pp. 275-293.
- Vona, F. (2019), 'Job losses and political acceptability of climate policies: why the "job-killing" argument is so persistent and how to overturn it', *Climate Policy*, vol. 19, no 4 (Spring 2019), pp. 524-532.
- Westhoff, L., Corti, F., Grabowska, I., Alcidi, C. and Chłóń-Domińczak, A. (2022), 'Empowering children: childcare services in a rights-based comparative perspective (1.0)'.
- Wiers-Jenssen, J. and Try, S. (2005), 'Labour market outcomes of higher education undertaken abroad', *Studies in Higher Education*, vol. 30, no 6, pp. 681-705.

Wiers-Jenssen, J., Tillman, M. and Matherly, C. (2020), 'Employability: how education abroad impacts the transition to graduate employment', in Anthony C. O., Streitwieser, B. and Van Mol, C. (Eds.), *Education abroad: bridging scholarship and practice*, New York: Routledge.

World Economic Forum (2023), 'Can automation pull us through the global labour shortage?', available at: <https://www.weforum.org/agenda/2023/01/how-automation-will-pull-us-through-the-labour-shortage-davos23/#:~:text=Developed%20and%20developing%20economies%20are,more%20jobs%20than%20they%20eliminate.>

World Health Organisation (2019), *Delivered by women, led by men: A gender and equity analysis of the global health and social workforce*, WHO Publishing, Geneva.

DATA SOURCES AND DEFINITIONS

Most of the data used in this report originates from Eurostat, the Statistical Office of the European Union. The main data sources used are:

- European Union Labour Force Survey (EU-LFS):
 - https://ec.europa.eu/eurostat/statistics-explained/index.php?title=EU_labour_force_survey_statistics
- ESA2010 National Accounts:
 - [https://ec.europa.eu/eurostat/statistics-explained/index.php?title=National_accounts_\(incl._GDP\)](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=National_accounts_(incl._GDP))
- EU-Statistics on Income and Living Conditions (EU-SILC):
 - [https://ec.europa.eu/eurostat/statistics-explained/index.php?title=EU_statistics_on_income_and_living_conditions_\(EU-SILC\)_methodology](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=EU_statistics_on_income_and_living_conditions_(EU-SILC)_methodology)

Definitions and data sources of main indicators

Real GDP: Gross Domestic Product (GDP), volume, annual change (Source: Eurostat, ESA2010 National Accounts [nama_10_gdp]). Dataset available [here](#).

Employment rate: number of people employed divided by the population in the 20-64 age bracket (Source: Eurostat, EU-LFS [lfsi_emp_a]). Dataset available [here](#).

Activity rate: labour force (employed and unemployed) as a share of total population in the 15-64 age group (Source: Eurostat, EU-LFS [lfsi_emp_a]). Dataset available [here](#).

Unemployment and youth unemployment rate: unemployed as a share of the labour force in the (respectively) 15-74 and 15-24 age group (Source: Eurostat, EU-LFS [une_rt_a]). Dataset available [here](#).

Long-term unemployment rate: persons in the 15-74 age group unemployed for a duration of 12 months or more as a share of the labour force (Source: Eurostat, EU-LFS [une_ltu_a]). Dataset available [here](#).

At-risk-of-poverty or social exclusion rate. Percentage of a population representing the sum of persons who are: at risk of poverty, or severely materially and socially deprived, or living in households with very low work intensity (Eurostat, EU-SILC [ilc_peps01n]). Dataset available [here](#).

At-risk-of-poverty rate. Share of people with an equivalised disposable income (after social transfer) below the at-risk-of-poverty threshold, which is set at 60 % of the national median equivalised disposable income after social transfers (Eurostat, EU-SILC [ilc_li02]). Dataset available [here](#).

Severe material and social deprivation rate. Inability to afford a set of predefined material items that are considered by most people to be desirable or even necessary to experience an adequate quality of life (Eurostat, EU-SILC [ilc_md11]). Dataset available [here](#).

Share of persons living in households with very low work intensity. Share of persons living in a household where the members of working age worked a working time equal or less than 20% of their total work-time potential during the previous year. (Eurostat, EU-SILC [ilc_lvhl11n]). Dataset available [here](#).

Income quintile share ratio S80/S20. Ratio of total income received by the 20% of the population with the highest income (the top quintile) to that received by the 20% of the population with the lowest income (the bottom quintile) (Eurostat, EU-SILC [ilc_di11]). Dataset available [here](#).

NEET: Young people not in employment, education or training. Share of people aged 15 to 29 who are not employed (i.e. either unemployed or economically inactive) nor engaged in any kind of further (formal or non-formal) education or training (Eurostat, EU-LFS [lfsi_neet_a]). Dataset available [here](#).

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