



Skills and Europe's Labor Market

How Technological Change and Other Drivers of Skill Demand and Supply are shaping Europe's Labor market

Background to "Growing United: Upgrading Europe's Convergence Machine"



Margo Hoftijzer
Lucas Gortazar

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For ease of reference, this report organizes EU countries into 6 regional sub-groups according to history and geography: EU17 South (Italy, Spain, Portugal, Greece, Cyprus and Malta); EU17 Continental (Luxemburg, Belgium, Austria, Netherlands, Germany and France); EU17 North (Ireland, Denmark, Finland, UK, and Sweden); CEE South (Romania and Bulgaria); CEE Continental (Slovenia, Slovakia, Hungary, Czech Republic, Poland and Croatia); CEE North (Estonia, Latvia and Lithuania).

List of countries

Austria	AT
Belgium	BE
Bulgaria	BG
Croatia	HR
Cyprus	CY
Czech Republic	CZ
Denmark	DK
Estonia	EE
Finland	FI
France	FR
Germany	DE
Greece	EL
Hungary	HU
Ireland	IE
Italy	IT
Latvia	LV
Lithuania	LT
Luxemburg	LU
Malta	MT
Netherlands	NL
Poland	PL
Portugal	PT
Romania	RO
Slovak Republic	SK
Slovenia	SI
Spain	ES
Sweden	SE
United Kingdom	UK

Acronyms and Abbreviations

CEE	Subgroup of the EU that includes the Central East Europe nations of Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia
CEE-Continental	Subgroup of the Central East Europe nations including the Czech Republic, Croatia, Hungary, Poland, Slovakia, and Slovenia
CEE-North	Subgroup of the Central East Europe nations including Estonia, Latvia and Lithuania
CEE-South	Subgroup of the Central East Europe nations including Romania and Bulgaria
EU	European Union
EU-28	All 28 member states of the European Union.
EU-17	Sub-group of the EU of 17 countries including Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, Malta, Netherlands, Portugal, Spain, Sweden, and United Kingdom.
EU17-Continental	Subgroup of EU-17 that includes Luxemburg, Belgium, Austria, Netherlands, Germany and France
EU17-North	Subgroup of EU-17 that includes Ireland, Denmark, Finland, UK, and Sweden
EU17-South	Subgroup of EU-17 that includes Italy, Spain, Portugal, Greece, Cyprus and Malta
LFS	Labor Force Survey
OECD	Organisation for Economic Co-operation and Development
O*NET	Occupational Information Network
PIAAC	Programme for the International Assessment of Adult Competencies
PISA	Programme for International Student Assessment
PPS	Purchasing Power Standard

Executive Summary

This report examines recent trends and underlying causes in labor market outcomes, to assess how the importance of skills for productive employment has evolved. It serves as a background paper to the findings and analyses that are reflected in Chapter 2 of the Growing United report (Bodewig, C., Ridao-Cano, C, 2018), on “The Future of Work”. It particularly reviews labor market outcomes and the demand and supply side factors that determine labor outcomes, with an emphasis on the extent to which technological change drives labor outcomes via its impact on the task content of jobs.

Technological developments, economic growth, demographic change, and globalization are all factors that determine the demand for skills by affecting the demand for goods and services, the location where these are produced, and the skills that are required to produce them. On the supply side, in addition and linked to the important trend of increased female labor participation in the last decades, the supply and skills composition of labor has been greatly affected by the increased educational attainment of the labor market, combined with an inflow of labor from outside of the EU and labor movements between EU countries. At the same time, regulatory frameworks appear to increasingly facilitate labor arrangements that are less secure than they were before.

The combination of short-term shocks and long-term trends have resulted in real and perceived insecurities about the future of jobs for current and future generations. In some of the lesser nuanced of discourses, a well-skilled elite has access to an increasingly well-paid but small number of jobs, while the remainder of the workforce and their offspring is pushed into low-paid jobs or unemployment due to a combination of technology, globalization, an influx of migrants, and a government that caters to the elite more than to the rest of the population.

This report attempts to assess to what extent an increasing labor market divide is occurring in the European Union, and which underlying factors affect these trends. Summarizing, the report finds that there is reason for concern and an urgent need for policy action, since across Europe several trends all risk contributing to increase the vulnerability of the same

population group, i.e. relatively low-skilled workers, old and young, in occupations that include mostly manual and routine tasks. This report focuses on the risks for this segment of the workforce due to the transition to an economy where the service sector and non-routine analytical tasks are increasingly prevalent and well-rewarded. In addition, it highlights how the low-skilled are increasingly likely to have temporary and part-time labor contracts, and are at a higher risk of being substituted by incoming migrant labor with similar skill profiles, especially in countries with rigid labor market systems. If, as is the case in the EU, this vulnerability is transferred within households from parents to children because education systems do not provide equal opportunities for skill development, then an urgent need exists to break this vicious cycle of intergenerational transmission of poverty before it becomes too entrenched to be reversed. In addition to structural reforms of the initial education system, interventions that would usefully be considered would promote effective and well-targeted adult training, increase job security, and strengthen social protection measures – all to avoid that the skill divide between and within countries is perpetuated and is allowed to reduce social cohesion and Europe’s promise to provide equal chances for all.

The specific labor market trends and findings summarized in this part of the report are as follows:

- Technological development is one important dimension that determines labor and skill demand, in combination with economic development, globalization, and demographic trends. Rather than simply replacing jobs, new technology has tended to redefine jobs in ways that demand higher skills. Globalization and offshoring of production can produce gains (and add jobs) in countries where production is relocated, but they also take away jobs, particularly among the lowest-wage workers. Population aging, which has long been a reality in Europe, in addition to placing pressures on welfare systems, can influence the labor market by increasing the need for higher labor productivity (to alleviate resulting labor shortages), and through changing the demand for goods and services that could for example increase the demand for bottom-tier jobs in health care and service occupations.
- Clear continuing trends in the past two decades has been the transition to service activities of more educated workers, simultaneous with a shift away from more routine and manual work toward jobs that are non-routine and inter-personal (like many service-sector jobs) or non-

routine and analytical. With some country exceptions, occupations that are manual, such as many in the agriculture and construction sectors, are declining across the EU.

- For several decades, demand has been steadily rising for high-skilled workers, those who can perform non-routine cognitive work that is not easily replaceable by machines, which includes both professional and technical positions complementary to ICT and automation. The most common trend in Europe concerning task content is, in fact, *de-routinization*, which is increasing the demand for jobs at the top of the professional and wage ladder and decreasing demand for middle-skilled jobs. All countries in the EU have been experiencing this shift. Job polarization—a trend observed in advanced economies like the United States, where mid-skill jobs decline and job growth occurs only among the higher and lower end of the skill spectrum — is not occurring widely across Europe. While the reasons are difficult to disentangle empirically, they may include a combination of differences in economic structure, the skill-level of the workforce, and the extent to which labor institutions promote or discourage labor participation of the low-skilled. The Growing United report, using an approach classifying jobs based on their intensity in different types of tasks, finds that, across the EU, the share of workers in jobs with a high intensity of non-routine cognitive skills has increased, while the share of workers in jobs with a high intensity in manual skills has fallen.
- On the supply side of skills in the labor market, the strong rise in educational attainment of the workforce is considered to have played a strong role in the changes in task content of jobs. Since the 1970s, many EU countries have transformed their education systems, greatly expanding access to universities. This has resulted in major increases in the share of workers with college degrees, from 20 to 30 percent between 2000 and 2015. Complementary to demand-side factors, this increase in the share of university graduates in the European workforce is positively correlated with the rise of non-routine cognitive tasks (both analytical and inter-personal), and with the decline of routine cognitive and manual task content. Examining job tasks by age cohort, we find across Europe that the greater the share of tertiary-educated workers within a cohort, the greater is the intensity of non-routine cognitive tasks among the jobs those workers hold.

- In all EU countries, flexible forms of employment like temporary contracts are more prevalent among workers with lower levels of education. While temporary employment is preferred by some due to the flexibility it offers, it tends to lower the skills of the workforce population and risks exacerbating inequalities between regions and population groups (e.g. between workers with different ages, education levels and skills).
- Lastly, the effect of migration on labor market outcomes is complex, and a review of available research found no consistent pattern of the impacts of migrants on the local economies they work in. A broad conclusion from available evidence would be that, overall, the identified impact of migrant labor on the economy and job outcomes as a whole is relatively small, and can be either positive or negative. Native labor with a skill profile similar to migrants appears vulnerable to substitution, however. The extent of the substitution effect, as well as its nature (i.e. whether it reduces employment or earnings), seems dependent on the rigidity and design of labor market institutions, including on the geographical and occupational mobility of labor.

Introduction

This report complements the recent World Bank publication, *Growing United: Upgrading Europe's Convergence Machine* (Bodewig, C., Ridao-Cano, C., 2018). The *Growing United* report highlights that, while the European Union is still the “convergence machine” that fosters an unparalleled depth and scope of regional economic integration, it is no longer working for everyone. The report points to a growing divide, reflected in inequality widening among households across and within EU countries. It reviews the underlying factors of this growing divide from two angles—that of people and that of firms—and for both it examines the reasons why some are left behind and others thrive.

This report delves deeper into a aspect that is central to the deepening divide between people: *skills*. Gaps in skills play a large role in explaining the growing divide between people. The *Growing United* report highlights that, at the same time that technology, globalization, and other megatrends are making access to ‘good jobs’ increasingly dependent on the possession of a minimum package of relevant skills, many education systems across Europe have become less successful in ensuring that all students acquire the skills that they need. In other words, just when skills became more important, schools became worse – or at least not any better - at providing equal opportunities to developing them. Ongoing developments in the labor market and schools thus risk creating a vicious cycle, that could exacerbate the divide between people across households, countries, and generations. Although this trend is not irreversible, and although it is not occurring (in equal measure) in all EU member states, it needs to be reversed sooner rather than later. Otherwise, breaking the vicious cycle is likely to become increasingly complicated as the divide widens and risks becoming cemented in society. This background report seeks to contribute to the dialogue on equality and skills in the European Union by taking a fresh look at the skills divide from the point of view of the labor market. Together with the background paper focusing on education systems in Europe¹,

¹ See Herrera-Sosa, K., Hoftijzer, M., Gortazar, L., Ruiz, M. (2018)

it complements the Growing United chapters on the Future of Work (chapter 2) and Opportunities for People (chapter 3).

This report can also be usefully read in conjunction with publications that address the topic of skills from a different angle. For example, a recent publication from the European Commission (European Commission 2017) highlights that bolstering Europe's education and training systems is a crucial part of the EU's agenda for smart, sustainable, and inclusive growth; that publication analyses equality in education by assessing member states' progress in achieving the EU's six key 2020 targets for education and training.

Report Outline

This review of labor market trends, the underlying causes that determine which skills are in demand, and how they are rewarded, starts with a framing chapter, briefly summarizing trends in inequity in the EU and ongoing discourse on the impact of technological change and other driver of skill demand and supply on labor outcomes. This is followed by a brief description of trend in employment and earnings in the EU since the late 1990's (chapter 2); and a brief description of factors that shape skill demand (technology, globalization, aging, and the level of economic development) followed by an analysis of the evolution of the task content of jobs (chapter 3). It then proceeds to discuss the parallel impact of supply-side factors, like education and migration, on the resulting labor market trends; and finally proposes an analytical framework to understand the extent to which the interaction of demand and supply factors is altering the labor market structure in the EU (chapter 5).

1. Skills at Work: The Changing Demand for Skills and Its Impact on Inequity

Inequality among people has been increasing in many parts of the EU since the 1990s, as low-income Europeans have been falling behind in the labor market. Inequality has been gradually increasing, particularly in CEE countries. Although within-country inequality is lower in the EU than in any other developed region in the world, most of the EU17-South countries and most CEE countries today have inequality levels above the OECD average. This has been driven mainly by the bottom 40 percent of the population with the lowest incomes falling behind. This fall is likely to persist over time and to have a long-term impact on growth (Inchauste and Karver, 2018).

European households' perceptions of their own situation and of the economy have also taken a turn for the worse. Many Europeans persistently believe that the economic situation is not good, and that it will not improve in the near future. Moreover, many perceive little improvement in their own well-being relative to the past and looking toward the future, with pessimism concentrated among older, middle-income individuals (Inchauste and Karver, 2018).

The role of the labor market in shaping individual welfare and economic outcomes is key to understanding these trends. Beyond affecting individual perceptions and collective identities, labor market outcomes are key to understanding economic outcomes and their redistributive impact. Indeed, policy and public debates around the future of work in a rapidly changing labor market are at the core of many local, national, and international forums.

Many discussions of labor market trends revolve around the impact of technological changes on jobs. In-depth economic and social research has examined the causes and likely effects of technological change on the labor market, and social media are rife with speculation about “whether the robots will take our jobs.” While some studies have identified types of jobs and tasks that are more prone to workplace automation and attempted to quantify them (Frey and Osborne 2013; McKinsey 2017; Arntz et al. 2016), much of the discussion about future impact necessarily remains speculative. And several voices highlight evidence that automation may create as many new jobs as the old ones it destroys (Autor 2015; Bessen

2016). It is now clear that the task content of jobs in EU countries has changed dramatically toward non-repetitive, machine-compatible tasks, while certain job tasks are subject to being replaced by machines and robots. However, implications of technological developments cannot be adequately assessed without considering other, non-technology-related trends that either influence skill demand or determine skill supply.

The objective of this part of the report is to provide an in-depth look at what has determined the EU trends in labor market outcomes, both from a skills-demand perspective and from a supply perspective. Comparing both within and between country outcomes, the proposed analytical framework presents dimensions of skills *demand* and *supply* that are at the center of the public debate and research in Europe. Even when demand and supply dimensions are discussed separately, it is important to acknowledge that both factors are inter-related. On the one hand, changes in skills supply through population upskilling may occur as a response to more demand for highly skilled workers in growing productive sectors and occupations. On the other hand, firms and sectors adjust their activity to the available skill supply, raising the demand for highly skilled workers if the population is becoming better skilled. Nevertheless, a closer look into underlying labor demand and supply factors allows us to better understand the labor dynamics behind the observed increases in inequality.

Labor demand factors relate to structural economic change (or economic transformation) that shapes the demand for labor and skills, displacing unproductive jobs and tasks and requiring new jobs and tasks as a consequence. At the core of the debate on economic transformation is the transition driven by technological change, resulting in a shift in the task content of jobs toward more nonroutine activities, while technological development increasingly reduces the need for workers to carry out routine activities.² Beyond technology, other key drivers of structural change include the offshoring of certain activities to less developed countries and structural changes in the demand for products and services due to higher income levels and demographic changes (aging) of the population, among other factors. As will be described in the

² In particular, this transition has been widely documented (especially in the UK and Germany) to be related to the technological change due to exogenous decreases in prices of ICT and computer capital in the last decades.

remainder of this report, the extent to which EU countries are affected by these factors differs between countries.

Labor supply factors influence the level, type, and distribution of skills of the workforce. They have been extremely relevant in the last decades for most, if not all, European countries. The expansion of education systems has been very important in many countries since the 1980s and particularly large in the EU-South and CEE countries, resulting in a rapid rise in the workforce's educational attainment. Simultaneously, the inflow of migrants has also had an impact on labor and skill supply. Hence, it is important to understand how and to what extent both phenomena affect the overall workforce skills and the evolution of the task content of jobs, and ultimately their redistributive impact across European households, to complement the analysis of the evolution of labor and skills demand in Europe.

BOX 1.1. A NOTE ON SKILLS TERMINOLOGY AND DATA

This report mostly distinguishes skills in terms of their cognitive, interpersonal, and manual nature, and based on whether they are routine and non-routine. In various instances, educational attainment is considered a proxy for skill attainment. Whereas other categorizations or a higher level of specificity may have been more ideal, and the authors recognize that educational attainment is far from a perfect proxy of skill attainment (as becomes even clearer by Growing United's analysis on inequities in Europe's education systems) this approach is in line with comparable methodologies applied in global literature on the topic of labor outcomes and skills, and guided by the nature of available data.

2. Trends in employment rates, earnings and alternative labor arrangements

Employment trends

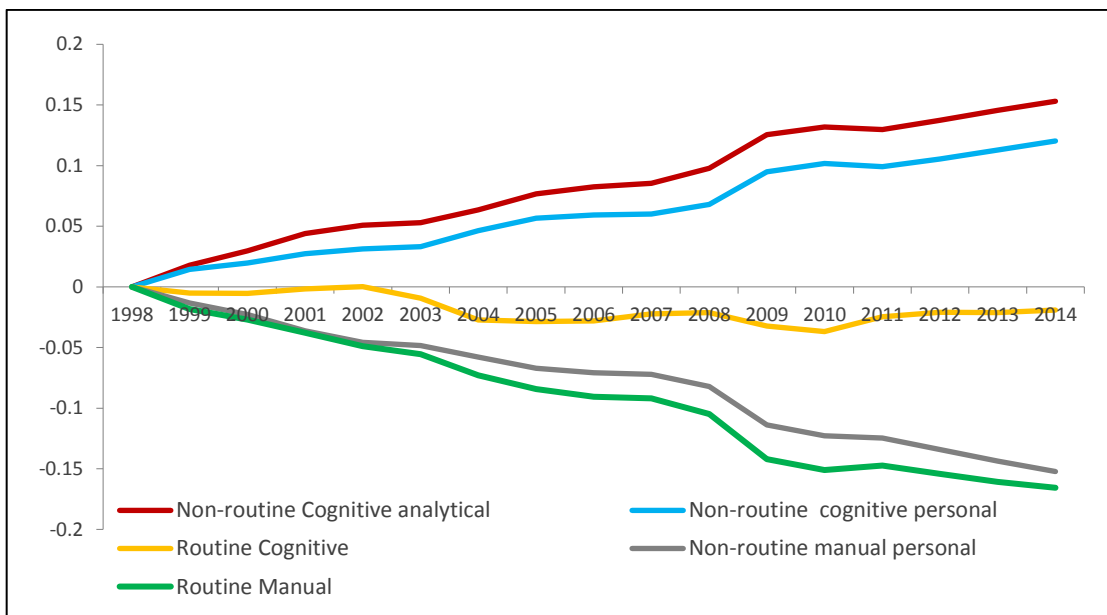
Employment rates in Europe peaked in 2015, after a steady growth between 1998 and 2008, a sharp decline between 2008 and 2013, and a moderate recovery in the last years. Between 2000 and 2008, employment rates saw particularly large expansions in EU17-South (from 57.8 percent in 2000 to 63.2 percent in 2007) and CEE-North (from 59.0 percent in 2000 to 67.6 percent in 2007).³ Conversely, the Great Recession in Europe generated a decline of employment in most EU countries. Employment suffered especially in the EU17-South countries, with employment rates falling to very low levels in Greece (from 61.4 percent in 2008 to 48.8 percent in 2013), Spain (from 65.8 percent in 2007 to 54.8 percent in 2013), and Cyprus (from 71 percent to 61.7 percent).

In the last two decades, Europe's labor market has been characterized by two key trends: the massive increase in participation of women and the transition to service activities. Employment rates grew in all countries in Europe since the beginning of the century. They did so particularly because of the surge in female participation in the labor market, a key feature that promoted gender equality and larger efficiency through population workforce upskilling. In particular, while the overall employment rate increased from 62.2 percent in 2000 to 64.7 percent in 2015, the female employment rate in the same period rose from 53.7 percent to 60.5 percent. At the same time, a transition to service-sector activities from industrial and manufacturing activities took place, especially in the EU-17, which had already transitioned out of agriculture economies. In the CEE countries, the growth in services came also from a transition out of agriculture; for example, since the early 2000s, the share of agricultural employment declined considerably in countries such as Bulgaria, Croatia, Hungary, Poland, and Romania.

³ EU-28 countries are grouped for the period of analysis (1998 or 2000 onwards) even if some countries joined the EU afterwards.

Related to the transition to service-sector activities is the increase in job tasks that require more analytical and interpersonal skills, usually performed by highly skilled workers. **Error! Reference source not found.** illustrates the evolution of job tasks following the proposed categorization by Autor, Levy and Murnane (2003). In this categorization, workers perform either *cognitive, interpersonal* or *manual* tasks, and they do so in a *routine* (repetitive) or *non-routine* manner. In particular, employment in occupations with non-routine interpersonal tasks, such as teamwork and interaction with colleagues, or with non-routine cognitive analytical tasks, such as verbal ability or problem-solving tasks, is growing. Conversely, jobs and occupations in which workers perform manual and physical tasks –such as the ones performed by agriculture workers, drivers, and workers in the construction sector—are declining, although the changes are quite different across countries in the EU, as will be seen in the next section. Technological change taking place around the world is altering and accelerating a transition toward service economies, which changes the task content of jobs by replacing tasks that are easily performed, with computers and machines becoming complementary to tasks (cognitive analytical or interpersonal) that cannot be replaced by machines. The labor market increasingly values the so-called non-routine tasks more highly than routine tasks, creating a stronger division of labor, with important redistributive consequences.

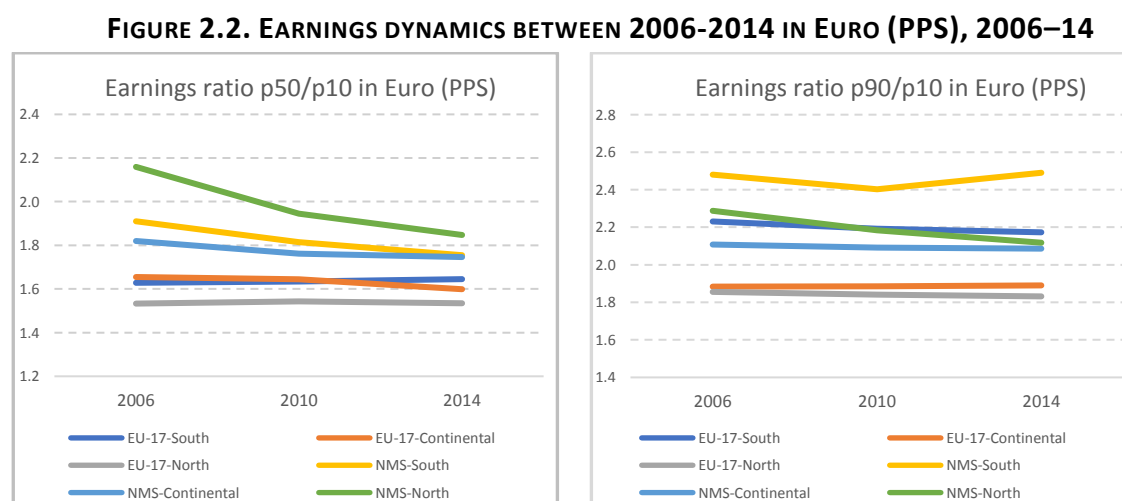
FIGURE 1.1. THE EVOLUTION OF TASK CONTENT OF JOBS IN EU-28, 1998–2014



Source: Gorka, S., Hardy, W., Keister, R., and Lewandowski, P. (2017). Malta and Luxembourg are excluded.

Earnings trends

Earnings in Europe generally increased, on average, between 2002 and 2010, but stagnated in 2014, especially for CEE countries and EU17-South. Earnings trends since the early 2000's display cross-country convergence between 2002 and 2010 and some divergence between 2010 and 2014. Within-country earnings inequalities have decreased or remained constant, although there are large inequalities above the average of the distribution for some countries. Figure 2.2 depicts the evolution of earnings ratios by groups of countries in the period 2006–14.⁴ The earnings ratio between median-earnings workers (p50, 50th percentile) and low-salary workers (p10, 10th percentile) decreased, with the largest declines in Hungary, Lithuania, Latvia, Poland, and Romania, although some large increases also occurred, like the one observed in Greece. The earnings ratio between the top percentile (p90) and the bottom percentile (p10) remains high. The sharpest changes were observed in the increases in Germany and Cyprus, and in the decreases in Estonia, Greece, Portugal, and Slovenia.⁵



Source: Authors based on Eurostat data. Malta and Luxembourg are excluded.

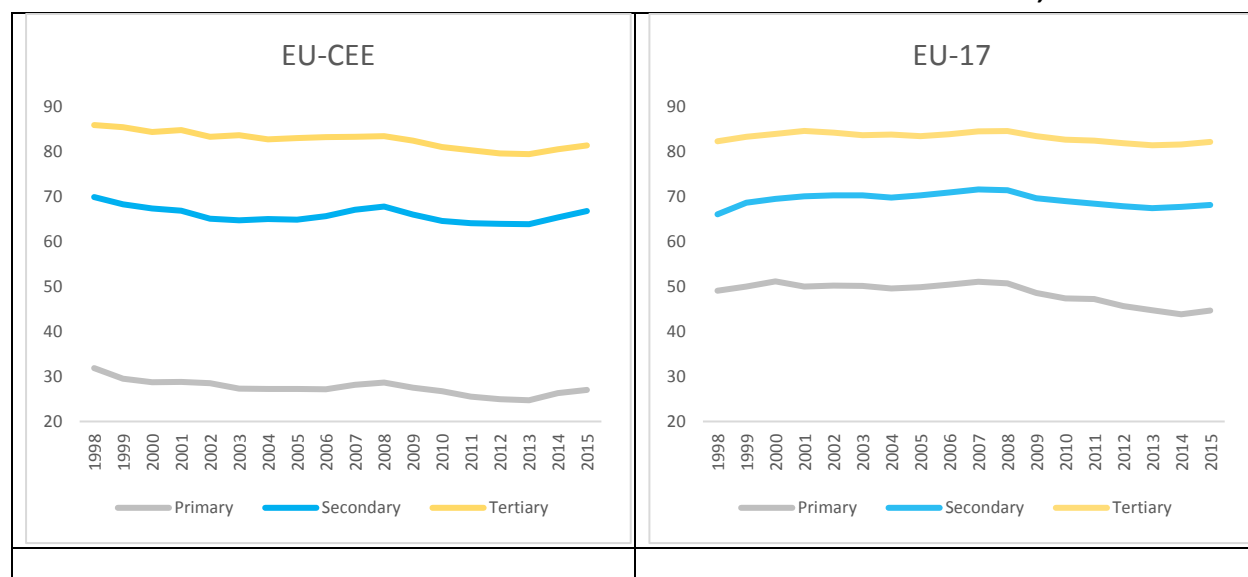
⁴ Data from the year 2002 have been excluded due to the low number of countries participating.

⁵ Earnings data are derived from the Eurostat Structure of Earnings survey, that covers firms with at least 10 employees. As the data do not include lower wages often found in smaller firms, nor informal labor arrangements, they might generate an artificial upward bias of the lowest paid workforce population.

Fewer jobs and less job security for the low skilled, the young, and women

Employment rates are strongly, and increasingly, related to education level, mainly because the employment rates among people with a primary-only education have declined the most. Differences between education levels are particularly high in CEE countries, where the employment rates of low-educated workers are still very low. In the EU17, employment rates among individuals with secondary education increased in all countries except Ireland and the United Kingdom, while in the CEE countries they declined on average by 2.9 percentage points. Finally, employment rates of tertiary educated individuals declined in the EU-17, while they rose in the CEE-North.

FIGURE 2.3. EMPLOYMENT RATES BY EDUCATION LEVEL IN THE EU-CEE AND EU-17, 1998–2014



Source: Own calculations using Eurostat Data. Malta and Luxembourg are excluded.

Fixed-term contracts have been widely used in labor-relation frameworks in the EU during the last decades. The share of employed workers with temporary employment contracts (defined as formal work arrangements that have a clear end-date, as opposed to undefined period of time contracts) has been relatively stable across the EU, with the exception of Poland, where this type of employment has increased considerably in recent years. Other countries, like Spain and Portugal, have also had temporary employment rates of more than

20 percent of total employment during economic expansions, following cyclical patterns (especially in Spain), while the evolution in other CEE countries has been anticyclical.

Temporary employment is particularly prevalent among young workers, especially in countries with high youth unemployment. Across the EU, almost a third (32 percent) of employed youth ages 15–29 have temporary contracts with particularly high rates in Poland (53.3 percent), Portugal (53.1 percent), Slovenia (51.4 percent), and Spain (54.3 percent).

In many countries, primary-educated workers are more likely to be temporarily employed than those with higher levels of education. The rapid growth in temporary jobs in Poland, which by 2014 had the highest share of temporary jobs in total employment among all EU countries, has been driven by a large expansion there of temporary work for primary-educated workers. Primary-educated workers in CEE countries also faced the strongest fluctuations in temporary employment, implying that they have been at a higher risk of falling into temporary employment during recessions than other groups of workers.

In addition to the potential benefits of flexible labor arrangements for both works and firms, there are also indications that fixed-term contracts can lead to inequitable and inefficient labor market outcomes. While labor market rigidities caused by excessive labor market protection prevent efficient allocation of labor, fixed-term contracts to balance such lack of flexibility may results in unfair and poor-functioning labor settings. For example, in a study of France, Blanchard and Landier (2002) find that temporary contract reforms led to higher turnover with an increased unemployment rate and unemployment duration. Cabrales et al (2014) find that excessive temporary employment tends to lower the skills of the workforce population, no matter what their previous education and skills background may be, due to higher rotation, perverse incentives, and lack of on-the-job training. A nuanced approach to balancing labor market protection with flexibility could imply attention to reducing the employment protection gap between permanent and temporary workers.⁶

Part-time work is also important to understanding income and employment distributional patterns in the EU, especially related to gender differences. The incidence of part-time work varies considerably across the EU, although it has increased in most EU-17 countries in

⁶ See Dolado, Lalé and Siassi (2016).

recent years (from 16.5 percent to 19 percent of total work between 2005 and 2015 for workers ages 20 to 64), with the share of part-time employment being particularly high in EU17-Continental and North. It is above 20 percent in Denmark, Germany, Ireland, and Austria, and as high as 46.9 percent in the Netherlands. In the CEE countries, part-time work is less important and has remained rather constant in recent years. Part-time workers are often female, with the share of male part-time workers being 8.8 percent in the EU-28 in 2016, and the share of female workers being part-time employed 31.9 percent. Across all EU countries, lower educated workers tend to access part-time work more disproportionately, with the gap with more educated workers being relatively stable throughout the years.

The option of part-time employment reflects a trade-off between integrating inactive workers by enabling more flexibility on the one hand, and involuntary part-time work on the other. Part-time employment has been useful in reconciling worker preferences and firm needs in central European labor markets, and limited access to part-time employment is often mentioned as an important factor preventing further women's employment expansion in the CEE countries (Razzu 2017). Conversely, the usage of part-time work to raise participation can result in involuntarily part-time employment, especially for women. EU17-South countries experienced both the expansion of part-time employment rates and a sharp increase in the shares of part-time workers reporting that they would prefer working full-time. The EU17-Continental and -North countries, on the other hand, combine the highest shares of part-time workers with the lowest shares of involuntary part-time employment.

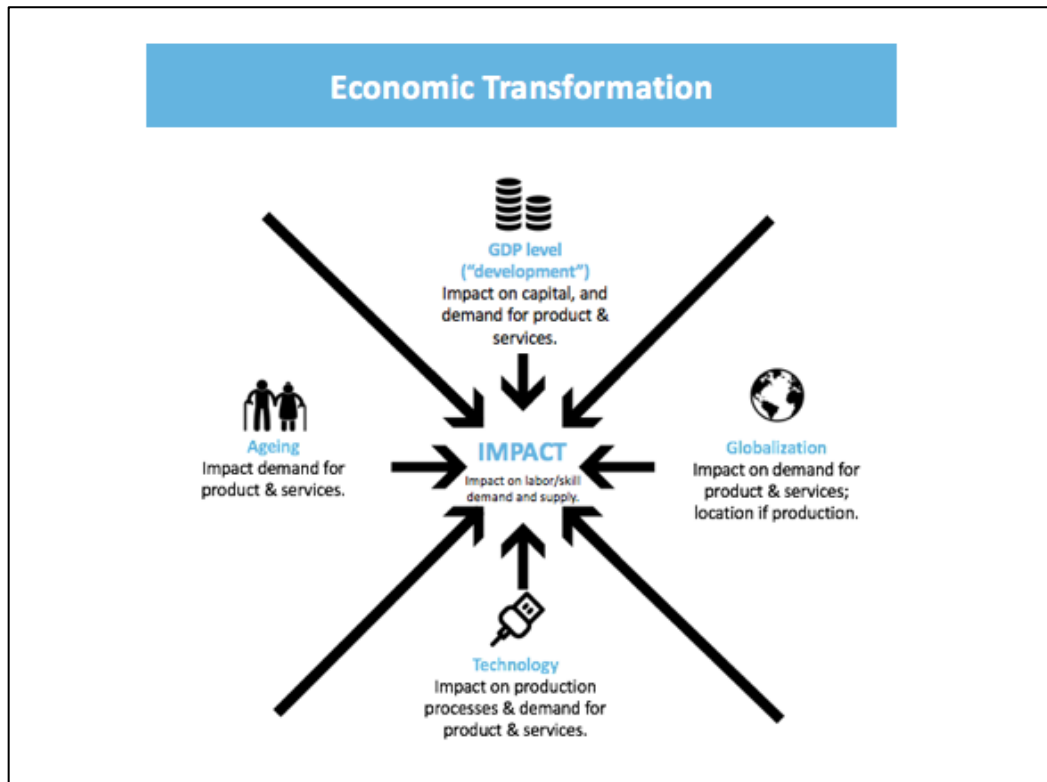
3. The evolution of the task content of jobs and skill demand

If one's goal is to reduce undesirable inequities in labor outcomes, identifying the right policy levers will require understanding the changes in labor and skills demand and their determinants. The current policy debate puts considerable focus on job de-routinization and job polarization as key determinants of increasing labor market inequities. This section presents a framework for describing the potential developments underlying these phenomena. It then examines to what extent job-deroutinization and polarization are occurring in the EU and what might explain the observed differences across EU countries.

Determinants of skill demand: a framework

Ample literature and public debates address economic transformation and the changing demand for new skills in the labor market through narratives hypothesizing about the future of work. In many of these discourses, the impact that technology has and will continue to have on job demand across the EU tends to play, justifiably, a central role. Technology, while important, is not the only determining factor of skill demand and the content of jobs. As is presented below, additional important dimensions include the overall level of development of an economy, globalization, and aging (Figure 3.1).

FIGURE 3.1. A FRAMEWORK FOR SKILLS DEMAND TRANSFORMATION



Source: Autors.

The first of the four factors represented in this framework is technology. The role of technological change in shaping skills demand has been widely studied for developed countries, especially the United States, United Kingdom, and Germany. Starting from the concept of skill-based technological change,⁷ essentially upward skilling, Autor, Levy and Murnane (2003) develop a more nuanced version of the impact of technology on skills demand. Such a theory presents computer capital and technology as substitutes for workers who perform repetitive and codifiable tasks, but also as complements to workers performing non-routine tasks. It was developed to describe the phenomenon of labor and wage polarization (the decline of middle-skill jobs and wages while the demand for high- and low-

⁷ See Berman, Bound, and Griliches (1994), Autor, Katz, and Krueger (1998), Machin and Van Reenen (1998), Berman, Bound, and Machin (1997), and Gera, Gu, and Lin (2001).

skilled jobs rises) in the United States and some European countries such as Germany and the United Kingdom.

Second, skill demand is determined by the level of a country's economic development, among others because households' wealth is an important determinant of the types of goods and services that they seek to purchase which, in turn, determines the task content of jobs. Higher levels of GDP per capita and development are also linked to wage levels and labor productivity, which influence skill demand via their impact on the types of production that are likely to be off-shored. This mechanism is reinforced by increased demand of skilled workers, as skilled workers tend to consume tradeable and non-tradeable goods that have a high content of high-skilled labor (Moretti, 2010). Moreover, identifying the stage of economic development helps understand the impact of technology on the demand for skills and jobs. As De la Rica and Gortazar (2016) show in a cross-country comparative study, country differences in ICT use at the workplace help explain differences in job de-routinization.

Third, globalization, particularly the offshoring of production processes, is another factor identified as transforming skills demand. As Hummels, Munch and Xiang (2016) point out, "offshoring becomes a new expression of the old idea: gains from trade arising from specialization." Nevertheless, the outsourcing of certain jobs and tasks can have direct implications on local labor markets and therefore become a concern to the public and to policy makers. Clearly, globalization and the offshoring of production can produce gains in those countries to which production is relocated (as well as to consumers globally), but it is equally true that there are losers in the labor market from which job activities disappear and that policymakers cannot ignore. Considering the nature of the jobs that are relocated, these losers are most likely to be low-wage workers.

Fourth, the aging of the overall population is an irreversible process in most, if not all, EU countries that is altering the demand for goods and services in the economy and can accelerate the impact of technology on skill demand. According to Eurostat, the old-age dependency ratio (individuals aged 65 or more as a share of working age population 16-65) in the EU will go from 27.8 percent in 2013 to 39.5 percent in 2030, and may be as high as 47.6 percent and 43.6 percent for Denmark and Latvia, respectively. This will pose several

challenges to welfare and labor market systems in the EU. But it is not clear how the economy and labor and skills demand will be affected. Recent research by Acemoglu and Restrepo (2017) finds a positive relation between aging and growth in developed countries. They argue that scarcity of labor through aging can promote more investment in automation and technology adoption. Beyond their finding on growth, a topic which is still widely discussed in research forums, they point to changes generated by aged populations in demanding new complementary goods and services (related to health and care services) that alter the skill demand at the top and the bottom of the distribution.

Job de-routinization: a mixed picture across Europe

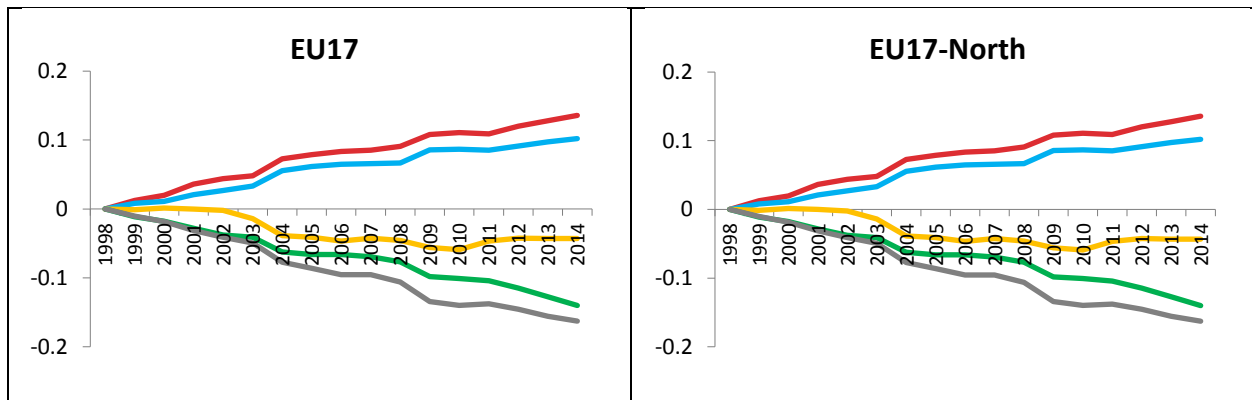
The shift from routine to non-routine work has been crucial to the medium-term development of labor markets in the developed world. Autor et al. (2003) show that key changes have occurred in the US labor market since the 1970s that can be attributed to computer adoption and the automation of production. In the United States, they find, computer adoption has complemented non-routine tasks while substituting for what had been workers' routine and repetitive tasks. Goos, Manning and Salomons (2014) and other authors argue that similar changes have occurred in Western Europe since the 1990s. Likewise, Spitz-Oener (2006) shows that in Germany, greater use of ICT by workers has reduced the importance of routine work. These shifts, observed in many other countries as well, are generally referred to as *de-routinization* because they decrease the demand for routine tasks, with both manual and cognitive routine jobs being replaced by machines. Common examples of affected jobs include clerical support workers, services and sales workers, skilled agricultural, forestry and fishery workers, craft and related trades workers, and plant and machine operators and assemblers. At the same time, there has been an increased demand for high-skilled workers who can perform non-routine cognitive work, both analytical and interpersonal, work that is (so far, at least) not replaceable by machines, and an increased demand to fill positions complementary to ICT and automation, such as managers, professionals, technicians, and associate professionals. Studies focusing on post-transition, middle-income, or developing countries confirm that the importance of non-routine work (and high-skilled jobs) is increasing in these countries. However, study findings have been much more ambiguous

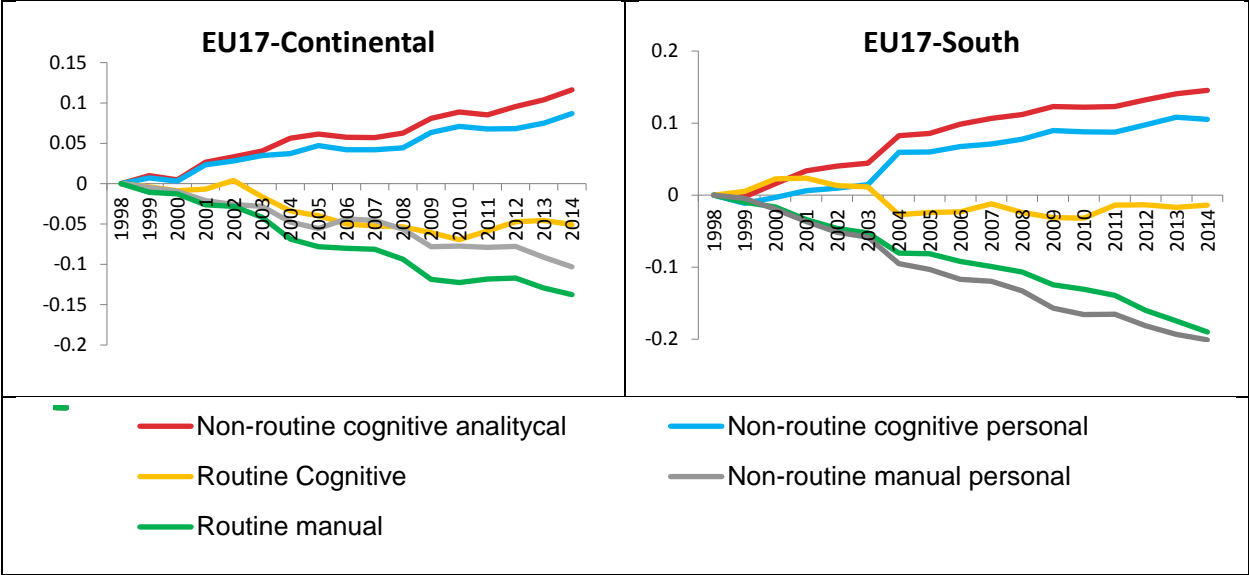
regarding the evolution of routine work (sometimes including middle-skilled jobs), which has been rising in several countries around the world (Aedo et al., 2013).

To better understand the full dynamics of labor demand in Europe, a comprehensive description of the way the task content of jobs has evolved there is necessary. To understand the recent trends in skills demand and portray the likely labor market of the future, this section looks at the evolution of task content of occupations. It does so by applying the methodology of Acemoglu and Autor (2011) to all European countries with available Labor Force Surveys (LFS) data between 1998 and 2014. It uses the Occupational Information Network (O*NET) as the source of information on tasks and generates five categories for tasks: *non-routine cognitive analytical*, *non-routine cognitive interpersonal*, *routine cognitive*, *routine manual*, and *non-routine manual physical*.

During the 16-year period under review, all countries in the EU experienced growth in non-routine cognitive tasks and a steep decline in jobs requiring both routine and non-routine manual tasks. The evolution of jobs' task content was quite similar among European countries, although the magnitude of the changes was slightly lower for EU17 Continental countries (Figure 3.2) and also for Bulgaria and Romania. Overall, there was a continual increase in demand for non-routine analytical and interpersonal tasks with a simultaneous decline in demand for manual tasks (both routine and non-routine) across countries and regions, although there was some variation in the magnitude of those changes.

FIGURE 3.2. EVOLUTION OF THE TASK CONTENT OF JOBS (EMPLOYED) IN THE EU17, BY REGION, 1998–2014



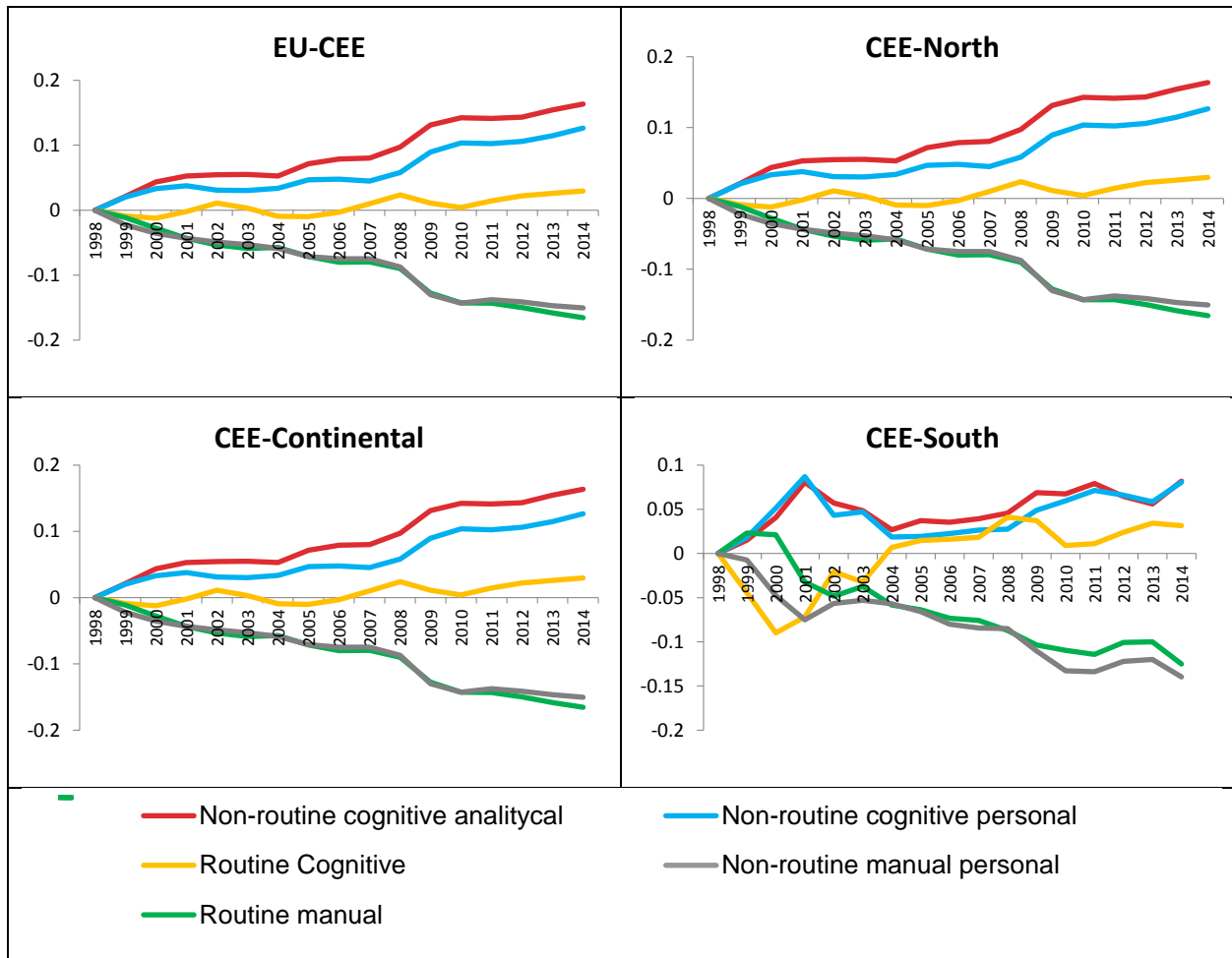


Source: Gorka, S., Hardy, W., Keister, R., and Lewandowski, P. (2017) Malta and Luxembourg are excluded.

What particularly distinguishes the EU-17 countries from the CEE countries is the trend observed for routine cognitive tasks, which decreased substantially among the former but slightly increased in the latter. There were also significant differences within different regions of the EU-17 and the CEE clusters. The Continental and Northern members of the EU17 recorded larger drops in routine cognitive tasks (comparable to the drop in manual tasks) than the Southern EU-17. While the Continental CEE countries also recorded a similar decline in routine cognitive tasks, as already noted the CEE countries as a whole saw routine cognitive tasks rising slightly (Figure 3.3). This increase was largely driven by the Northern CEE countries, such as Lithuania, Latvia, Estonia, but also Poland, Slovakia, Romania, and Bulgaria. In the Southern CEE countries, the intensity of routine cognitive tasks barely changed during the period. It seems that the level of economic development played a role in explaining the differences in the trend for routine cognitive task content of jobs across EU countries: in countries with higher levels of GDP per capita, ‘economic development’ implies a move away from routine cognitive task content to increased non-routine cognitive task content; in countries which still are less advanced in their economic transformation, the

transformation process also comprises a change toward increased routine cognitive task content (from manual tasks).

FIGURE 3.3. EVOLUTION OF TASK CONTENT OF JOBS (EMPLOYED) IN CEE, BY REGION, 1998 - 2014



Source: Gorka, S., Hardy, W., Keister, R., and Lewandowski, P. (2017).

Nevertheless, routine cognitive tasks will likely decline in Central and Southeast European economies as well. The analysis of the task content of jobs held by the unemployed suggests that routine cognitive tasks will eventually decline even in places where they are still increasing (Gorka, S., Hardy, W., Keister, R., and Lewandowski, P., 2017). Across all EU countries, jobs held by workers before they became unemployed are more intensive in manual and routine cognitive tasks than the average job, including in countries where routine

cognitive tasks are currently still increasing. This pattern will tend to cause jobs with routine cognitive task content to decline over time.

De-routinization without job polarization?

The shift away from manual and routine cognitive tasks at the workplace and the rise in non-routine cognitive tasks are altering the structure of the skills demand in Europe. Since the late 1990s, workers across Europe have performed tasks that are less manually intensive and more intensive in cognitive (analytical and personal) requirements, as well as more non-routine. The evolution of routine cognitive tasks is more complex and depends on countries' level of economic development: routine cognitive tasks are declining in advanced countries but remaining constant or even rising in less advanced countries. Overall, this process is closely related to the cognitive skills that workers have at the workplace, and it has most affected workers born after 1970, as distinct from those born before 1970.

Although job polarization is sometimes presented as the next step after job de-routinization, the evidence about this is mixed. Job polarization has occurred in a few advanced countries. Routine-biased technical change theory predicts a decline in demand for middle-skilled workers performing routine work and a rise in demand for high-skilled non-routine cognitive and interpersonal jobs (Table 3.1). It also assumes an increase in the demand for low-skilled non-routine manual work, which is not yet prone to automation and can be performed by humans relatively cheaply (e.g., janitors, waiters and waitresses, and drivers). This last prediction has indeed been observed in the United States (Autor, Katz, and Kearney 2006), in the United Kingdom (Goos and Manning 2007), and in Germany (Spitz-Oener 2006), and together with the de-routinization of jobs at the middle and top of the skill distribution it is often referred to as *job polarization*. Polarization and its relation to machines and robots have been widely discussed in public debates and influence social narratives in the context of the Great Recession. A natural subsequent question is whether as a result of technology adoption, job polarization implies wage polarization. For example, Acemoglu and Autor (2011) document a U-shaped growth in the United States of wages in the period 1998–2014,

which according to Firpo, Fortin and Lemieux (2011) and Autor and Dorn (2013) is closely related to technology adoption.

TABLE 3.1. POLARIZATION AND DE-ROUTINIZATION HYPOTHESIS

Hypothesis	Low-Wage Occupation	Middle-Wage Occupation	High-Wage Occupation
Polarization	Positive (small)	Negative (large)	Positive (large)
De-Routinization	No effect	Negative (large)	Positive (large)

Source: Authors

Empirical evidence does not seem to corroborate the job (and wage) polarization hypothesis for the vast majority of European countries. Job polarization is a topic of debate in many European forums, yet the evidence on it is mixed. Studies differ in terms of the periods analyzed, and most of them use incomplete data sources, so it is hard to draw a coherent summary of their findings. For example, examining the pre-crisis period of 1993–2006, Goos, Manning and Salomons (2014) find a clear rise in low-pay occupations only in Finland, Ireland, Norway and the United Kingdom, all of which are highly developed and service-oriented economies, which leads the authors to conjecture that this may also be occurring in Europe’s other highly developed and service-oriented countries. In other cross-country approximations, Fernandez-Macias and Hurley (2016) (studying the period 1995–2007) and Eurofound (2017) (studying 2008–15) describe the evolution of employment by occupation-sector wage quintiles. They find a diverse set of patterns of structural employment changes across Europe that help reject the wage polarization hypothesis.⁸ Other studies stress the

⁸ Indeed, a problematic approximation to data from another set of studies that analyze trends in the task content of jobs is that it tends to compress the task framework into three categories only: *abstract* (which includes non-routine cognitive and interpersonal tasks), *routine* (which includes cognitive and manual routine tasks), and *manual* (which includes manual non-routine tasks). Usually, these tend to assimilate each task into a wage-skill-occupation group (high, middle, and low respectively), an approach which has generated difficulties in interpreting the data according to the original framework, simplifying complex and diverse dynamics that do not really match to the theory. Although this has worked relatively well for the case of the US, extending the approach to the EU creates methodological issues. For example, Goos et al. (2009; 2014) use the three-category papers to gather tasks into three categories. However, Fernandez-Macias and Hurley (2016) analyze the EU-LFS for the period 1995–2007, in which they use a new task classification derived from the worker-level European Working Conditions Survey (carried out every five years by Eurofound) and argue that routine jobs are not placed at the middle of the distribution as Goos et al. (2009; 2014) suggests. More generally, placing Routine Manual tasks together with Routine Cognitive tasks in the middle

importance of labor market institutions to understand the dynamics of wage structure. For example, Dustmann, Glitz, and Frattini (2008) describe an increase in the low-tail inequality in the 1990s, mostly due to de-unionization and labor market institutions, hence rejecting the hypothesis of job polarization at the bottom. In a broader approach, Naticchioni, Ragusa, and Massari (2014) test wage polarization in 15 European countries between 1995 and 2007: they find no evidence of wage polarization but rather a drop in the lower tail of the distribution of wages, which they attribute to labor market institutions, such as part-time or fixed-term work. The Growing United report classifies jobs based on their intensity in different types of tasks, rather than on task content and wage data, as tends to be done in polarization literature. Using this approach, the report finds that, across the EU, the share of workers in jobs with high intensity of non-routine cognitive skills has increased, while the share of workers in jobs with a high intensity in manual skills has fallen. It also posits that medium-skill, medium-educated workers are also at risk, either currently or in the future depending on the country.

Country evidence in Europe concerning the polarization and de-routinization hypothesis points to the need to look to technology interacting with the other key factors presented in the framework that were described at the onset of this chapter. The most common observed trend seems to be de-routinization, with increases in demand for jobs at the top and decreases in the middle, rather than polarization, which includes de-routinization along with an increase in demand for jobs at the bottom. The demand for high-skilled workers performing non-routine tasks (both cognitive and interpersonal) seems to be rising together with technology adoption. Nevertheless, what happens for workers who perform relatively more routine intensive tasks is less clear. As Fernandez-Macías and Hurley (2016) argue, “a diversity of outcomes does not suggest a dominant universal factor such as computerization, but a diversity of factors with complex interactions.” For example, population aging seems to have an important role in shaping skills demand when interacting with technology

of the skills-wage distribution creates a large set of middle-wage (skill) occupations. But if Routine Manual tasks are rather placed in the lower tail of the wage distribution (as it happens in many EU countries), this can create a downward bias of the demand of middle-skill occupations and an upward bias of the changes in low-skill occupation jobs, generating an unreal perception of job polarization. Finally, Dicarolo et al. (2016) find that the rankings of occupations usually constructed along task dimensions derived from the United States are quite unrelated when they are constructed in low- and middle-income countries.

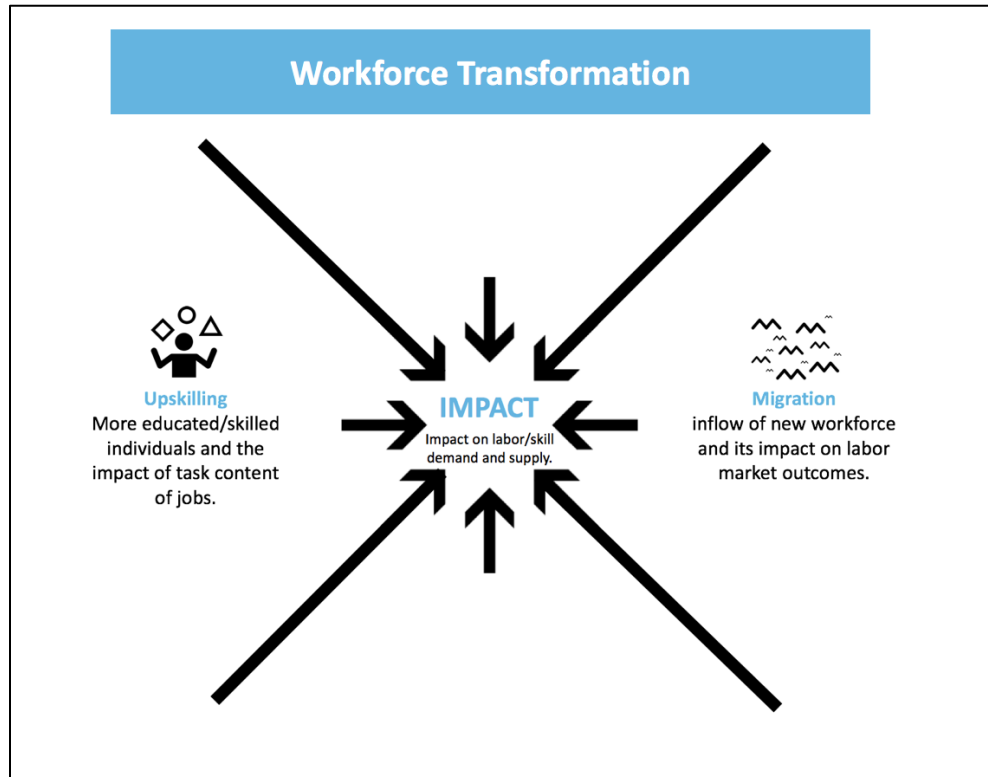
adoption. From their study of France, Moreno-Galbis and Sopraseuth (2014) argue that population aging in combination with technology adoption can accelerate the rising demand for personal services at the low-tail of the distribution, thus causing job polarization. Moreover, the level of development of a country and its economic structure may be more informative than the penetration of technology and robots to understand the extent to which de-routinization and polarization are taking place. For example, Dicarlo et al. (2016) analyze a harmonized survey of workers' skills and tasks for a set of six low- and middle-income countries and find significant differences in the task mix used by workers across occupations. They also find that the heterogeneity of task content across occupations declines as countries develop and grow, suggesting that countries' growth brings some degree of specialization in certain occupations. Moreover, reviewing a world sample of less developed countries, Maloney and Molina (2016) find no strong evidence of polarization or de-routinization; the employment of plant and machine operators and assemblers has not shown relative decreases in recent decades. These authors argue that offshoring has operated as a positive force that routinizes middle-skill jobs in less developed countries, although that trend could be reversed by further offshoring to very low-income countries.

4. Skills supply and the task content of jobs

Determinants of skill supply: a framework

To understand the dynamics of labor market outcomes in the EU it is necessary to understand the evolution of Europe's skills supply factors. For various reasons, the size and structure of the workforce has changed dramatically during recent decades. Figure depicts a framework that identifies some of the factors that underlie the transformation. In particular, many countries have transformed and universalized their education systems, with a sharp increase in tertiary education graduates in most countries. This has implied a more educated and skilled workforce population. In addition, migrants, both from other EU countries and from outside the EU, have changed the socio-demographic and skills characteristics of the workforce. Clearly these two factors have influenced not only the economic results but also the public narratives around labor market and skills demand.

FIGURE 4.1. A FRAMEWORK FOR SKILLS SUPPLY TRANSFORMATION



Source: Autors.

First, the working-age population in Europe is more educated today than it was two decades ago. The proportion of tertiary-educated workers among workers ages 25 to 64⁹ went from 20 percent in 2000 to 30.1 percent in 2015, with country-specific increases during that period ranging from 8 percentage points in Italy (rising from 9.7 to 17.7 percent) to 20.8 percentage points in Ireland (rising from 22.0 to 43.1 percent). Conversely, there was an important reduction in the share of low-educated students,¹⁰ which dropped from 35.6 percent in 2000 to 23.5 percent in 2015. Countries like Greece, Spain, and Portugal saw a reduction in the low-educated share of the workforce population, which fell by 19 to 26 percent in only 15 years. These figures point to a huge transformation of the labor supply. In parallel, evidence from the PIAAC survey (implemented by the OECD) shows that, within countries, between 2011 and 2015 there was a gradual upskilling of the newest generations entering the labor market.¹¹

Second, the increase in the migrant population has influenced skills supply in Europe and therefore labor market dynamics. Although less important than education upskilling, migration is a sizeable dimension that affects the key actors and economies of the region. In the EU-17, migrants' presence¹² has risen rapidly over the last two decades.¹³ Today, half of EU countries have a migrant presence of more than 10 percent of the population. Looking at the EU countries with the largest populations, the migrant share was considerable in 2015: 15.3 percent in Germany, 13.5 percent in the United Kingdom, 11.7 percent in Spain, 11.7 percent in France, and 9.4 percent in Italy.

⁹ Although working age population is defined as those aged 15 to 64, we restrict this group to 25 to 64 when talking about education attainment in order to capture tertiary educated graduates.

¹⁰ Low educated students are those with achieving than primary, primary or lower secondary education.

¹¹ See OECD (2013).

¹² A *migrant* is defined as a foreign-born person regardless of her parent's origin or her nationality status.

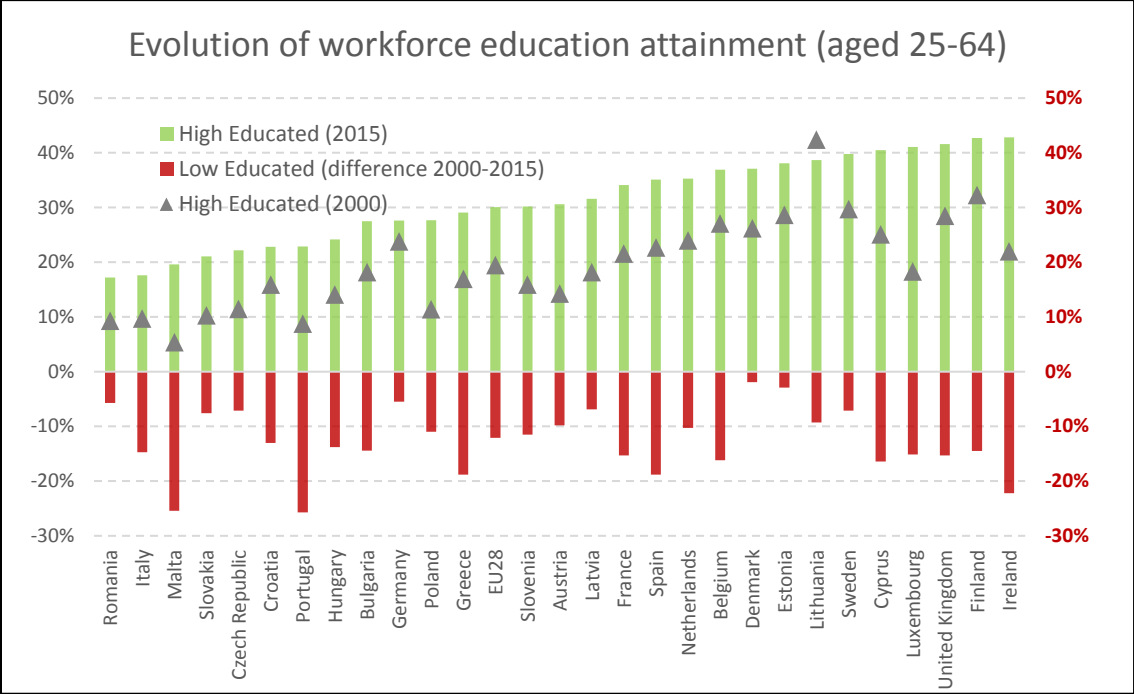
¹³ In CEE, only the Czech Republic experienced a substantial increase in the share of migrants in the population, although from a low base (see also Figure 4.7).

Upskilling: higher educational attainment and higher skills

Since the early 2000s, the changes in education attainment and skills of the adult population have been substantive in most EU countries. European workers entering the labor market at the end of the 1990s were born in the late 1970s, a time when compulsory schooling did not includeh upper secondary education in many EU countries. Further reforms and post-secondary expansion took place in many countries during the 1980s and 1990s (Garrouste 2010). The expansion of compulsory schooling, in particular, has been shown to have had an impact on reducing inequality in further education and economic outcomes in Europe.¹⁴ This expansion took place as a response not only to the skills demand of the labor market but also to a rather exogenous process of education convergence and economic openness (Murtin and Viarengo 2011). The resulting changes in the educational attainment of the population ages 25 to 64 can be seen in Figure 4.2. In particular, the average share of tertiary educated workers in the EU28 is 30.1 percent, having increased by more than 12 percentage points since 2000. Moreover, there has been a decrease of the proportion of low-educated workers by more than 10 percent on average, with large variations observed across countries. It is likely that this trend of rising educational attainment will continue in the years ahead, especially at the low tail of the distribution, for the least developed EU countries in terms of GDP per capita.

¹⁴ See Cabus and De Witte (2011) and Brunello, Fort, and Weber (2009). Interestingly, Ballarino et al (2013) find similar results, but they suggest a turning point after which more education expansion generates more education attainment *inequality*, since further expansion is mainly driven by the expansion of tertiary and post-tertiary schooling, which tends to lead to a new upsurge of education inequality.

FIGURE 4.2. CHANGE IN EDUCATION ATTAINMENT OF EU28 WORKFORCE POPULATION BETWEEN 2000 AND 2015, BY COUNTRY



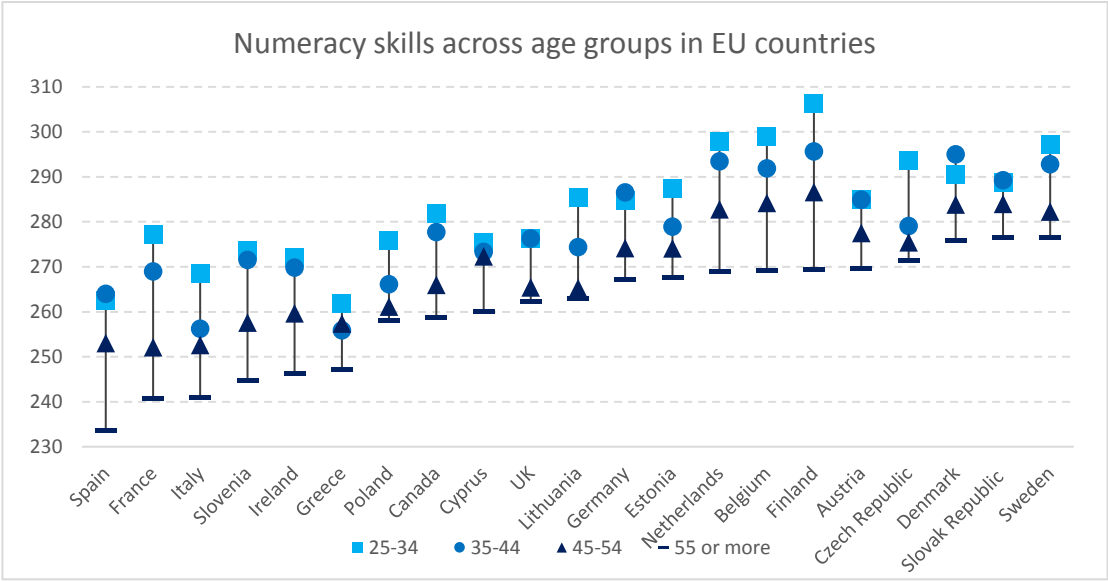
Source: Eurostat.

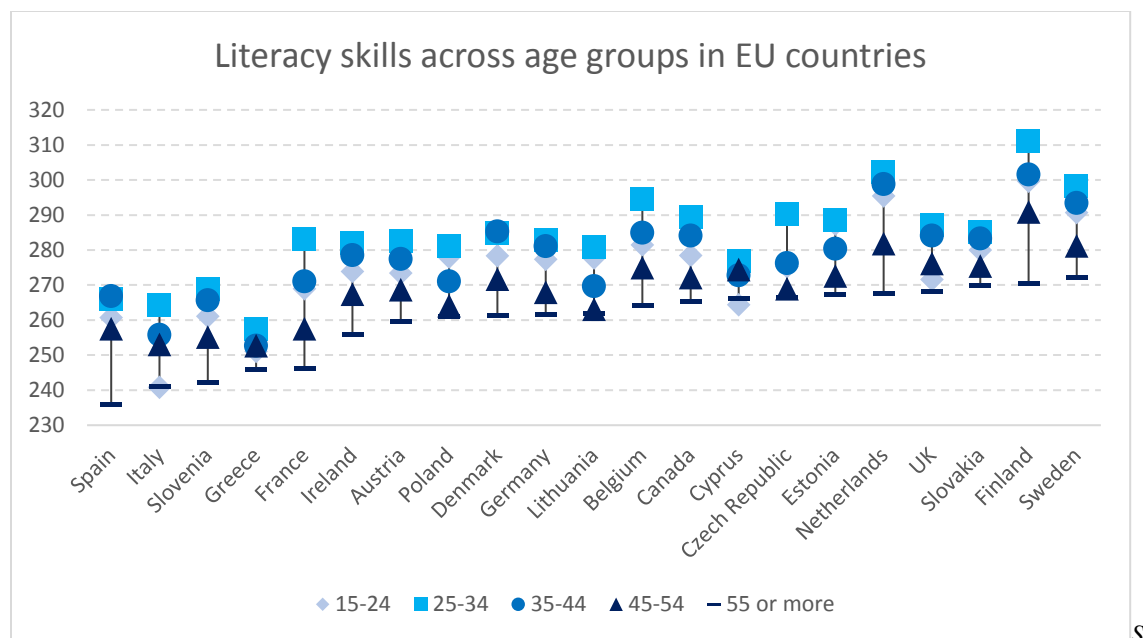
Education expansion has not only implied higher attainment but has also kept skill levels high among individuals entering the labor market with university degrees. Recent evidence points to the importance of skills, rather than diplomas, as key predictors of wage returns among the workforce population.¹⁵ Data from the Programme for the International Assessment of Adult Competencies (PIAAC) allow one to compare the skills of the workforce population with the tasks they perform on the job. As shown in Figure 4.3, the younger generations are arriving with higher skills when they enter the labor market, mostly because they achieved more years of schooling. What is not immediately clear is whether more years of schooling and diplomas have come at the expense of a lower quality of skills of university and post-secondary graduates due to mass education. To respond to this last question requires separating this phenomenon with the natural context of skill loss that workers experience as they become older. Using the PIAAC survey for several EU countries, Calero et al (2016) compute the net effect of these two opposite forces (schooling and aging)

¹⁵ See Sondergaard and Murthi (2012) and Hanushek et al (2015).

on skills. They find that the schooling expansion did not come at the expense of less skills for those students who attained upper secondary or post-secondary non-tertiary education. Moreover, for those who attained tertiary education, the increase in university diplomas came with better skills for the cohorts born between 1960 and 1975, when compared to those born between 1945 and 1960. However, the increases of newer cohorts' born between 1980 and 1990 who attained tertiary degrees translated more schooling into slightly less skills. In aggregate terms, however, it is clear that the large efforts made in expanding education access have translated into more skills and more learning of newly arrived secondary and tertiary education graduates, with very little quality decrease as a consequence of the universalization.

FIGURE 4.3. NUMERACY AND LITERACY SKILLS OF THE WORKFORCE POPULATION, BY AGE GROUP AND COUNTRY





Source: World Bank analysis based on PIAAC data. Data collection took place between 2011 (1st wave) and 2015 (2nd wave).

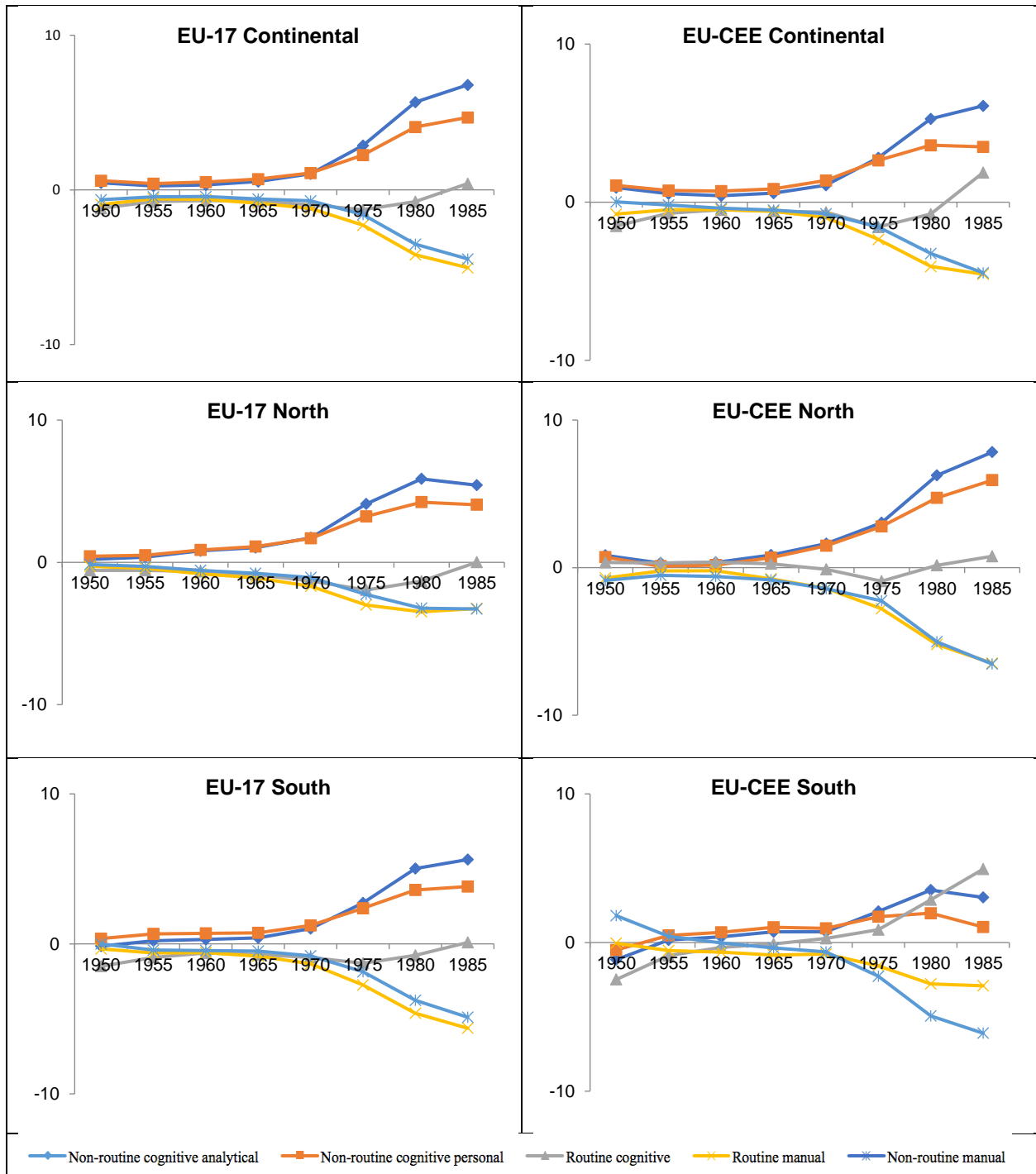
Higher educational attainment and the task content of jobs

Changes in the task content of jobs were largely driven by workers born after 1970. **Error! Reference source not found.** Figure 4.4 depicts the task content of jobs for each cohort in the EU, by region, when they enter in the labor market. The higher the absolute value of a coefficient in a given cohort, the faster the change of a particular task content for that cohort. The patterns of changes in the task content of jobs varied substantially across cohorts, but not between country regions. In general, younger cohorts recorded faster changes in task content intensity than older cohorts. This translated into a widening of the intergenerational gap in the evolution of task content, both in the EU17 and in the CEE countries. Clearly, the dynamics of all task content changes for older cohorts were sluggish, whereas the shifts recorded by younger cohorts were much more evident. The largest differences between younger and older cohorts were observed for non-routine cognitive analytical and interpersonal tasks, and they were more pronounced for EU-17 countries than CEE countries. Mirroring the changes of non-routine cognitive tasks, younger cohorts saw a steeper fall in manual tasks compared to older ones. The intergenerational gap in changes in routine

cognitive tasks was much smaller than for manual and non-routine cognitive tasks. Both the older and the younger cohorts recorded rather small average rates of change. An important point is that in both the EU17 and the CEE regions, the youngest cohorts documented a positive growth rate of routine cognitive tasks, although this was significantly higher for CEE countries. Summing up, European countries have experienced an increasing intergenerational divide in the changes in the task composition of jobs. The pace of the shift from highly manual toward non-routine cognitive jobs was significantly faster for younger cohorts, while older cohorts experienced much slower changes. The gap between generations was the smallest in the evolution of routine cognitive tasks.

Changes in job tasks for specific cohorts are strongly correlated with the expansion of tertiary education. Just as changing skills and labor demand have shaped individuals' decisions on pursuing their education, the expansion of education systems has directly affected the labor market and the structure of economy. In fact, the change of the share of tertiary-educated workers within cohorts was positively and strongly correlated to the change of the intensity of non-routine cognitive tasks within cohorts. This relationship is evident in all regions when one examines the basic correlation between these two changes. As can be seen in Table 4.1, the relation is positive and very large for non-routine cognitive analytical and interpersonal tasks, whereas it is negative and strong for routine and non-routine manual tasks. For routine cognitive tasks, the relationship is more ambiguous, except for Bulgaria and Romania. For these last two countries the relationship was positive and strong, possibly due the fact that they are among the least developed economies of the EU and hence have large shares of agricultural employment, so the rise in middle-skill routine cognitive jobs occurred during education expansion.

FIGURE 4.4. CHANGES IN TASK CONTENT BY COHORT ENTRY TO THE LABOR MARKET, CEE COUNTRIES, BY REGION, 1950–85



Source: Gorka, S., Hardy, W., Keister, R., and Lewandowski, P. (2017). The graph depicts linear time-trend coefficients from fixed-effects panel regressions on the task content intensities within cohorts.

Table 4.1. Correlations between change (1998 to 2013) in cohort task intensities and change in cohort share of tertiary-educated workers (in employment), by EU17 and CEE region

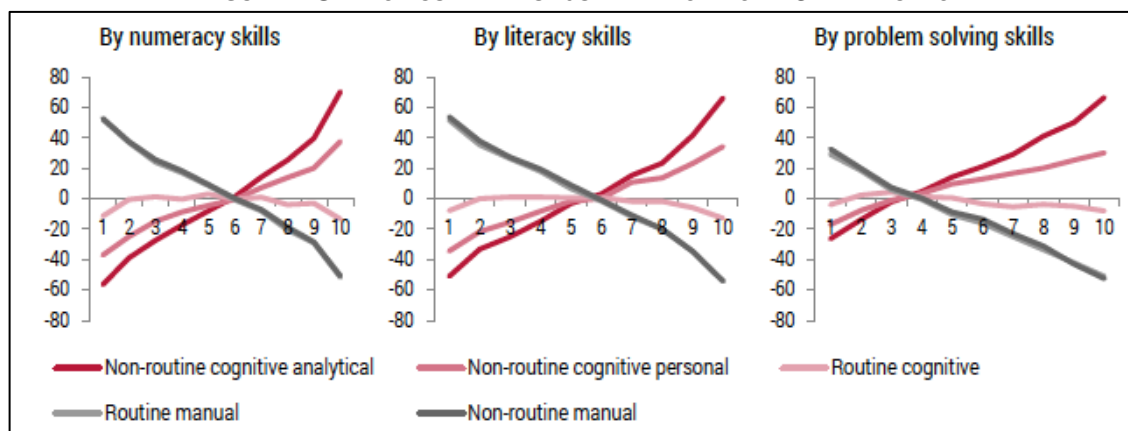
	Non-routine cognitive analytical	Non-routine cognitive interpersonal	Routine cognitive	Routine manual	Non-routine manual
EU17 Continental	0.89	0.74	-0.14	-0.9	-0.83
EU17 North	0.92	0.79	-0.24	-0.88	-0.87
EU17 South	0.77	0.66	-0.03	-0.8	-0.77
CEE South	0.84	0.78	0.72	-0.91	-0.9
CEE Continental	0.77	0.65	0.2	-0.89	-0.84
CEE North	0.85	0.84	-0.1	-0.76	-0.81

Source: Goraka, S., Hardy, W., Keister, R., and Lewandowski, P. (2017). Calculations based on EU-LFS and O*NET data.

The reverse side of the story shown in Figure 4.3 is that the EU workforce is still characterized by a large skill divide, both between and within countries. Figure 4.5 presents the averaged results of task intensity of workers by ordering them by their literacy, numeracy, and problem-solving skills. The intensities of non-routine analytical and interpersonal tasks increase with skill levels, whereas the intensities of both routine and non-routine manual tasks decrease with skill level. The distribution of task content intensities by skill deciles is similar for different types of skills, especially for numeracy and literacy skills: the workers with below-median skills exhibit above-average manual tasks and below-average non-routine cognitive tasks, while the opposite is true for the workers with above-median skills. However, in the case of problem-solving skills, only the 30 percent of workers with the lowest skills have above-average manual tasks and below-average non-routine cognitive tasks. The median worker in the problem-solving skills distribution has above-average non-routine cognitive tasks and below-average manual (non-routine and routine) tasks. As such, it seems that even workers with below-average problem-solving skills (4th and 5th decile) are important for the performance of non-routine work, though the general relationship with these skills is flatter than with literacy and numeracy skills. This could be due to the fact that problem-solving skills, as measured by PIAAC, are a combination of analytical skills (related

to critical thinking, creativity, and intuition) and the ability to work in digital environments.¹⁶ Therefore, it may be that workers with basic problem-solving skills are familiar with technological environments and are therefore more prone to perform non-routine analytical tasks that are complementary to technology.¹⁷ Finally, the relationship between the intensity of routine cognitive tasks and skill level is weak.

FIGURE 4.5. TASK CONTENT OF JOB INTENSITIES BY SKILL DECILES



Source: Gorke, S., Hardy, W., Keister, R., and Lewandowski, P. (2017) based on PIAAC and O*NET.

Note: In each country, workers were assigned to the deciles of a country-specific distribution of a particular skill. Then, the task content intensities were computed by these deciles

This has translated into an employment divide, where low-skilled workers increasingly risk falling behind. Chapter 2 of this report, for example, shows a rising employment gap. Employment rates of high- and middle-educated workers have remained unchanged in most cases between 1998 and 2014, whereas low-educated workers have increasingly become less likely to be employed. In most cases, the employment rate of middle- and high-educated workers did not change much between 1998 and 2014. But it declined everywhere for low-educated workers, reflecting in part the disproportionate impact of the crisis on these workers. At the same time, Figure 4.5 has shown positive (negative) prospects for high (low)

¹⁶ OECD (2009, page 9) defines problem-solving in technology-rich environments as “using digital technology, communication tools and networks to acquire and evaluate information, communicate with others and perform practical tasks. The first PIAAC problem-solving survey focuses on the abilities to solve problems for personal, work and civic purposes by setting up appropriate goals and plans, and accessing and making use of information through computers and computer networks.”

¹⁷ It is important to note that PIAAC does *not* aim to measure generic problem-solving skills, but only focuses on technological environments.

skilled workers in the coming years. All this will add significant difficulties over low-skilled workers in the coming years.

With the future of work dependent on technological changes, aging, and other factors, the generations currently in the education system can expect to face even harsher challenges, living in a society that will need to boost productivity to secure growth and sustain welfare systems. Evidence from the OECD's Programme for International Student Assessment (PISA) shows that overall, at age 15, newer cohorts, born in the late 1990s, do not seem to be acquiring more skills than those born in the previous decade. Although there are countries where young students have improved their performance significantly in recent years, such as Poland and Portugal, other countries, including Finland, Netherlands, Sweden, and the Slovak Republic, are displaying a worryingly downward learning trend among the younger generations. This urges policymakers to make immediate efforts in education and social policies to help future generations, particularly the most disadvantaged, acquire more skills, ultimately to bring about better economic and social outcomes¹⁸

The diverse patterns of migrant numbers and profiles across the EU

In addition to increasing educational attainment of the workforce, another factor that has altered the structure of labor market skill supply in recent decades has been the inflow of migrants to many EU countries.¹⁹ It is to be noted, that this has been a heterogeneous and diverse process, as made evident when one looks at each country in terms of migrant inflow. The share of migrants as part of the workforce in CEE-South and CEE-Continental is generally small (below 3 percent), and has not significantly increased in the period from 2000 to 2015.²⁰ The share of migrant workers is substantially larger in EU-17 countries, ranging generally from 3.9 percent (Finland) to 19.2 percent in Sweden, and with Luxemburg as an outlier with foreign-born workers comprising nearly half of the labor force. Moreover,

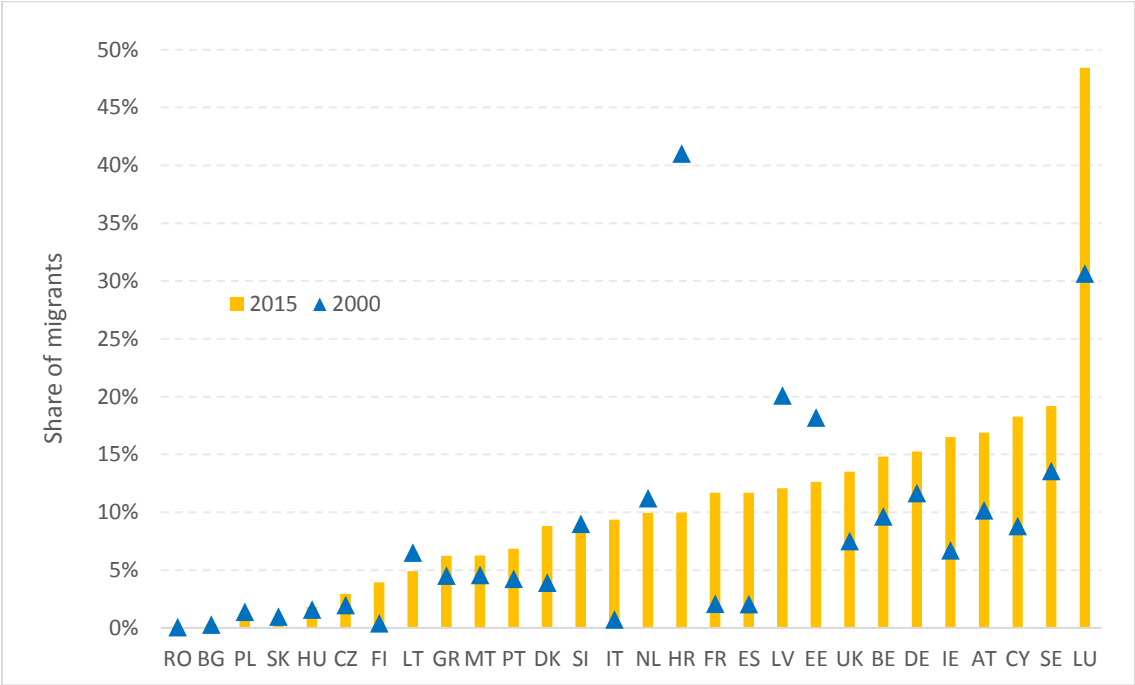
¹⁸ An elaborate review of equity in education can be found in Herrera-Sosa, K., Hoftijzer, M., Gortazar, L., Ruiz, M. (2018), which is a complementary background study to the Growing United report.

¹⁹ This report focuses on the impact of immigration on labor market outcomes in receiving countries. It does not review the economic and social impact of emigration in sending countries.

²⁰ Exceptions are Slovenia and Croatia (8.8 percent and 10 percent foreign-born workforce in 2015), and the Czech Republic, where the share of migrants in the workforce increased from 2.0 percent in 2000, to 2.9 percent in 2015.

except for the Netherlands, all EU-17 countries have seen an increase in the share of migrants in the workforce, in many case quite substantial (Figure 4.6). Today, public discourse and policy intent increasingly focus on migration, and therefore it is imperative to provide an in-depth look at the effect of migration on the labor market in the last decades, by looking at the implications on both natives and migrants themselves.

FIGURE 4.6. SHARE OF MIGRANTS IN THE WORKFORCE, EU28 COUNTRIES, BY COUNTRY, 2000 AND 2015

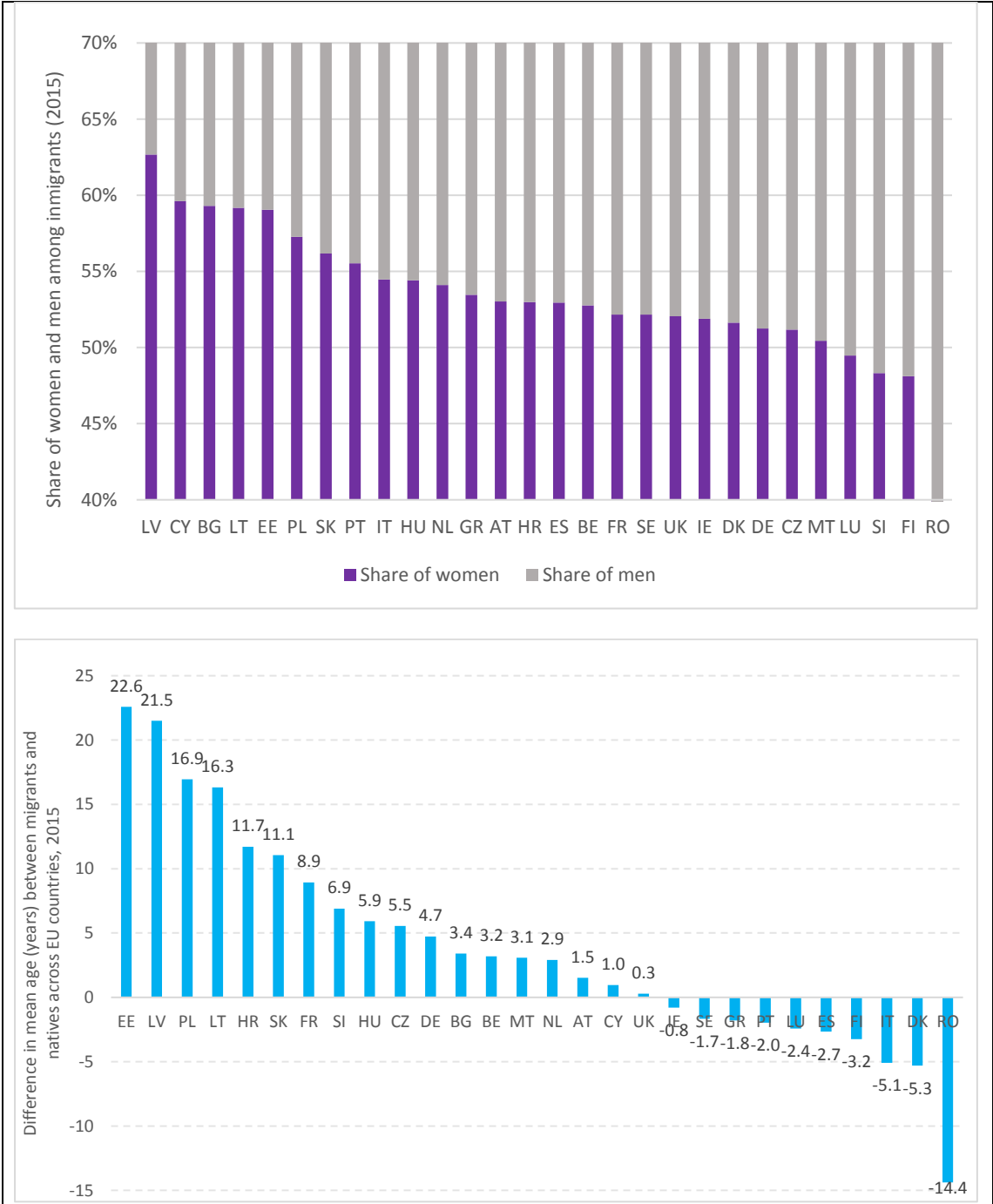


Source: Eurostat.

The socio-demographic profile of immigrants varies considerably across countries. Although women are normally overrepresented among migrants, Figure 4.7 shows that the extent of this overrepresentation ranges from the very high numbers of Baltic countries, Cyprus, and Poland (all of them featuring a migrant presence that is more than 57 percent female), to the more contained figures in many EU17 countries, which are below 53 percent. Variation related to the age of migrants is still wider. For example, the Baltic countries constitute again a particular case, having a substantially older migrant population. Among Western European countries with a moderate-to-high presence of immigrants, France stands out with its older migrant population, followed by Germany at a distance. In contrast, Southern European and Nordic countries (Sweden, Denmark, Finland) display a much younger profile. Regarding

the age of migrants compared to native residents, the picture is again very diverse across countries; Baltic countries have the oldest migrants compared to the age of natives, while countries in South Europe (both EU-17 and CEE countries) having younger migrant populations compared to the age of the native population.

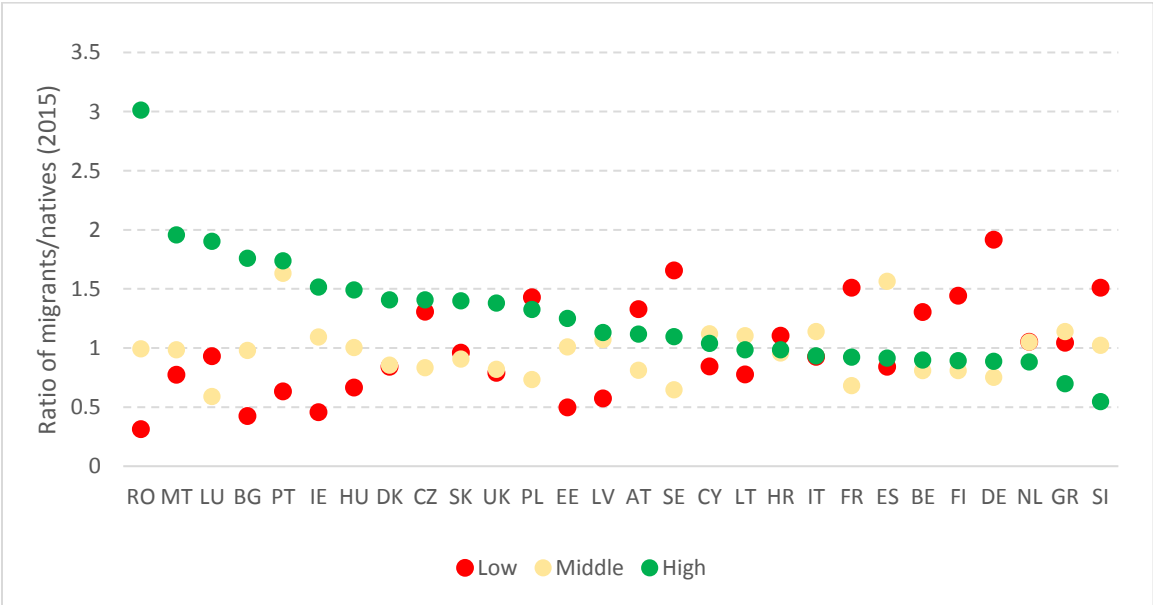
FIGURE 4.7. GENDER AND AGE PROFILES AMONG WORKFORCE IMMIGRANTS IN EU28 COUNTRIES, 2015



Source: World Bank, based on Eurostat.

The education skill set of incoming workers is a crucial factor in defining the impact that migration might have on local labor markets. There are few countries where immigrants' profiles match those of natives. Figure 4.8 depicts the ratios between local and foreign-born workers for three different levels of education attainment. It shows that Croatia, Italy, Lithuania, the Netherlands, and Cyprus are the countries with the lowest levels of variance between migrants and natives. But these countries are exceptions, and it can be said that generally immigration tends to bring a new education mix into the economy. In countries like Portugal, Ireland, Denmark, and the United Kingdom, migration seems to be skill-biased, with a higher presence of the highly educated among the foreign workforce. France and Germany, on the other hand, display a larger presence of lower-educated individuals among migrants. Spain and Portugal are the only two countries with a disproportional entry of mid-skilled immigrants, as compared with locals, a fact that is mostly due to the countries' lack of strong professional and vocational education systems.

FIGURE 4.8 RATIO OF MIGRANTS/NATIVES IN THE WORKFORCE BY LEVEL OF EDUCATION IN EU28 COUNTRIES, 2015



Source: Authors based on Eurostat.

The impact of migration on labor market outcomes: three country studies

In contemporary public and political discourse in Europe, the impact of migration on labor outcomes in the receiving country is a regularly recurring topic. Nevertheless, research on the phenomenon is less abundant than exists, for example, on the impact of technological change on labor outcomes. Moreover, in the literature reviewed for the purpose of developing this present report, the approaches that are applied tend to vary relatively widely and, most likely at least partly because of this, a clear and shared understanding of the nature and scope of the impact of migration on labor outcomes in the EU remains to emerge. This section summarizes key findings on the impact of migration on labor outcomes in (European) receiving countries, based on a review of secondary literature on the topic.

Migration is a diverse phenomenon with variations even among European countries, and therefore merits a review from national perspectives. To better grasp the particularities of migration impact on employment and earnings outcomes, three country cases have been selected for a review: the United Kingdom, Germany, and France. These countries were chosen based on criteria related to relevance, diversity, and the quality of available research. The selected countries are the largest member states in terms of population and economy.²¹ While all three have a relatively large and increasing share of migrants in their workforce, they differ in the skill mix of migrants, labor market institutions, and other institutional factors that affect their competitiveness and labor and product market flexibility (Table 4.2 below). In addition, all three countries are at the forefront of academic debates and policy discussions on the impact of migration on native workers, although (as described below) this is not to say that there is a consensus on either the impact of migration on labor outcomes not on its main drivers. The available research on the topic for the three countries is summarized in Box 4.1.

Table 4.2. Selected indicators reflecting labor market outcome and institutional differences (UK, France, and Germany)

	UK	France	Germany
Unemployment rate (2016)	4,8%	9,9%	3,8%
OECD Employment Protection Index (regular contracts)	1,1	2,38	2,68
Unemployment benefit replacement rate (single person, 2014)	34%	80,0%	88%

²¹ Combined, they make up 42 percent of the EU's population and produce over half of its GDP.

Hourly minimum wage (2017)	8,82	9,76	8,84*
Trade (% of GDP, 2015)	42%	61%	86%
OECD Product Market Regulation Index (2013)	1,08	1,47	1,28

Sources: OECD (Employment Protection Index, Unemployment Benefit replacement rate, Product Market Regulation Index) , World Bank (trade indicator), Eurostat (hourly minimum wage, unemployment rate)

* Estimate 2015

BOX 4.1. THREE COUNTRY STORIES OF MIGRANT WORKFORCE AND INSTITUTIONAL SETTINGS

The United Kingdom. The United Kingdom has a moderately high presence of immigrants (13.5 percent). The share of highly educated workers among immigrants is substantially higher than among the native population (47 percent compared to 34 percent, as per the 2015 European Labor Force Survey), and they are mostly employed in the service sector with permanent contracts as employees.²² The United Kingdom’s labor market is flexible, particularly when compared with the rest of Europe. This leads to the assumption that the impact of migrants on labor outcomes would be via earnings rather than employment and, indeed, most UK-oriented studies focus on this possible wage effect. Available research²³ is plentiful and findings are diverse; if any consolidated findings can be distilled, they are that, first, any noted effects of migration on wages or employment of the overall workforce tend to be small and are – depending on the publication – either positive or negative. Second, if there is a positive effect, it is mostly enjoyed by native workers higher up in the skill or wage distribution. Third, and most importantly, negative effects, although remaining relatively small, are mostly (and maybe exclusively) suffered by the lower-skilled and lower-earning tiers of the distribution (including previous migrants). These are also the main points of consensus underlined by the most recent review of the literature to date, undertaken by Ruhs and Vargas-Silva (2017).

France. France’s labor market experience with migrant inflows highlights the importance of labor institutions in shaping outcomes, as France’s relatively rigid wages seem to imply that labor market adjustments occur more strongly via the employment channel. In France, immigrants’ presence evolved to reach 11.7 percent of the population in 2015, but unlike in the United Kingdom the pool is substantially skewed toward low-educated workers. Despite high- and mid-skilled individuals having increased their presence in recent years and showing that the most recent influxes are positively skill-biased, the low-education segment still dominates in absolute terms. In addition, migrants into France

²² Eurostat.

²³ See Manacorda, Manning, and Wadsworth (2006, 2012); Gilpin et al (2006); Dustmann, Glitz, and Frattini (2008); Nathan (2011); Lucchino, Rosazza Bondibene, and Portes (2012); and Migration Advisory Committee (2012).

are substantially older than the native population.²⁴ Although, like for the United Kingdom, the evidence is quite mixed and it is difficult to draw a unified conclusion, four features stand out.²⁵ First, in general, effects and adjustments through the employment channel are more significant due to rigidities in set wages. Second, these effects range from small-to-moderate negative impacts to slightly positive consequences, depending on the time frame considered and on the assumptions made in the research.²⁶ Third, there is significant evidence of two adjustment mechanisms being widely used by the lower-skilled native population to counteract supply shocks: geographical and occupational (upward) mobility, which might help to explain why negative impacts of immigration are minimized in the short term or disappear in the long term. Fourth, the segmented nature of the French labor market between fixed-term and permanent contracts (Le Barbanchon and Malherbet, 2013) implies that the lower tier of the structure is in more direct competition with foreign workers, and therefore bears a disproportionate part of the adjustment.

Germany. Germany has the highest level of migrant presence among the three chosen examples, at 15.3 percent of the population (as of 2015). Moreover, this presence was already well above 10 percent in 1998. Migrants' average age is five years above that of natives (48 vs. 43).²⁷ Germany, like France, has high employment protection for regular contracts, as well as strict product market regulation (although more flexible than France). A review of evidence²⁸ on the impact of migration on labor outcomes of the workforce in Germany, produces relatively similar findings as for France, with employment rather than wages being the more common channel via which labor supply changes are absorbed. In terms of both earnings and employment trends, the effects of migration inflows on the labor market are found to be small overall, and seem to be more important for native, low-skilled workers.

Overall, the evidence reviewed is mixed on what has happened to local workers as a result of the inflow of migrants to EU countries, and given the variety of findings, it is hard to draw strong comparative conclusions. It does appear clear that the extent to which native workers,

²⁴ Their average age is at 48, which is 9 years older than the national average, possibly reflecting the old story of migration into the country linked to its colonial past, that is contemplated by the literature (e.g., Hunt 1992).

²⁵ See Jayet, Ragot, and Rajaonarison (2001), Ortega and Verdugo (2014; 2015), Edo (2015; 2016), and Edo and Toubal (2015).

²⁶ Different assumptions are used, for example, concerning the skill distribution of native and migrant workers, affecting their substitutability.

²⁷ These features are a consequence of the country's recent history, including the reunification following the fall of the Berlin Wall, which gave ethnic Germans the option to return to the "West German" side of their country of origin from Eastern European countries after the collapse of the Soviet Union.

²⁸ See De New and Zimmerman (1994), Hatzius (1994), Pischke and Velling (1997), Bonin (2005), Brücker and Jahn (2008), Steinhardt (2009), D'Amuri et al (2010), Prantl and Spitz-Oener (2011) and Glitz (2012).

especially the lower-educated, share characteristics with migrants (and thus can be more easily substituted on the job market) determines whether they are more likely to win or lose from migration. Also, institutions appear to play an important role in determining the channel and scope of impact via which labor supply shocks are absorbed. Countries with more rigid labor institutions appear more likely to absorb the inflow of low-educated migrants through the employment channel, protecting the wages of the employed but reducing employment opportunities for those workers who can be substituted by migrant labor. Generally, we presume that flexibility in wage mechanisms, individual geographical and occupational mobility, and product markets are important aspects that help exploit the positive impact and mitigate the possible negative effect of migrant labor. Regardless, even when the overall impact of migration is positive, specific segments of the workforce are likely to face negative consequences of migration, at least on the short term. These are the segments at risk of substitution, due to their similar characteristics with migrants in terms of key characteristics such as education, skills, occupation, and location. The profile of workers at risk of substitution by migrants may also make them particularly vulnerable to be negatively affected by other economic trends that change labor and skill demand, such as technology and globalization. This, thus, strengthens the case for identifying the groups that are most at risk and supporting them via well-targeted social protection and labor market policies (including skills development), as well as for well-designed labor and product market institutions.

5. Decomposing changes in task content in supply and demand factors

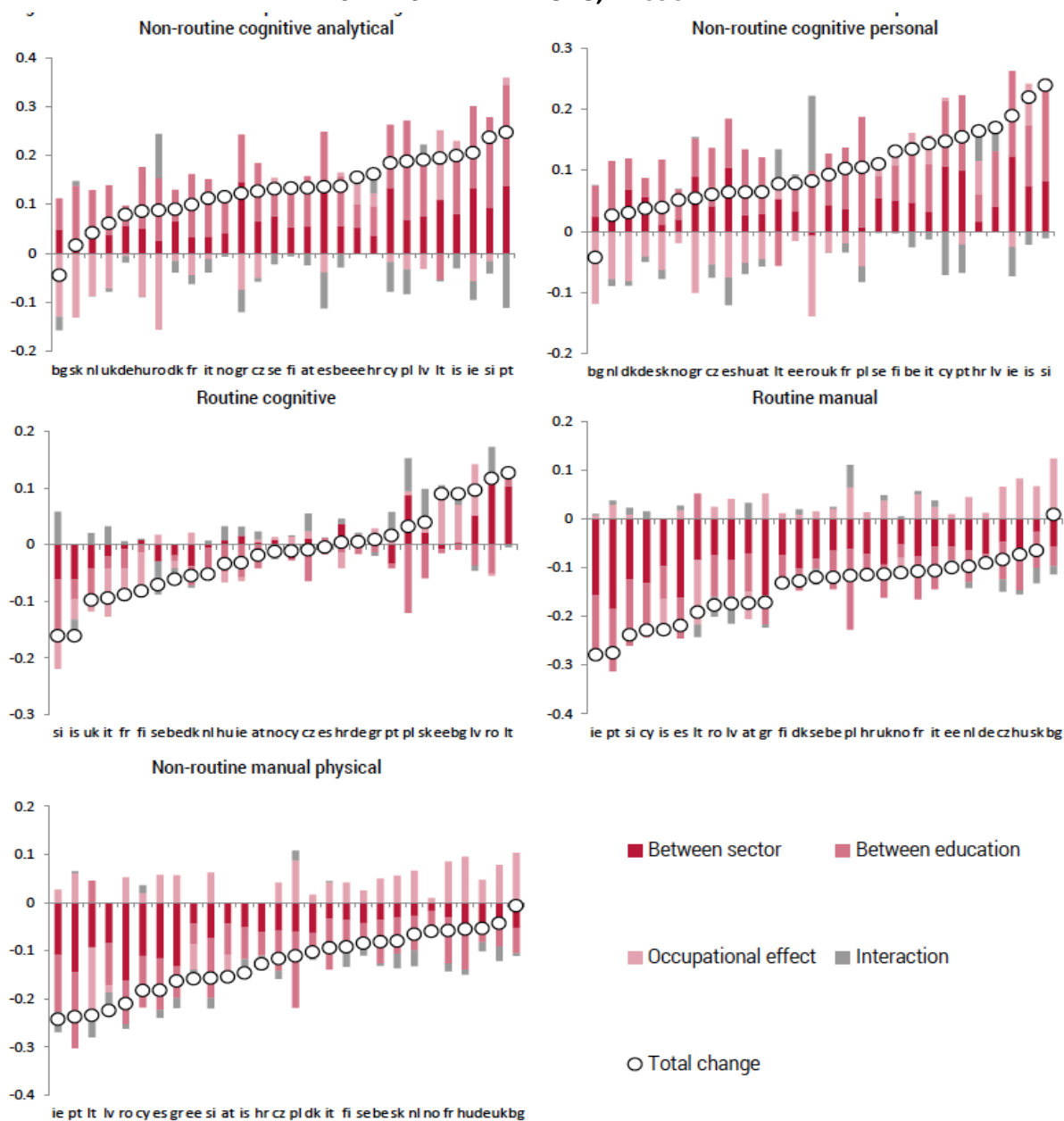
Whereas the previous sections of this report discussed demand and supply side factors in isolation (in chapter 3 and chapter 4, respectively), this chapter takes a closer look at the interplay of these aspects in shaping the task-content of jobs. Clearly, supply-side factors are driven partly by exogenous forces unrelated to labor demand within the European Union: education expansion has been partly driven by internal demands for greater democratization and universalization of opportunities from previously excluded sectors of the population; migration occurs as a response to economic shocks outside Europe. At the same time, students and families make schooling decisions based on expectations of future labor demand. Similarly, skill demand respond both to developments that are not directly related to changes in skill supply (such as technological change), and to labor supply factors resulting from education upgrading or the inflow of migrants with a different skill profile from the native population skills (e.g., no high technological industry will further develop if the workforce has not acquired higher levels of computer and problem- solving skills).

To arrive at a deeper understanding of the relation between changes in task content and its possible drivers, we conduct a decomposition looking at supply and demand factors, including structural effects, occupational effects, educational effects, and the interaction between all these effects. Even while recognizing that decomposition does not imply causality, the analysis highlights interesting aspects of correlation. In this decomposition, ‘structural effects’ are considered changes in the sectoral structure of the economy; ‘occupational effects’ are changes in occupational structure and within-occupation task-content; and ‘educational effects are’ changes in educational attainment of the workforce.²⁹

Figure 5.1 shows the results of the decomposition analysis for each job task and each country between 1998 (or the earliest available) and 2014 (or the latest year available).

²⁹ Data and methodological challenges do not allow the inclusion in the decomposition of all specific demand- and supply side factors identified in chapter 3 and 4 of this report.

FIGURE 5.1. A SHIFT-SHARE DECOMPOSITION OF CHANGES IN TASK CONTENT BETWEEN 1998-2000 AND 2012-2014 IN THE EU28, BY COUNTRY



Source: Gorka, S., Hardy, W., Keister, R., and Lewandowski, P. (2017) (2017), based on EU-LFS and O*NET.

Note: The interaction term is positive (negative) if the task content increases more (less) than what is implied by changes in the sectoral structure, by changes in educational structure within sectors, and by changes in the task content of occupations held by workers at a given education level in a sector.

Increases in *non-routine cognitive analytical and interpersonal* tasks are principally associated with between-sector effects and between-education effects. The between-sector effects include declines in the shares of sectors where these tasks are rarely

performed, like agriculture or some manufacturing branches, and increasing shares of sectors where these tasks are often performed, in particular professional services. The between-education effects include educational upgrading in the form of rising workforce shares of tertiary graduates. In the vast majority of countries, the contribution of the between-education effects was higher than the contribution of the between-sector effects, and it was the strongest in countries that recorded substantial increases in tertiary attainment of younger cohorts.

Declining *routine cognitive* tasks are associated with workforce upskilling in the majority of countries, but the direction of change was generally correlated to structural and occupational changes. This was the case for the CEE countries as well as Portugal and Greece. In countries where the intensity of routine cognitive tasks declined noticeably (such as the United Kingdom, Italy, France, Finland, and Slovenia), structural and occupational changes were aligned with the educational changes.

The decline of the intensity of *manual* tasks (both routine and non-routine) was widespread in all EU countries. It was largest in the Baltic countries, Southern European countries, and Ireland, and was mainly correlated with between-sector effects (declining employment shares of agriculture or manufacturing, which pushed cognitive tasks up), followed by between-education effects (better educated workers being less likely to perform manual tasks). The occupational effect was moderately positive in the majority of countries.

Further task change decomposition by specific sectors reveals the correlated between the increasing importance of service sectors (health, education, finance) and the rise in non-routine (analytical and interpersonal) tasks and the fall in manual tasks, while the mixed evolution of cognitive routine tasks is partly correlated to the varied roles played by agriculture, construction, and trade in each country. Figure 5.2 depicts the contributions of each sector of the economy to the changes in the task content of jobs between 1998–2000 and 2012–14 in each country. First, decreasing shares of sectors where non-routine cognitive tasks are less often performed, such as manufacturing and, to a lesser extent, agriculture, contributed to the economy-wide relative rise of jobs with high non-routine analytical and

non-routine interpersonal task content.³⁰ This trend was further associated with the rise of sectors rich in non-routine cognitive tasks such as health care, education, transport, storage and communication, financial intermediation, and real estate and other business activities. Second, the gross reallocation of labor out of agriculture (a sector with jobs where cognitive tasks are rarely performed) was strongly associated with change in the cognitive routine task content of jobs in the CEE countries. In Portugal and Greece, this positive but more moderate link was accompanied by the changes that occurred within service sectors such as retail, trade, and hotels and restaurants. The decrease of manual tasks was widespread across countries, and associated with the decline in the manufacturing sector, and was larger for routine than for non-routine manual tasks. The decline of non-routine manual tasks is associated with the evolution of transport, storage, and communication sectors, which usually demand skills that require good spatial orientation and manual dexterity, for the operation of vehicles and machines, rather than repetitive motions.

³⁰ Except in Romania, which reported a negative contribution of agriculture to non-routine cognitive tasks change.

Figure 5.2. Contribution of economic sectors to the task content changes between 1998-2000 and 2012-2014 in EU countries.



Source: Gorke, S., Hardy, W., Keister, R., and Lewandowski, P. (2017) (2017) based on O*NET and EU-LFS data. Note: The contribution of a given sector is calculated as a sum of structural, educational, occupational and interaction effects in that sector. Countries are sorted by the country-level task content change. Sectors: A - Agriculture, C - Mining and quarrying, D = Manufacturing, E = Electricity, gas and water supply, F = Construction, G = Wholesale and retail trade, H = Hotels and restaurants, I = Transport, storage and communication, J = Financial intermediation, K = Real estate, L = Public administration and defense, M = Education, N = Health and social work, O = Other community, social and personal activities. Other sectors (Fishing, Activities of households, and Extra-territorial organizations and bodies) were excluded due to too-small samples. Lithuania is omitted due to data issues.

6. Conclusion

Overall, the findings in this report suggest that the changing nature of work is driven by various skills supply and skills demand factors. Whereas the specific extent to which each factor is responsible for observed trends can be hard to determine, it is clear that technological change is – and will continue to be – an important driver of change. The further introduction of machines, robots, or artificial intelligence into the labor market will likely have a different pace and impact on the different EU member states, depending among others on other demand and supply factors such as population ageing and the level of economic transformation in each member state, as well as on labor institutions that play an important role in explaining labor outcomes in the EU.

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