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Assessing the role of migration in European labour force growth by 2030

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Abstract

This paper presents the methodology as well as the results of the joint OECD-European Commission project *Migration-Demography Database: A monitoring system of the demographic impact of migration and mobility*. The objective of the project is to evaluate the contribution of migration to past and future labour market dynamics across EU and OECD countries. After assessing the role of migration over the last five to 10 years in shaping the occupational and educational composition of the labour force, this project looks at the potential contribution of migration to the labour force in a range of alternative scenarios. This paper presents the results from the second part of the project: it focuses on projections over the period 2015-2030, and aims at identifying the drivers of changes in working-age population and active population in European countries, and in particular the role of migration flows.

Résumé

Ce papier présente la méthodologie ainsi que les résultats du projet commun OCDE-Commission européenne *Migration-Demography Database: Un système de suivi de l'impact démographique de la migration et de la mobilité*. L'objectif de ce projet est d'évaluer la contribution de la migration aux dynamiques passées et futures du marché du travail dans les pays de l'UE et de l'OCDE. Après avoir évalué le rôle de la migration au cours des cinq à dix dernières années dans l'évolution de la structure professionnelle et éducative de la population active, ce projet examine la contribution potentielle de la migration à la population active dans divers scénarios alternatifs. Cet article présente les résultats de la seconde partie du projet: il se concentre sur les projections pour la période 2015-2030 et vise à identifier les déterminants des évolutions de la population en âge de travailler et de la population active dans les pays européens, et en particulier le rôle des flux migratoires.

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Introduction

EU countries are currently undergoing major demographic changes, as is also the case for most non-European OECD countries. Because of its numerous social and economic implications, population ageing is one the most significant long-term challenges for many European and non-European OECD countries (European Commission, 2015[1]; OECD, 2006[2]; United Nations, 2015[3]). The median age of the population of the EU has increased from 34 in 1985 to almost 43 in 2015, with differences existing across member countries. A number of non-European OECD countries are also affected by this trend. For example, Japan has experienced very rapid ageing, with a median age that increased from 35 in 1985 to almost 47 in 2015. Although somewhat younger than the European population, Northern American countries are also getting older: in 2015, the median age was 38 in the United States and 41 in Canada, up from 31 in both countries in 1985. A similar trend is observed in Australia and New Zealand.

Countries which have started their demographic transition later remain significantly younger, but are also ageing and will reach the same situation as Europe in the coming decades. This is for example the case of Mexico, which had a median age of 27 in 2015, or Turkey, with a median age of 30 in 2015.

Population ageing in OECD countries is mostly driven by fertility decline and increasing longevity. In most cases, the latter component is predominant. For EU countries as a whole, the population aged 65 and over has increased by about 60% between 1985 and 2015, while the population aged 0-4 has decreased by 15%. In addition, some EU countries have not experienced any significant fertility decline in the recent decades, while the increase of longevity is observed everywhere. In the United States, Canada, Australia and New Zealand, fertility remains quite dynamic, but the 65+ population is increasing more and more rapidly. Among OECD countries, Japan and Korea have experienced especially radical change in their demographic structure: between 1985 and 2015, the population aged 0-4 has declined by 30% in Japan and 40% in Korea, while the 65+ population has increased, respectively, by 170% and 280%. Although the ageing process might start to slow down in the "oldest" countries, it is expected that these trends will continue in the coming decades.

These demographic transformations stem from both economic and social progress. Better than ever, populations in OECD countries are protected against a wide range of deadly diseases and are able to enjoy longer and healthier lives. Individuals are also better able to choose how many children they will have, and when to have them. However, these changes also generate new economic and social challenges that have been extensively documented (Bloom, Canning and Fink, 2010[4]; Harper, 2014[5]).

A direct implication of the change in the age structure of the population is the increase in public expenditures on pensions, social security and health care, including services dedicated to the elderly population (Colombo et al., 2011[6]). This means that fewer resources are available for other social protection needs. In addition, rising dependency

ratios imply that repartition pension systems are under increasing stress, which has led several OECD and EU countries to put in place new pension reforms such as increasing retirement age or mandatory contributions, reducing pensions, or implementing a combination of those options (OECD, 2016[7]). Due to the changes in the distribution of economic and political resources between generations, intergenerational conflicts are also likely to be more prevalent (Busemeyer, Goerres and Weschle, 2009[8]; European Commission, 2015[1]; European Commission, 2015[9]; European Commission, 2017[10]).

In addition to these fiscal and intergenerational implications, ageing population has an impact on the size of the working age population (in relative and absolute terms) and consequently on the functioning of the labour market (Borsch-Supan, 2003[11]; European Commission, 2017[10]). In particular, labour shortages may emerge in specific regions, sectors or occupations, at different skill levels. The risk of shortages is especially acute in occupations where labour demand is bound to increase because of ageing itself, such as healthcare or domestic services, or as a consequence of ongoing technological changes.

This structural evolution of the labour market is currently combined with two major, more temporary, phenomena. First, a number of EU and OECD countries still suffer from relatively low employment rates in the wake of the Great Recession and the austerity policies that have been implemented to cope with rising public debts (OECD, 2016[12]; European Commission, 2016[13]). Second, large cohorts of baby-boomers are exiting the labour force, which may generate tensions in some segments of the labour market. Both issues tend to obscure the long-term outlook of the labour market in EU and OECD countries, and make the policy discussion about potential solutions more polarised.

Another key contextual element that is particularly relevant for current and future evolutions is the rising participation of women to the labour market, which shows an increase of around 3 and 4 percentage points in the OECD area and the EU27 respectively between 2005 and 2015. Women are now also more likely to enter both fast growing and highly-skilled occupations than men (OECD/EU, 2014[14]), positively contributing to the overall upskilling of the labour force.

Moreover, in the last decade, many OECD countries have experienced an increase in migration inflows, sometimes associated with outward mobility of natives. Compared to births and deaths, migration is still a relatively small demographic component in absolute terms, but it may become pivotal as countries experience near-zero rates of natural increase. With respect to increasing mobility, EU countries deserve special attention, due to the migration opportunities opened by the freedom of movement of workers in the area. In 2015, around 11.4 million of citizens aged 20-64 from the EU28 and the EFTA countries resided in a country different from their country of birth. This figure represents an increase of 5.3% compared to 2014 (European Commission, 2017[15]).

In this context, the potential contribution of international migration to the mitigation of the economic challenges raised by ageing has been widely discussed (United Nations, 2000[16]; Coleman, 2008[17]; European Commission, 2016[18]). Migration has sometimes been advocated as a "solution" to those problems. Since migrants from less developed countries are on average younger than the population in OECD destination countries, they can help offset issues related to population ageing. In addition, upon arrival, migrants may also tend to have higher fertility norms than host populations, which can slow down the fertility decline. These effects are real, but they are only temporary. The overarching consensus is that international migration cannot offset the negative effects of population and labour force ageing in the long-term. Migrants themselves get old, and additional migration inflows can only have a temporary effect on the age structure. The impact on

fertility is also transitory, since migrants progressively change their fertility behaviours as they integrate into more affluent host societies.

The role of migration can be assessed by looking at the population projections elaborated by the Population Division of the United Nations. Data shows that the working-age population (15-64) of EU countries is expected to decrease by 15% between 2015 and 2050 under the medium-variant scenario, which assumes that net migration towards EU countries is on average 750 thousands per year. In the scenario with zero net migration, a 23% decline of the working-age population is projected. This implies that merely stabilising the size of the working-age population of EU countries until 2050 would require more than doubling net migration compared to its current level; this is not only unrealistic, but would provide only a temporary slow-down in the ageing of the population.

Although the long-term demographic impact of immigration towards OECD countries is now well understood to be limited, its impact on the dynamics of the labour market is more complex and varies across countries. In addition to age structure, there are indeed key differences between natives and immigrants, as well as between different groups of foreign-born, which have implications on labour market structure and composition.

The skill structure of the working-age native and migrant populations is the first important dimension to consider, especially in the context of exit of the post-war cohorts from the labour force. Although these retiring workers are much better educated than the previous generations, the cohorts coming after them in most OECD and EU countries have reached, on average, even higher levels of education. However, since the new entrants belong to smaller cohorts, there might be a potential need for skills at both ends of the educational distribution. This trend is reinforced by current changes in labour demand, which is particularly dynamic for both low-skilled and high-skilled workers in the services sector (Autor and Dorn, 2013[19]; Goos, Manning and Salomons, 2009[20]), a situation which is likely to continue (Cedefop, 2016[21]).

Migrants towards OECD countries come from a broad range of countries and have diverse backgrounds in terms of formal and professional qualifications. There is, however, a bimodal pattern in the education distribution of immigrants in a number of EU and OECD countries: migrants are often overrepresented among both the low and the highly educated (Arslan et al., 2015[22]). This can be partly explained by the mix of motives for which migrants come to live and work in their respective host countries: some come for family or humanitarian reasons, which rarely involve education-related selection, while others come to study or to work, in which case they are more likely to be – or become – highly-educated.

Beyond skills, the second important differentiating factor to consider when looking at the potential implications of immigration on the dynamics of the labour market is participation. On the one hand, labour market participation of some categories of migrants, especially low-educated women, tends to be below average, sometimes because of insufficient language proficiency. On the other hand, highly-educated labour migrants typically have participation and employment rates than can be higher than those of natives. In the EU context, there is often a contrast in terms of participation between migrants from other EU countries and migrants from third countries: the former generally have participation rates that are as high as natives, or even higher, while the latter may have less favourable labour market outcomes (European Commission, 2016[18]; OECD/EU, 2015[23]).

In order to better understand the role of migration in the current and future labour market dynamics it is fundamental to take into consideration country-specific differences in the education structure and participation rates, between immigrants and natives, as well as between different groups of foreign-born. This last point is particularly crucial for EU countries, not only because of the similarity between natives and migrants from other EU countries, but also because the latter benefit from freedom of movement within the EU, which is not the case for third country nationals.

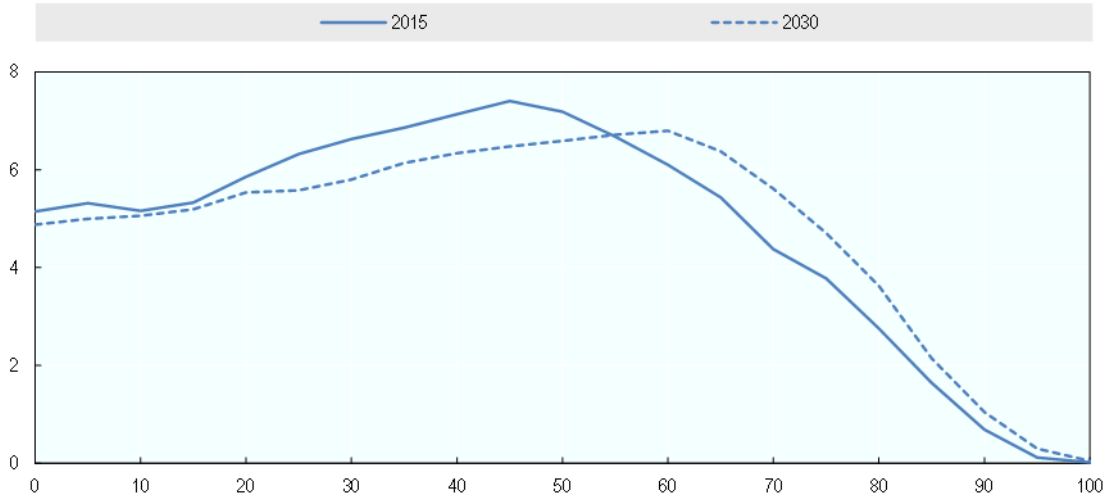
Building on the work carried out jointly by the OECD and the European Commission in the framework of the project on "Matching economic migration with labour market needs" (OECD/EU, 2014[14]), the objective of this OECD-EC project on "Migration-Demography Database: A monitoring system of the demographic impact of migration and mobility" is to create a database that will update, expand and streamline the analysis of the demographic impact of immigration on the size and composition of the labour force. This project includes both a retrospective analysis over the last 10 years, and projections over the next 15 years.

This paper focuses on projections over the period 2015-2030, and aims at identifying the drivers of changes in working-age population and active population in European countries, and in particular the role of migration flows.

Population projections for European countries

According to existing projections, the age distribution of the European population will undergo a significant shift in the coming decades. This is shown in Figure 1 using Eurostat projections for the period 2015-2030. As a result of this ageing process, the average age of the EU population is set to increase from 42 years to 44.5 years over this period.

Figure 1. Age distribution of the EU population in 2015 and 2030 according to the baseline scenario of Eurostat population projections (in %)



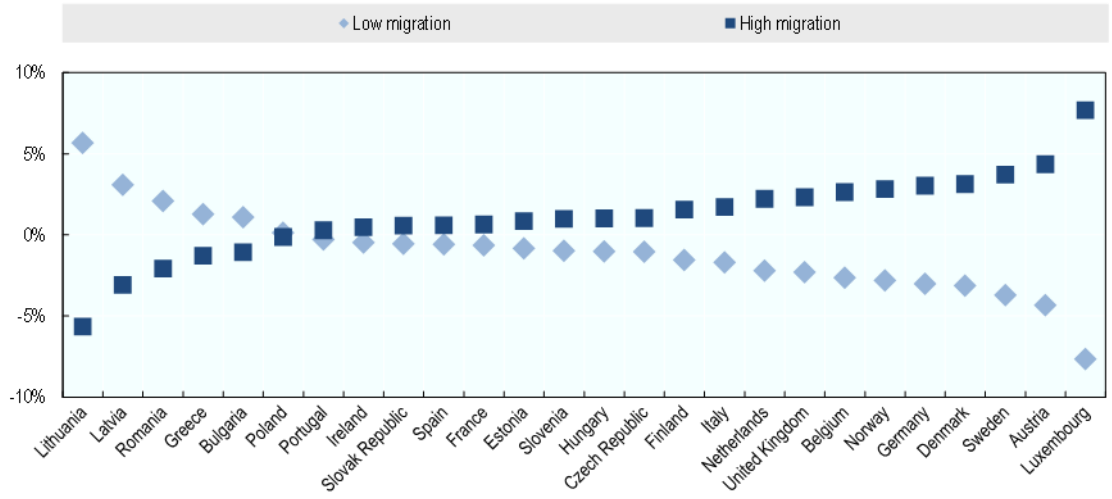
Source: Eurostat 2015 Population projections; OECD estimates.

These projections rely on assumptions on fertility, mortality and net migration (Eurostat, 2017). Regarding migration, which is the demographic component of interest in our analysis, EU-wide net migration rates in Eurostat projections are about 0.4% in 2015 and 0.2% in 2030, reflecting an assumption that net migration rates tend towards zero in the very long run. Most countries are expected to have moderate positive net migration rates over the period 2015-2030, but there are significant different across countries, with Luxembourg being the country with the highest net migration rate (2% in 2015, 1.2% in 2030) and Lithuania the one with the lowest rate (-0.8% in 2015 and -0.7% in 2030). Apart from Luxembourg, other countries which are expected to have relatively high migration rates during this period are Austria, Germany, Sweden, and Denmark.

Eurostat projections include three variants with different migration assumptions: the baseline scenario, defined in Eurostat (2017[24]), a low migration scenario, which assumes that the absolute[1] level of net migration is one third lower than in the baseline scenario over the whole projection period, and a high migration scenario, with the absolute level of net migration one third higher than in the baseline. Comparing these three scenarios helps understand the potential role of migration as a driver of demographic change in European countries in the coming decades. Figure 2 looks at the implication of these different scenarios for the size of the working-age population (15-74) in 2030 by comparing the low and high migration scenarios with the baseline, with countries ranked by increasing net migration rate. For most countries, switching from the low migration scenario to the high migration one has a negligible impact on the size of the working-age population by 2030: in about half of all EU28 countries, the difference is smaller than 3% in absolute value. For countries with high net migration (positive or negative), however, the difference is not trivial: for Luxembourg, the high migration scenario implies a working-age population 15% larger by 2030 than the low migration scenario; on the contrary, for Lithuania, which has a negative net migration rate in the baseline, the high migration scenario leads to a working-age population 11% smaller than the low migration one. For countries with net migration close to zero in the baseline, such as Poland or Portugal, there is virtually no difference between the low, high and baseline scenarios.

[1] Note that net migration can be negative.

Figure 2. Difference of working-age population (15-74) between the baseline scenario and the low/high migration scenarios of Eurostat projections by 2030



Source: Eurostat; OECD estimates.

Labour force projections by educational attainment and place of birth

Population projections are essential to better understand future demographic change in European countries, and help develop public policies suitable for this new context of ageing population and low and unstable fertility. In order to evaluate the implications of these trends for the economy, and particularly for the labour market, it is necessary to include additional dimensions.

First, while the size of the working-age population is a crude indicator of the potential number of workers in an economy, labour force participation varies significantly across age, gender, educational attainment and migration background, as well as across countries. Recognising that all working-age individuals do not have the same likelihood to participate to the labour market allows to account for this heterogeneity and will lead to more relevant conclusions, not only regarding the contribution of different groups to the labour market, but also on the overall labour market outcome.

Second, access to employment, and to specific occupations, is largely conditioned by appropriate skills. Although formal education does not necessarily provide skills that are relevant to the labour market, and although low-educated workers with strong professional expertise are in high demand in certain occupations, a high level of educational attainment is a strong predictor of employment steadiness and of access to highly paid jobs. This is especially true for young entrants on the labour market without prior experience, or for immigrants, for whom relevant diplomas can act as a useful signal to employers in terms of competence and adaptability. Including education as another dimension can enrich the diagnostic that can be made about the future of labour supply.

Third, migration flows towards most European countries have increased in recent years, due to intra-EU mobility, as well as immigration from non-EU countries. Although predicting future migration is extremely difficult, there is little reason to assume that this

trend will reverse. As a result, in a context of slower natural increase, and even decline for some countries, the role of migration in the dynamics of the population and the labour force is likely to become more important in coming decades. In EU countries, mobile EU citizens benefit from much more favourable conditions than non-EU nationals in terms of residence and work rights. It is therefore essential to account for the distinct role of both categories. In addition, emigration and return migration of native-born workers play a critical role in some countries, especially in Eastern European Member States.

The projections presented in this report shed light on the future of the European labour force by educational attainment, and disaggregating the population by place of birth with three categories: native-born, immigrants from EU countries and immigrants from non-EU countries.

The population is projected using the traditional cohort-component method (see the methodological appendix for a detailed presentation). Projecting the population by place of birth does not entail specific challenge since these population sub-groups do not overlap. Projections by education level are however more challenging because, contrary to gender or place of birth, the highest level of educational attainment of an individual can change over the life cycle. The approach followed in these projections to include the education dimension is to add it once the population has been projected. This generates projections of the working-age population and results for the labour force are then obtained by using labour force participation rates by education level estimated on the basis of the EU Labour Force Survey.

Three key variables affect the dynamics of the labour force in the projections: net migration, the education distribution, and the labour force participation rate. For each of these dimensions, different scenarios are considered in order to assess the sensitivity of the baseline results to plausible deviations. These scenarios are described in Table 1, and discussed more thoroughly in Appendix B.

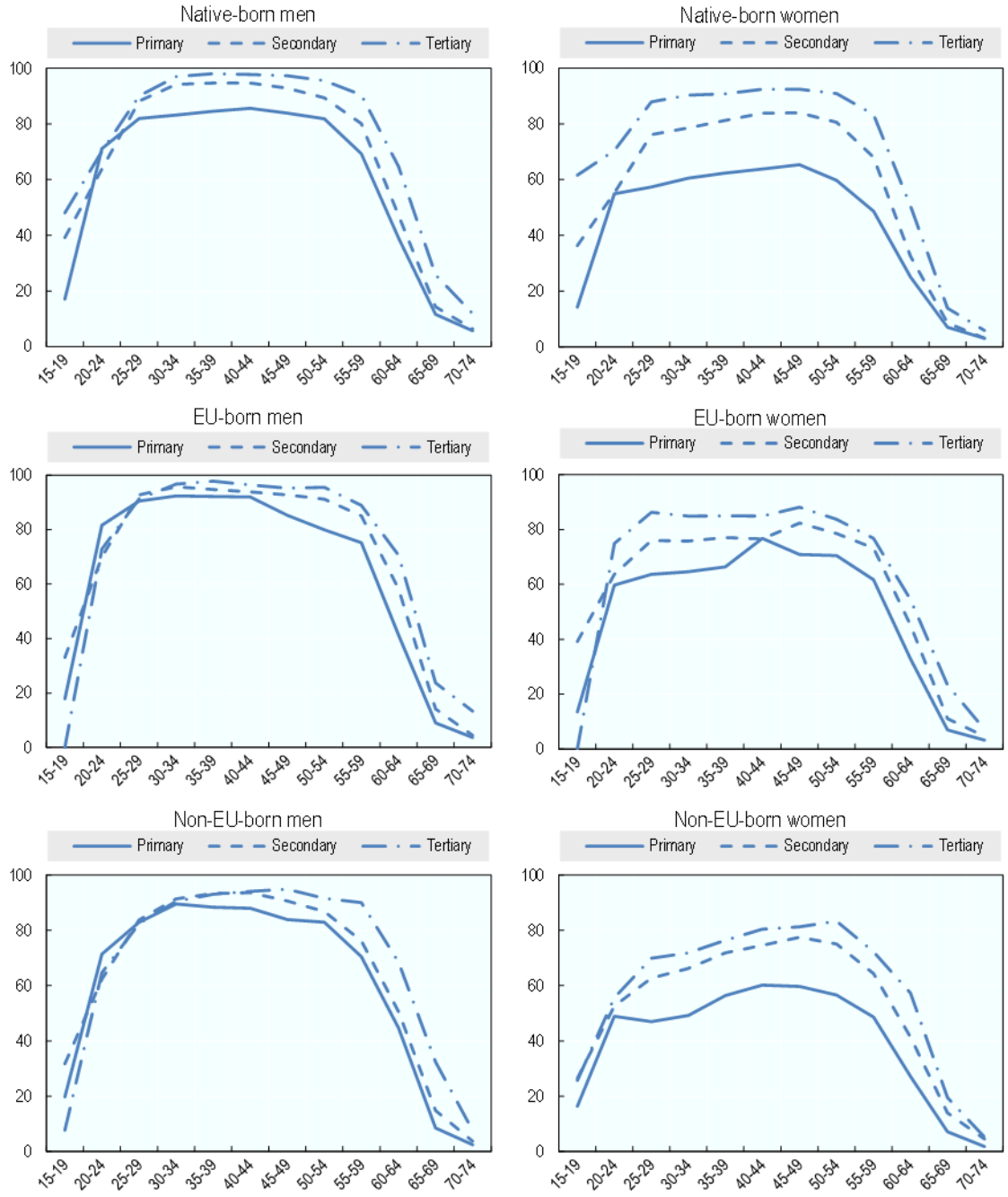
Labour force participation rates vary significantly by age and education. As shown in Figure 3, participation to the labour market is typically highest between 30 and 50 years old, and it is usually increasing with the level of education. In addition, labour force participation is lower among women than men, with the gap being particularly acute for people with less than secondary education. There is also a significant difference in participation rates between native-born and immigrants from non-EU countries, especially among the tertiary-educated and among women. Finally, there are very large differences across EU countries in terms of average participation rates, as well as in terms of gaps between men and women and between native-born and immigrants (OECD, 2015).

Table 1 Description of the scenarios

Net migration	Education distribution	Labour force participation
Baseline Net migration rates for 2016-2030 are set to the level and age profile observed during 2010-2015. *Zero* All net migration rates for 2016-2030 are set to zero. *Low* For a given population cell (country, sex and origin), net migration rates by age for 2016-2030 are set to the baseline level, minus 30% of the absolute value of the total net migration rate of the cell. *High* For a given population cell (country, sex and origin), net migration rates by age for 2016-2030 are set to the baseline level, plus 30% of the absolute value of the total net migration rate of the cell.	*Baseline* The distribution of education observed in 2015 is kept constant for all categories for 2016-2030, although the whole distribution is aged over time, as described above. *Low trend* The share of tertiary-educated among people aged 30-34 increases by 6 percentage points between 2015 and 2030. *Medium trend* The share of tertiary-educated among people aged 30-34 increases by 9 percentage points between 2015 and 2030. *High trend* The share of tertiary-educated among people aged 30-34 increases by 12 percentage points between 2015 and 2030.	*Baseline* The labour force participation rates observed in 2015, which are disaggregated by 5-year age group, gender, educational attainment and place of birth, are assumed to remain constant until 2030. *Gender convergence* The participation gap between men and women is reduced for each group over the period 2015-2030 until it reaches zero in 2030, by increasing the labour force participation rate of women when it is lower than that of men. *Origin convergence* The participation gap between native-born and immigrants is reduced for each group over the period 2015-2030 until it reaches zero in 2030, by increasing the labour force participation rate of immigrants when it is lower than that of natives. *Gender and origin convergence* This scenario combines the two variants outlined above, thus allowing to set both the gender gap and the gap between native-born and immigrants to zero by 2030.

Note: See Appendix B for details on the different scenarios.

Figure 3. Labour force participation rates in European countries, by highest level of educational attainment, age, sex, and place of birth, 2015 (%)



Note: The countries covered in this analysis are: Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom, Norway, and Switzerland.
Source: EU Labour Force Survey; OECD estimates.

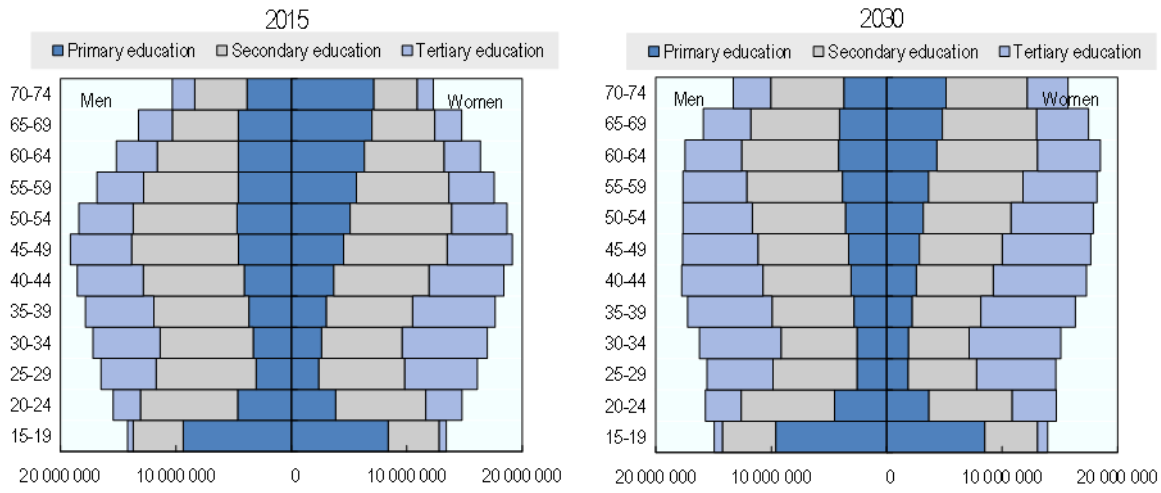
Projection results

a. Working-age population projections

As noted above, these projections can first be used to assess the dynamics of the working-age population by sex, age, educational attainment and place of birth. Figures 4 and 5 show the age and sex distribution of the population of European countries in 2015 and in 2030, focusing respectively on the education dimension (Figure 4) and the distribution by country of birth (Figure 5). The 2030 pyramids are produced under the assumption that net migration remains stable between 2015 and 2030 at the level observed in 2010-2015, and that the education distribution follows the medium trend scenario (see Table 1 and Appendix B).

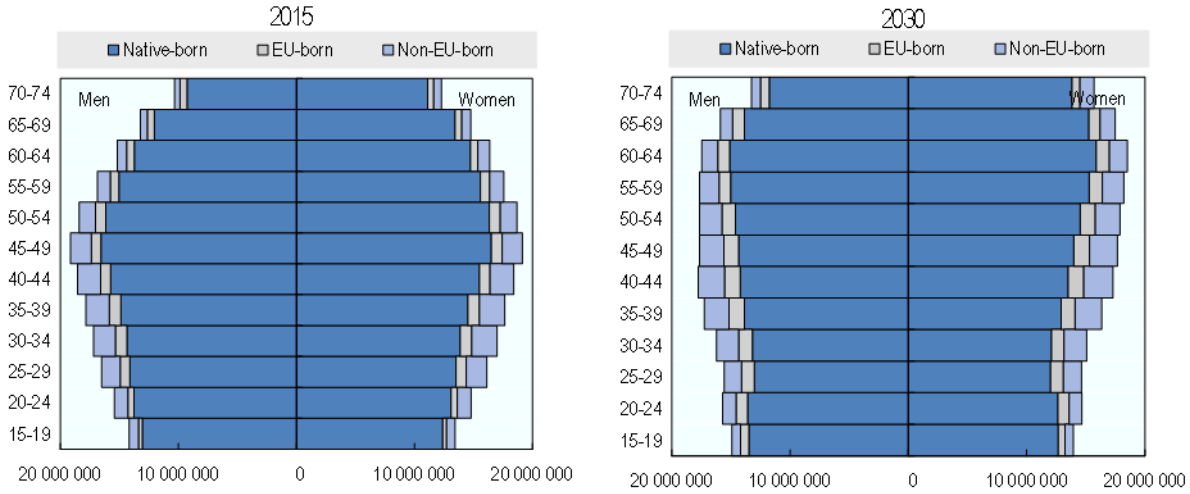
Compared to 2015, the 2030 pyramid exhibits a more rectangular shape: the bulge around age 50, representing generations born at the end of the baby-boom, will be smoothed out. In terms of education, one can observe a significant expansion of the tertiary-educated population, while the number of primary and secondary-educated people decreases. The increase in the share of tertiary-educated individuals is particularly noticeable for the 30-34 age group, which is consistent with the fact that this group benefits the most from the educational progress incorporated in the medium trend education scenario.

Figure 4. Age and sex distribution of the working-age population of European countries, by highest level of educational attainment, in 2015 and 2030 (projection)



Note: The 2030 projection shown here concerns the working-age population and assumes baseline migration and medium trend education. See Appendix B for the definitions of those variants.
The countries covered in this analysis are: Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom, Norway, and Switzerland.
Source: See Appendix B; OECD estimates.

Figure 5. Age and sex distribution of the working-age population of European countries, by place of birth, in 2015 and 2030 (projection)

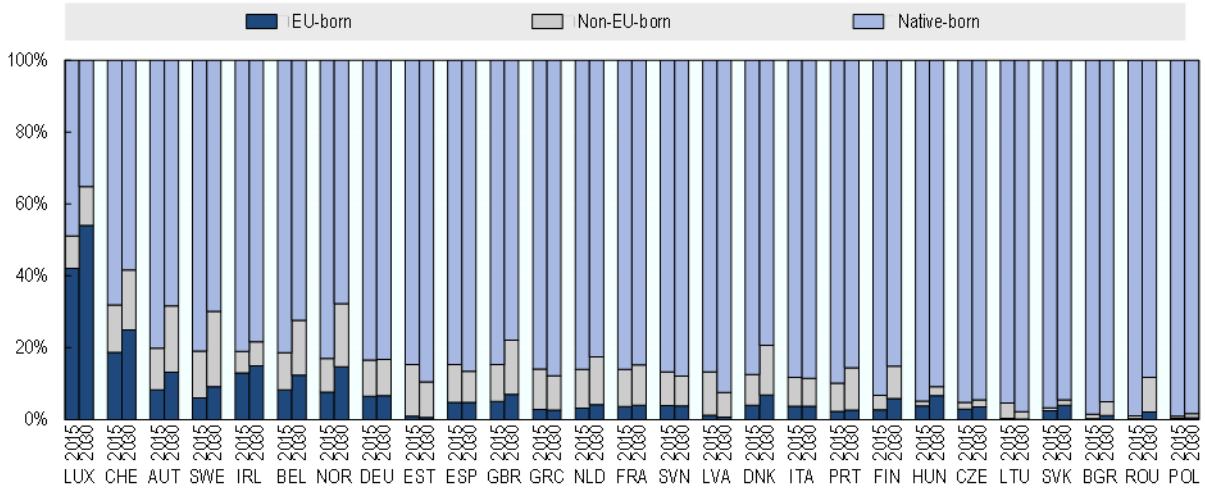


Note: The 2030 projection shown here concerns the working-age population and assumes baseline migration and medium trend education. See Appendix B for the definitions of those variants.
The countries covered in this analysis are: Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom, Norway, and Switzerland.
Source: See Appendix B; OECD estimates.

At the country level, there are significant differences in terms of the share of immigrants in the working-age population (Figure 6). For example, Luxembourg had the highest share of all countries, with 51% in 2015, followed by Switzerland (32%). At the other end of the spectrum, Poland, Romania and Bulgaria had very few working-age immigrants in 2015 (about 1% of the working-age population). Overall, two-thirds of countries had shares between 10% and 20%. Among the working-age foreign-born, the share of those born in EU countries also varied significantly, from more than 80% in Luxembourg and about 70% in Hungary, Slovakia and Ireland, to less than 10% in Lithuania, Latvia and Estonia.

According to the results of the projections, assuming that net migration in 2016-2030 remains similar to what was observed in 2010-2015 (i.e. the baseline scenario), the share of immigrants in the working-age population is set to increase in most countries. Countries where the largest increases are anticipated are those where recent migration trends, on which projections are based, have been particularly high; such high net migration rates are not necessarily sustainable over long periods.

Figure 6. Distribution of the working-age population in European countries by place of birth, in 2015 and 2030 (projection)



Note: The 2030 projection shown here assumes baseline migration. See Appendix B for the definitions of those variants.
Source: See Appendix B; OECD estimates.

b. Projections of future labour force

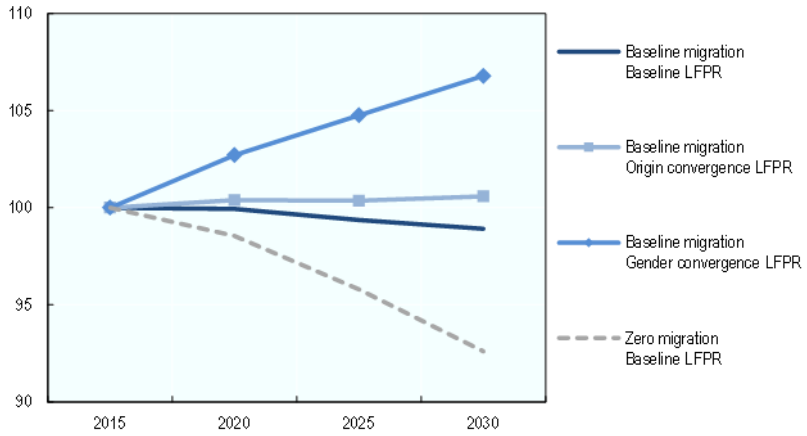
One of the key value-added of these projections is to go beyond the purely demographic dimension and provide an outlook of the future size and structure of the labour force. Figure 7 provides an aggregate overview of the change of the total labour force of European countries under different scenarios. Under a scenario where net migration remains at its baseline level over the whole period 2015-2030, and where labour force participation rates also remain at the level observed in 2015 for all population categories (i.e. by age, gender, educational attainment, and place of birth)[2], the total labour force of European countries is expected to decline by about 0.8%, or about 2.7 million people.

Setting net migration to zero after 2015, while keeping the baseline labour force participation rates, would lead to a 7.4% decline in the labour force (about 18.5 million people). The net impact of this scenario compared to the baseline is therefore to reduce the labour force by 6% in 2030. Although this scenario is not realistic – and not easy to grasp as zero net migration can be reached with arbitrarily small or large levels of gross flows – it provides a benchmark to assess the potential role of migration to maintain the level of the labour force.

[2] The results presented in Figure 7 are obtained under the medium trend education variant (+6 percentage points in the share of tertiary-educated among people aged 30-34 by 2020, and an additional 6 percentage points increase by 2030). The choice of a specific education variant may affect the size of labour force because highly-educated people have on average higher participation than low-educated people. However, the overall effect is much smaller than the changes induced by different levels of net migration or different labour force participation rates.

Figure 7. Change in total labour force of European countries between 2015 and 2030 according to different projection variants

Population 15-74, base 100 in 2015



Note: LFPR: labour force participation rate. See Appendix B for the definition of the variants.
The countries covered in this analysis are: Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom, Norway, and Switzerland.
Source: See Appendix B; OECD estimates.

Other scenarios of interest are those assuming a gradual increase in labour force participation in segments of population where it is currently lower than average, in particular women and immigrants. The gender convergence scenario assumes that the gap in labour force participation rates between men and women gradually decreases to reach zero in 2030. This occurs separately for all age categories, education groups, as well as for native-born and immigrants. Since participation is typically higher for men than for women in a majority of population categories, this scenario implies a significant increase in the number of women on the labour market, while the number of men remains similar to the baseline. Overall, in this scenario, the total labour force of European countries would increase by 6.8% between 2015 and 2030, and it would be 7.9% higher in 2030 than under the baseline variant.

Similarly, the origin convergence variant assumes that the participation gap between native-born and immigrants (both from inside the EU and outside) would reach zero by 2030. In this case, the total labour force of European countries would increase modestly by 0.6% between 2015 and 2030, with the increase among immigrants barely offsetting the decline among native-born due to ageing. Eliminating both the gender and origin gaps by 2030 would lead to a 7.5% increase in the labour force between 2015 and 2030. These variants highlight the quite different labour force potential of activation policies aimed at women or immigrants (or both).

The consequences of different scenarios regarding labour force participation are shown in Table 2. Under baseline scenarios for participation rates and education, it is expected that the overall labour force participation rate of European countries would decline by 2 percentage points between 2015 and 2030, from 64.5% to 62.6%. This change would be slightly attenuated if the education distribution in European countries is shifted upward significantly (under the high trend education scenario). Unsurprisingly, scenarios where

the participation rates of women and immigrants converge towards those of more active groups would lead to an increase or a smaller decline in participation rates, even more so when combined with the high trend education variant. Under the gender convergence scenario, instead of declining, the average labour force participation rate of European countries would increase by more than 3 percentage points by 2030. Under the origin convergence scenario, the decline in participation rate would be limited to 1% or less. These changes operate differently for men and women: the gender convergence scenario benefits mostly women and this drives the overall increase in participation; on the other hand, the origin convergence scenario benefits both men and women, although the latter benefit slightly more because the participation gap between native-born and immigrants is more acute among women.

Table 2 Change in labour force participation rate of European countries between 2015 and 2030 according to different projection variants, population 15-74 by gender (%)

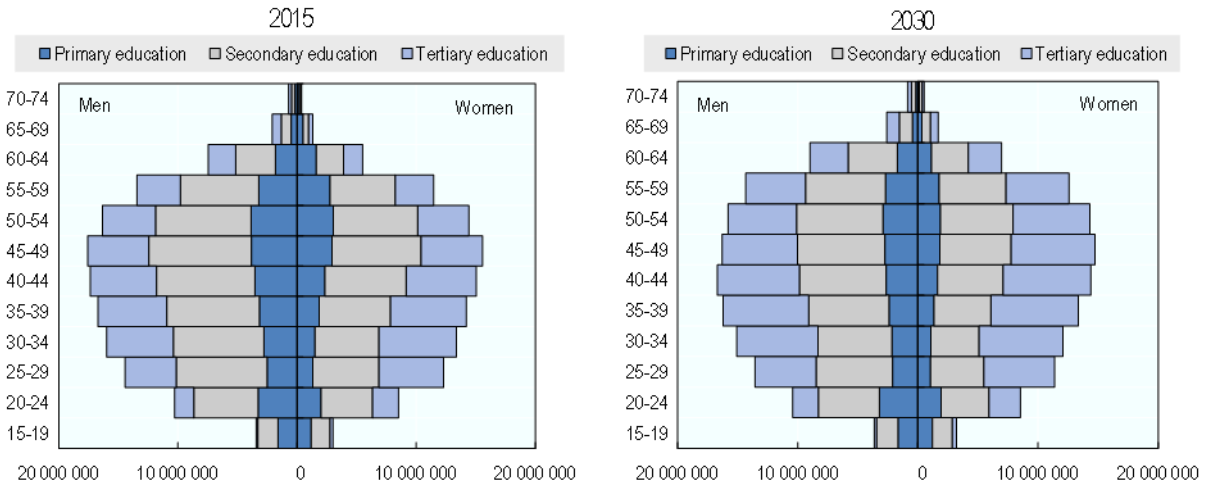
Scenario		2015	2030	2015-2030 change
Labour force participation	Education			
			Total	
Baseline	Baseline	64.5	62.6	-1.9
Gender convergence	Baseline	64.5	67.8	+3.3
Origin convergence	Baseline	64.5	63.7	-0.9
Baseline	High trend	64.5	63.0	-1.5
Gender convergence	High trend	64.5	68.0	+3.4
Origin convergence	High trend	64.5	64.1	-0.5
			Men	
Baseline	Baseline	70.5	68.1	-2.3
Gender convergence	Baseline	70.5	68.1	-2.3
Origin convergence	Baseline	70.5	68.8	-1.7
Baseline	High trend	70.5	68.3	-2.2
Gender convergence	High trend	70.5	68.3	-2.2
Origin convergence	High trend	70.5	69.0	-1.5
			Women	
Baseline	Baseline	58.7	57.2	-1.5
Gender convergence	Baseline	58.7	67.5	+8.7
Origin convergence	Baseline	58.7	58.6	-0.1
Baseline	High trend	58.7	57.7	-1.0
Gender convergence	High trend	58.7	67.6	+8.9
Origin convergence	High trend	58.7	59.2	+0.5

Note: See Appendix B for the definition of the variants.
The countries covered in this analysis are: Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom, Norway, and Switzerland.
Source: See Appendix B; OECD estimates.

The overall results of the labour force projections can be shown as population pyramids (Figures 8 and 9). In Figure 8, the labour force is shown in 2015 and 2030, disaggregated by education level. Compared to the corresponding working-age population pyramids (Figure 4), the labour force pyramid is naturally much thinner for age groups with low participation, such as the 15-19 age group or the 65+. The educational balance is also different as higher educated people tend to have higher participation rates. The gender differential in terms of participation is also reflected in the pyramid. For example, in

2015, for the 45-49 age group, the population of women with tertiary education was 6% larger than that of their male counterparts. However, in terms of labour force, the difference was negligible. This difference is even larger for groups with lower educational attainment: among the primary-educated aged 45-49 in 2015, men outnumbered women by only 1% in the population, while men outnumbered women by more than 20% in the labour force.

Figure 8. Age and sex distribution of the labour force of European countries, by highest level of educational attainment, in 2015 and 2030 (projection)

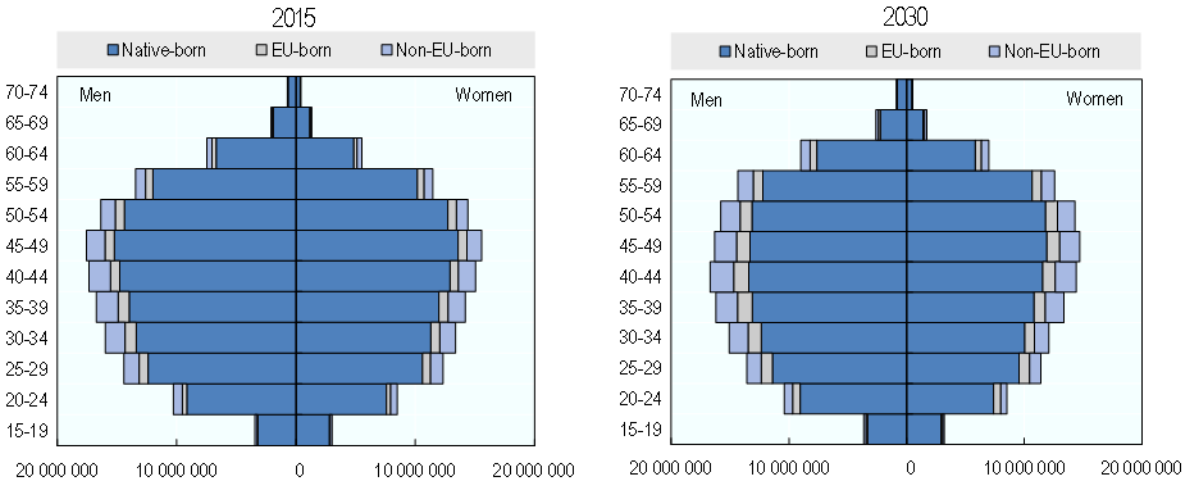


Note: The 2030 projection shown here assumes baseline migration, medium trend education and baseline labour force participation. See Appendix B for the definitions of those variants.
The countries covered in this analysis are: Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom, Norway, and Switzerland.
Source: See Appendix B; OECD estimates.

Between 2015 and 2030, the labour force will become significantly older: the share of the workforce aged 55+ will increase from less than 17% to 19.5%, while the share aged 20-35 will decrease from 42% to 40.5%. It will also undergo an upward shift in its education composition: under the medium trend education scenario, the expansion of the tertiary-educated labour force is clearly visible, for both men and women, especially for intermediate age groups. There will be fewer workers with only primary or secondary education, and this decrease will be particularly significant for the relatively young workers (aged 25-39), with a 20% decline over 15 years. This phenomenon is partly due to the assumption that a higher share of the young cohorts will obtain a tertiary education, but also to the ageing of the workforce and the differential labour force participation of older people by level of education. In fact, this ageing component alone accounts for two-fifths of this decline. The ageing of the large cohorts born in the 1960s who have relatively high educational attainment, and the fact that tertiary educated individuals aged 55+ tend to have higher participation rates than those with lower educational attainment, translates into many more "old and educated" workers in 2030 than in 2015. Country-specific results on the labour force by educational attainment according to different education and migration scenarios are provided in Appendix A.

In terms of countries of origin, under the baseline migration scenario, there will be a slight decrease in the number of native-born workers (-5%), but a significant increase in the number of foreign-born workers (+26%) (Figure 9). However, considering the relatively small share of immigrants in the labour force, the overall change will still be slightly negative (-1%). These differences play out differently across age groups. For example, the number of native-born aged 40-44 is expected to decrease by 10% between 2015 and 2030, while the number of EU-born and non-EU-born immigrants is expected to increase respectively by 54% and 18%.

Figure 9. Age and sex distribution of the labour force of European countries, by place of birth, in 2015 and 2030 (projection)



Note: The 2030 projection shown here assumes baseline migration, medium trend education and baseline labour force participation. See Appendix B for the definitions of those variants.
The countries covered in this analysis are: Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom, Norway, and Switzerland.
Source: See Appendix B; OECD estimates.

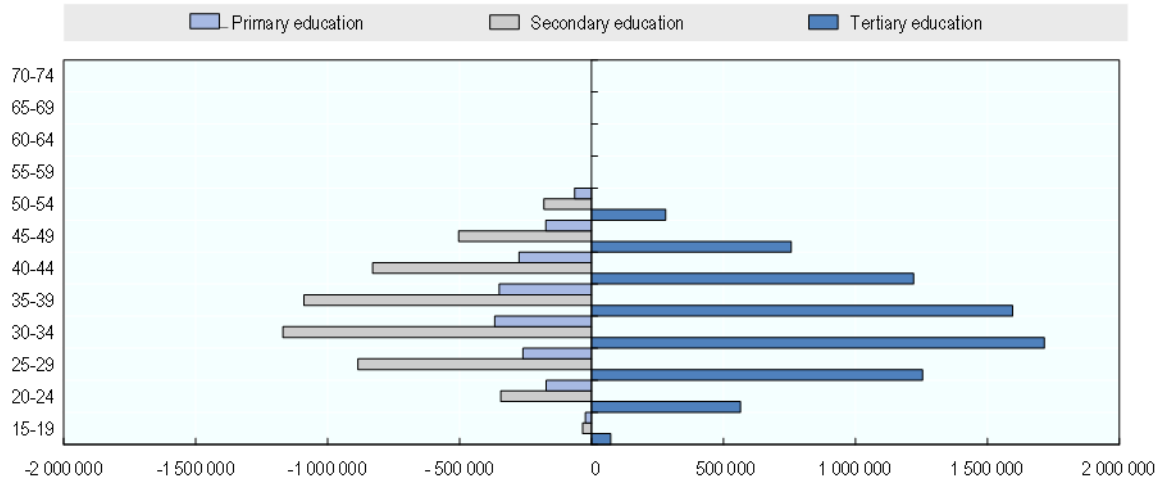
Projections also allow looking at the contrast between different variants, which is useful to better understand the potential role of specific policy options. For example, changes in educational attainment of the young cohorts could occur more or less rapidly over the next 15 years. Looking at the difference between the low trend and high trend scenarios for education, this would have significant implications for the educational distribution of the labour force (Figure 10). Under the high trend scenario, the number of tertiary educated individuals in the EU labour force would be 7.5 million higher than under the low trend scenario, which represents a difference of more than 7.5%. Thus, primary and secondary educated segments of the labour force would be much smaller. While most of this difference stems from the increased number of highly-educated individuals in the working-age population, there is also a small additional effect due to the higher participation rates of this group compared to less educated ones. Indeed, abstracting from the latter by looking at the working-age population, the difference in the number of tertiary-educated individuals between the two scenarios is 6.7%. The fact that most of this difference is concentrated among the relatively young age groups also has implications for the future makeup of the labour force.

Regarding the age structure, some countries will likely be confronted to a much older labour force than others (Figure 11). Workforce ageing is particularly pronounced in Italy, where the 50-54 years-old will make the largest group of the labour force in 2030. This is in contrast with Sweden, for example, where the largest group will be those aged 35-39. France and the Netherlands have an intermediate position, with age groups of very similar size.

In some countries, the contribution of men and women to the labour force will be relatively balanced. This is for example the case of France and Spain. Although men will be more numerous than women, the difference will not exceed 10% in these two countries. On the other hand, in Germany and Italy, women will be underrepresented in the labour force by more than 20%. Under the assumption that labour force participation rates will remain similar to what they were in 2015, these 2030 cross-country differences largely reflect the current gaps in labour force participation between men and women in those countries.

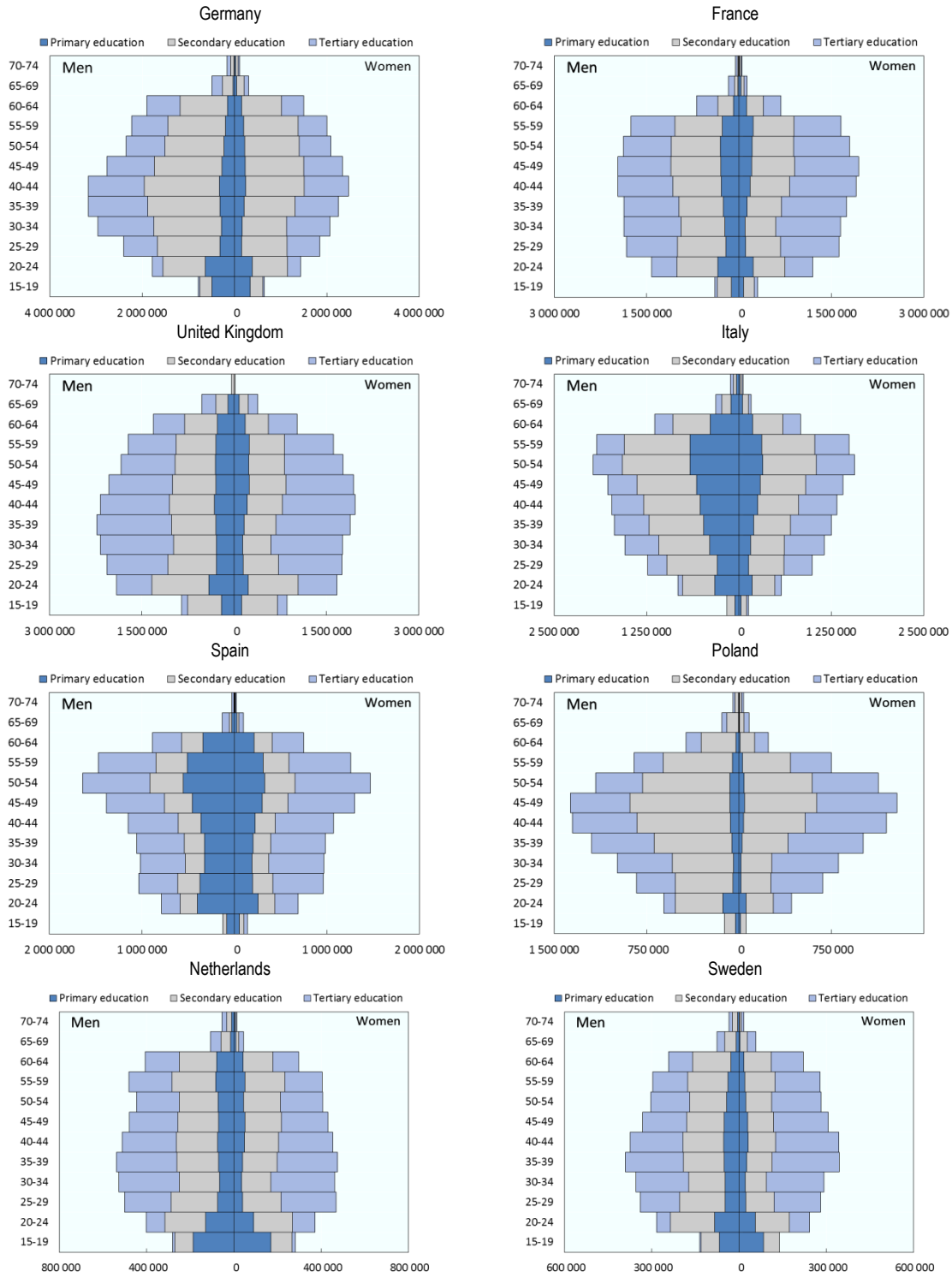
The projected educational distribution also differs significantly from one country to another. While some countries are expected to have a very large share of tertiary educated workers, this is not the case of others. Among the sample of large EU countries, Italy is the one which is expected to see the lowest share of highly-educated individuals in its labour force, with 28% (in 2015, this share was 20%). At the other end of the spectrum, the United Kingdom and Spain will see respectively 49% and 48% of tertiary-educated in their labour force, followed closely by France and Sweden (47% each).

Figure 10. Difference in the education distribution of the labour force of European countries in 2030 according to two different projections: low trend vs high trend education



Note: The 2030 projection shown here assumes baseline migration, high or low trend education, and baseline labour force participation. See Appendix B for the definitions of those variants.
The countries covered in this analysis are: Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom, Norway, and Switzerland.
Source: See Appendix B; OECD estimates.

Figure 11. Age and sex distribution of the labour force of selected EU countries, by highest level of educational attainment, in 2030 (projection)



Note: The 2030 projection shown here assumes baseline migration, medium trend education and baseline labour force participation. See Appendix B for the definitions of those variants.
Source: See Appendix B; OECD estimates.

Conclusion

The projections discussed in this paper indicate that the size and composition of the 2030 labour force in EU countries will be very different from what it is now. The main factors driving the future evolution will be ageing and the ongoing increase in the share of tertiary-educated workers.

Although the labour force is much less sensitive to ageing than the overall population, the decline of fertility in a number of European countries leads to much smaller cohorts of new labour market entrants, thus increasing the average age of the labour force. This process occurs with varying intensity across the EU, with some countries maintaining – at least for now – a level of fertility close to replacement. Beyond 2030, in a context where the population will continue ageing, there is much uncertainty with regards to the evolution of fertility.

While the increase in the share of young workers with tertiary education is likely to continue, the speed of the progress will have a strong impact on the future labour force. Under the high trend education scenario, there will be 7.5 million more tertiary-educated workers in EU countries by 2030 than under the low trend education scenario (106 million instead of 98.5 million).

In this context, the role of international migration as a component of the labour force at the macro level will likely remain modest. In most European countries, even a relatively large increase in net migration flows would not affect much the expected trends. However, migration could hold a much more important role at the micro level, by allowing a lessening of regional imbalances across EU countries, or reducing short term labour scarcity in specific occupations.

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Appendix A: Supplementary tables

Table 3 Total projected labour force by educational attainment in 2030 according to different education and migration variants (thousands)

		Primary-educated			Secondary-educated			Tertiary-educated		
	Migration scenario:	Baseline	High	Low	Baseline	High	Low	Baseline	High	Low
	AUT - Austria									
Education scenario	Baseline	647	704	597	2 422	2 584	2 287	1 734	1 856	1 633
	High trend	596	649	551	2 178	2 322	2 057	2 040	2 186	1 919
	Low trend	621	676	574	2 300	2 453	2 172	1 887	2 021	1 776
	Medium trend	609	663	563	2 239	2 387	2 115	1 964	2 103	1 847
	BEL - Belgium									
Education scenario	Baseline	913	991	846	2 109	2 206	2 024	2 349	2 454	2 258
	High trend	821	891	761	1 877	1 965	1 801	2 717	2 842	2 607
	Low trend	867	941	803	1 993	2 086	1 912	2 533	2 648	2 433
	Medium trend	844	916	782	1 935	2 025	1 857	2 625	2 745	2 520
	BGR - Bulgaria									
Education scenario	Baseline	343	345	340	1 544	1 565	1 526	921	935	908
	High trend	317	320	315	1 430	1 449	1 413	1 087	1 103	1 072
	Low trend	330	332	328	1 487	1 507	1 469	1 004	1 019	990
	Medium trend	324	326	321	1 459	1 478	1 441	1 045	1 061	1 031
	CHE - Switzerland									
Education scenario	Baseline	786	864	718	2 299	2 432	2 182	2 328	2 498	2 180
	High trend	728	799	666	2 064	2 183	1 959	2 625	2 816	2 459
	Low trend	757	832	692	2 181	2 307	2 071	2 476	2 657	2 319
	Medium trend	743	815	679	2 122	2 245	2 015	2 551	2 736	2 389
	CZE- Czech Republic									
Education scenario	Baseline	257	261	254	3 487	3 515	3 463	1 250	1 262	1 238
	High trend	239	243	236	3 250	3 275	3 227	1 504	1 519	1 491
	Low trend	248	252	245	3 368	3 395	3 345	1 377	1 390	1 365
	Medium trend	244	247	241	3 309	3 335	3 286	1 441	1 454	1 428
	DEU - Germany									
Education scenario	Baseline	5 940	6 241	5 658	24 069	24 921	23 259	13 047	13 529	12 590
	High trend	5 514	5 792	5 254	22 060	22 840	21 319	15 702	16 286	15 149
	Low trend	5 727	6 017	5 456	23 065	23 880	22 289	14 375	14 908	13 869
	Medium trend	5 620	5 905	5 355	22 563	23 360	21 804	15 039	15 597	14 509
	DNK - Denmark									
Education scenario	Baseline	550	575	529	1 366	1 444	1 304	1 303	1 393	1 231
	High trend	509	532	490	1 227	1 294	1 173	1 503	1 607	1 419
	Low trend	529	553	510	1 297	1 369	1 239	1 403	1 500	1 325
	Medium trend	519	542	500	1 262	1 332	1 206	1 453	1 554	1 372
	EST - Estonia									
Education scenario	Baseline	60	60	59	289	293	284	249	253	245
	High trend	54	55	54	264	268	260	283	287	278
	Low trend	57	58	56	276	280	272	266	270	262
	Medium trend	56	56	55	270	274	266	274	279	270
	ESP - Spain									
Education scenario	Baseline	6 491	6 564	6 423	4 868	4 927	4 813	8 985	9 044	8 928
	High trend	5 916	5 984	5 853	4 424	4 478	4 372	10 094	10 163	10 027
	Low trend	6 203	6 274	6 138	4 646	4 703	4 593	9 539	9 604	9 478
	Medium trend	6 060	6 129	5 995	4 535	4 590	4 483	9 816	9 884	9 753
	FIN - Finland									
Education scenario	Baseline	373	418	337	1 169	1 207	1 139	1 172	1 211	1 141
	High trend	345	385	312	1 052	1 087	1 024	1 335	1 381	1 297
	Low trend	359	402	325	1 111	1 147	1 081	1 254	1 296	1 219
	Medium trend	352	393	318	1 081	1 117	1 053	1 294	1 338	1 258

Table 3 Total projected labour force by educational attainment in 2030 according to different education and migration variants (thousands) *(cont.)*

		Primary-educated			Secondary-educated			Tertiary-educated		
	Migration scenario:	Baseline	High	Low	Baseline	High	Low	Baseline	High	Low
	FRA - France									
Education scenario	Baseline	4 366	4 511	4 235	12 926	13 109	12 760	13 072	13 261	12 900
	High trend	3 981	4 114	3 861	11 597	11 763	11 445	14 981	15 203	14 781
	Low trend	4 173	4 312	4 048	12 261	12 436	12 102	14 027	14 232	13 840
	Medium trend	4 077	4 213	3 954	11 929	12 100	11 774	14 504	14 717	14 310
	GRC - Greece									
Education scenario	Baseline	854	879	831	1 708	1 741	1 676	1 308	1 328	1 288
	High trend	798	821	776	1 553	1 583	1 524	1 548	1 573	1 524
	Low trend	826	850	803	1 630	1 662	1 600	1 428	1 450	1 406
	Medium trend	812	836	790	1 592	1 623	1 562	1 488	1 512	1 465
	HUN - Hungary									
Education scenario	Baseline	507	518	497	2 424	2 472	2 380	1 235	1 265	1 209
	High trend	467	477	458	2 232	2 277	2 192	1 486	1 521	1 455
	Low trend	487	498	478	2 328	2 375	2 286	1 361	1 393	1 332
	Medium trend	477	487	468	2 280	2 326	2 239	1 423	1 457	1 393
	IRL - Ireland									
Education scenario	Baseline	254	269	241	840	905	784	1 090	1 191	1 006
	High trend	237	251	225	757	813	708	1 214	1 328	1 120
	Low trend	246	260	233	798	859	746	1 152	1 259	1 063
	Medium trend	242	256	229	778	836	727	1 183	1 293	1 091
	ITA - Italy									
Education scenario	Baseline	6 931	7 110	6 755	12 305	12 596	12 020	6 022	6 161	5 886
	High trend	6 498	6 666	6 333	11 434	11 705	11 169	7 459	7 633	7 290
	Low trend	6 714	6 888	6 544	11 869	12 150	11 594	6 741	6 897	6 588
	Medium trend	6 606	6 777	6 439	11 651	11 928	11 382	7 100	7 265	6 939
	LTU - Lithuania									
Education scenario	Baseline	75	78	73	502	518	487	526	543	510
	High trend	67	69	65	455	469	441	592	611	574
	Low trend	71	73	69	479	494	464	559	577	542
	Medium trend	69	71	67	467	481	453	576	594	558
	LUX - Luxembourg									
Education scenario	Baseline	83	97	71	134	152	120	193	224	166
	High trend	74	86	64	118	133	105	220	256	191
	Low trend	78	91	68	126	143	112	206	240	178
	Medium trend	76	89	66	122	138	109	213	248	184
	LVA - Latvia									
Education scenario	Baseline	86	88	83	407	418	395	284	292	276
	High trend	79	81	76	375	386	365	328	338	318
	Low trend	82	84	80	391	402	380	306	315	297
	Medium trend	80	83	78	383	394	372	317	326	308
	NLD - Netherlands									
Education scenario	Baseline	1 646	1 686	1 610	3 693	3 772	3 621	3 477	3 549	3 411
	High trend	1 525	1 562	1 492	3 340	3 412	3 274	3 997	4 081	3 920
	Low trend	1 586	1 624	1 551	3 517	3 592	3 448	3 737	3 815	3 666
	Medium trend	1 556	1 593	1 521	3 428	3 502	3 361	3 867	3 948	3 793
	NOR - Norway									
Education scenario	Baseline	582	649	530	1 268	1 394	1 168	1 520	1 662	1 407
	High trend	528	588	480	1 136	1 248	1 048	1 727	1 892	1 596
	Low trend	555	619	505	1 202	1 321	1 108	1 623	1 777	1 502
	Medium trend	542	603	493	1 169	1 285	1 078	1 675	1 835	1 549

Table 3 Total projected labour force by educational attainment in 2030 according to different education and migration variants (thousands) *(cont.)*

		Primary-educated			Secondary-educated			Tertiary-educated		
	Migration scenario:	Baseline	High	Low	Baseline	High	Low	Baseline	High	Low
	POL - Poland									
Education scenario	Baseline	971	975	967	9 276	9 315	9 239	6 437	6 472	6 404
	High trend	892	896	889	8 431	8 465	8 398	7 511	7 550	7 472
	Low trend	932	935	928	8 854	8 890	8 818	6 974	7 011	6 938
	Medium trend	912	915	908	8 642	8 678	8 608	7 242	7 281	7 205
	PRT - Portugal									
Education scenario	Baseline	1 825	1 884	1 769	1 329	1 379	1 282	1 311	1 363	1 264
	High trend	1 706	1 762	1 654	1 217	1 263	1 174	1 554	1 614	1 499
	Low trend	1 766	1 823	1 712	1 273	1 321	1 228	1 433	1 489	1 381
	Medium trend	1 736	1 792	1 683	1 245	1 292	1 201	1 493	1 551	1 440
	ROU - Roumania									
Education scenario	Baseline	1 628	1 653	1 603	4 242	4 333	4 158	1 858	1 922	1 802
	High trend	1 516	1 539	1 493	3 938	4 020	3 861	2 358	2 435	2 290
	Low trend	1 572	1 596	1 548	4 090	4 176	4 010	2 109	2 180	2 047
	Medium trend	1 544	1 568	1 521	4 014	4 098	3 935	2 233	2 308	2 168
	SWE - Sweden									
Education scenario	Baseline	921	1 014	843	2 476	2 577	2 390	2 559	2 703	2 435
	High trend	840	923	770	2 229	2 318	2 152	2 903	3 069	2 761
	Low trend	881	968	806	2 352	2 447	2 271	2 731	2 886	2 598
	Medium trend	861	946	788	2 290	2 383	2 211	2 817	2 978	2 680
	SVN - Slovenia									
Education scenario	Baseline	80	81	79	466	471	461	314	317	311
	High trend	74	75	73	423	428	418	365	368	361
	Low trend	77	78	76	445	449	440	339	343	336
	Medium trend	76	77	75	434	439	429	352	356	349
	SVK - Slovakia									
Education scenario	Baseline	148	149	147	1 741	1 756	1 728	645	657	636
	High trend	137	138	136	1 609	1 623	1 597	790	803	779
	Low trend	143	143	142	1 675	1 690	1 663	718	730	708
	Medium trend	140	140	139	1 642	1 657	1 630	754	766	744
	GBR - United Kingdom									
Education scenario	Baseline	5 467	5 687	5 281	14 027	14 644	13 509	15 816	16 660	15 101
	High trend	4 955	5 149	4 791	12 643	13 188	12 186	18 004	18 957	17 197
	Low trend	5 211	5 418	5 036	13 335	13 916	12 848	16 910	17 809	16 149
	Medium trend	5 083	5 284	4 914	12 989	13 552	12 517	17 457	18 383	16 673

Note: The 2030 projection shown here assumes baseline labour force participation. See Appendix B for the definitions of the different scenarios.
Source: See Appendix B; OECD estimates.

Appendix B: Methodology

Projections

This paper provides projections for the working-age (15-74) and active population of 27 European countries[3] between 2015 and 2030. In addition to the usual age and sex dimensions, the population is disaggregated by educational attainment (lower secondary or less, upper secondary, tertiary) and country of birth, distinguishing three categories: native-born, EU-born, and other foreign-born. On top of the demographic dimensions, labour force participation rates for each category allow to compute estimates of the active population at a disaggregated level.

The database covers all EU countries for which data on the different dimensions are reliable enough, plus Norway and Switzerland. Coverage restrictions are due in some cases to missing data on population and mortality, or insufficient sample size in labour force surveys used to estimate the joint distribution of education and place of birth, as well as labour force participation rates.

The projections follow the basic cohort-component method. Since the focus is on projecting the working-age population from 2015 to 2030, and assuming that labour force participation is null before the age of 15, there is no need to include births in the projections. Indeed, all individuals of working age in 2030 were already born in 2015. As a result, the basic projection equation is written:

$$(1) \qquad P_{t+1}^{a+1} = P_t^a - D_{t,t+1}^a + M_{t,t+1}^a$$

It states that the population aged $a+1$ in year $t+1$ (P_{t+1}^{a+1}) is equal to the population aged a in year t (P_t^a), minus the deaths having occurred between t and $t+1$ ($D_{t,t+1}^a$), plus net migration between t and $t+1$ ($M_{t,t+1}^a$), for individuals of this age. Net migration is defined as the difference between immigration and emigration, and can be positive or negative. This equality remains valid for projecting non-overlapping sub-groups of the population, such as men and women, and native-born and foreign-born individuals[4].

Starting from year t, projecting to year $t+1$ and beyond requires making assumptions on the future evolution of mortality and net migration. The period 2010-2015 is used to estimate baseline mortality and net migration rates, which can be kept as is or altered to reflect specific assumptions and then applied to future periods. For EU countries, detailed data on the number of deaths by age and sex are readily available, which allows to estimate death rates. Additional data on mortality by category of origin (native-born, EU-born, and other foreign-born) allows computing origin-specific death rates for all countries. Estimating net migration rates is less straightforward: while data on the number of foreign immigrants over a specific period is usually collected by governments, for example through administrative data on residence permits, very few countries collect data on foreign emigrants. Moreover, in the case of EU countries, freedom of movement implies that most EU countries no longer collect administrative data on immigration of foreign EU nationals. Finally, since nationals do not require permits to enter or exit their

[3] Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom, Norway, and Switzerland.

[4] It would not be the case if sub-groups were defined along characteristics that can vary across time, such as nationality.

own country, there is typically no administrative data on net migration of nationals[5]. As a result, for the purpose of demographic projections, net migration is usually estimated as a residual from equation (1), and this is the approach followed here: age-specific net migration rates are estimated separately by gender and by category of origin (native-born, EU-born, and other foreign-born) for each country[6].

This method has two main drawbacks. First, it is not possible to estimate separately immigration and emigration, which would be useful to investigate more concrete and more policy relevant migration scenarios. Second, since net migration is computed as a residual, it also includes errors made in the measurement of population and deaths. The smaller net migration is, the more sensitive it is to this problem. When actual net migration is close to zero, measurement errors can easily lead to spurious estimates of net migration.

Once death rates and net migration rates by age and sex are obtained for a given year t' for which the population (also by age, sex and category of origin) is known, it is straightforward to project to year $t' + 1$ using equation (1). The population in year $t' + 1$ is then used to obtain the next year, etc. Equation (1) is therefore used first to estimate net migration rates at baseline, using existing data on population and mortality (i.e. for the period 2010-2015), and it is then used to project the population beyond 2015, with assumptions on the future pattern of mortality and net migration (kept at the baseline level, or modified according to various scenarios, as discussed below).

Including educational attainment in the projection model leads to an additional difficulty. Contrary to gender or place of birth, the highest level of educational attainment of an individual can change over the life cycle. Frequent changes are even expected from primary (achieved) to lower secondary (achieved) around 15, and from lower secondary (achieved) to upper secondary (achieved) around 18. Achievement of tertiary education is spread over a much wider age interval, and can occur between 20 (for short undergraduate study cycles) and 35 or above (for doctorates). In the cohort-component model discussed above, these transitions between education levels could be accounted for through appropriate measurement of age-specific transition rates (from primary to secondary, and from secondary to tertiary). However, available data on completion rates that exist for some countries do not allow the computation of robust transition rates. Without this information, it is impossible to estimate age-specific net migration rates disaggregated by level of educational attainment.

The approach followed in these projections to include the education dimension is to add it once the population has been projected. This requires first estimating the distribution of education by age in 2015 for each country, sex and group of origin. One can safely assume that almost all individuals aged 40 and above have reached their final educational

[5] Some European countries have population registers, which are typically maintained via the legal requirement that both nationals and foreigners residing in the country must register with the local authorities. Aggregation of these local accounts results in a record of population and population movement, including immigration and emigration, at the national level.

[6] In the context of these projections, net migration rates are specific to a given population cell, i.e. the denominator of the rate is the population of the cell, and not the total population. For instance, when referring to the net migration rate of native-born women aged 30, the numerator is the number of net migrants in this category and the denominator is the population of native-born women aged 30.

attainment, i.e. they are no longer subject to transitions[7]. We therefore assume that a cohort aged 40 in year t' will keep the same education distribution at age 41 in year $t' + 1$. For younger cohorts, if there is no progress in terms of educational attainment over time, the education distribution observed in t' can be replicated in year $t' + 1$. If we assume, on the contrary, that younger cohorts benefit from improved educational opportunities, for example with a higher likelihood of completing a tertiary education, the share of tertiary-educated individuals must be shifted upwards in cohorts below age 41 in year $t' + 1$.

This approach implies that death rates are equal across education levels. This assumption is counterfactual: higher educated individuals have on average a higher life expectancy. However, this is less of an issue when death rates are low, which is the case for the working-age population of EU countries. Second, it also implies that the distribution of education among net migrants mirrors the distribution of education in the corresponding population, which is not necessarily true, especially when migration patterns are changing rapidly. It should be noted, however, that net migration rates are computed separately for each age group, which limits the bias introduced by this approach.

The final layer of labour force projections is participation rates. They are estimated for the year 2015 by country, age, sex, origin group and education, and simply interacted to the corresponding working-age population to obtain the labour force.

Data sources and procedures

Data on population by age (0+), sex and place of birth (native-born vs foreign-born) from 2010 to 2016 is taken from Eurostat (*migr_pop4ctb*). For some countries or years, a limited number population cells are missing or aggregated, especially for the oldest categories, and are therefore imputed. Data on deaths by age and sex, as well as by place of birth, also come from Eurostat (*demo_magec* and *demo_macbc*). For each population cell defined by country, age, sex and origin, death rates are averaged over the period 2010-2015.

Once annual net migration rates are estimated for the period 2010-2015, they are smoothed across years using a local non-parametric regression to minimise noise. In addition all migration rates for individuals aged 80 and above are set to zero.

The education distribution, i.e. the share of individuals having reached primary, secondary and tertiary level of education, is estimated from the 2010-2015 EU Labour Force Surveys. These shares are computed separately by sex and 5-year age groups. Data is missing for some countries and years, and need to be imputed. In order to reduce noise in data, the education distribution by age for each year is smoothed using non-parametric local regressions. The same data is used to compute the share of EU-born and other foreign-born among immigrants. Finally, the 2015 EU Labour Force Survey is used to estimate labour force participation rates by age, sex, origin groups and education.

[7] As discussed below, education trends scenarios are based on the 30-34 age group, where the share of tertiary-educated individuals is usually the highest in most countries. Although education transitions between 35 and 39 are possible, they are typically rare and recent improvements in the level of education imply that the share of tertiary-educated is lower than among the 30-34.

Projection variants

Projection variants, or scenarios, are built for three key variables of the projections: net migration, education, and labour force participation. Mortality is assumed to remain constant over the projection period, i.e. at the level estimated over 2010-2015.

The four scenarios considered for net migration are the following:

- *Baseline migration:* Net migration rates for the period 2016-2030 are set to the level and age profile observed during the period 2010-2015.
- *Zero migration:* All net migration rates for 2016-2030 are set to zero.
- *Low migration:* For a given population cell (country, sex and origin), net migration rates by age for 2016-*2030* are set to the baseline level, minus 30% of the absolute value of the total net migration rate of the cell. Since net migration rates are estimated by age, and can be positive or negative, this procedure guarantees that the decrease in the number of net migrants in a cell is distributed across ages proportionately to the share of each age group in the population. The use of the absolute value ensures that the low migration scenario actually leads to a lower number of net migrants when total net migration is negative.
- *High migration:* For a given population cell (country, sex and origin), net migration rates by age for 2016-2030 *are* set to the baseline level, plus 30% of the absolute value of the total net migration rate of the cell. Since net migration rates are estimated by age, and can be positive or negative, this procedure guarantees that the increase in the number of net migrants in a cell is distributed across ages proportionately to the share of each age group in the population. The use of the absolute value ensures that the high migration scenario actually leads to a higher number of net migrants when total net migration is negative.

Regarding education, scenarios are set with respect to the share of people aged 30-34 having completed higher education. Scenarios are built in reference to the recent trend observed for this share. Between 2014 and 2015, it increased from 38% to 38.6% for the European countries in this analysis. Extrapolating this trend leads to an increase of 9 percentage points in the share of tertiary-educated 30-34 between 2015 and 2030, which defines the medium trend scenario[8].

- *Baseline education.* The distribution of education observed in 2015 is kept constant for all categories for the period 2016-2030, although the whole distribution is aged over time, as described above.
- *Medium trend education.* The share of tertiary-educated among people aged 30-34 increases linearly every year, with a total growth of 9 percentage points between 2015 and 2030. Over the projection period, the decline of the shares of primary and secondary-educated people among the 30-34 is distributed according to their initial shares[9]. For people aged 15-29 and 35-44, the share of tertiary-educated is interpolated between the baseline level and the share at 30 and 34, respectively.

[8] The EU objective, set in the Europe 2020 Strategy, of 40% of people aged 30–34 having completed higher education by 2020, is likely to be reached ahead of time, and is achieved even in the *low trend* scenario.

[9] If the share of tertiary-educated increases from s_3 to s_3' under a particular scenario, the share of primary educated will decrease from s_1 to $s_1' = s_1 \times \left(1 - s_3^{'}\right)/(s_1 + s_2)$, while the share of secondary-educated will decrease from s_2 to $s_2' = s_2 \times \left(1 - s_3^{'}\right)/(s_1 + s_2)$.

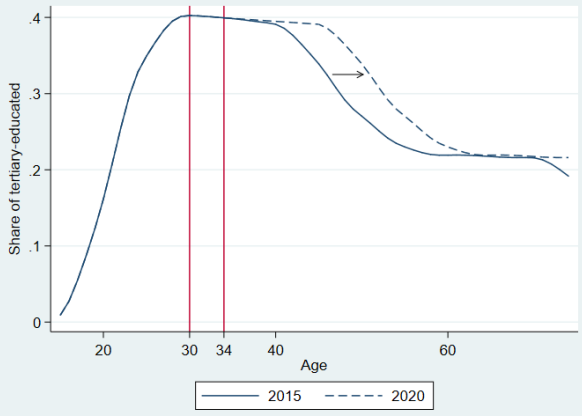
The education distribution is kept at the baseline level for individuals aged 45+ in 2020, and 55+ in 2030, since they are assumed to have reached their final level of education in 2015 at age 40.

- *Low trend education.* The share of tertiary-educated in the 30-34 age group increases by 6 percentage points between 2015 and 2030 (one-third below the *medium trend* scenario). The adjustment procedure for other age groups follows the same approach as in the medium trend scenario.
- *High trend education*. The share of tertiary-educated in the 30-34 age group increases by 12 percentage points between 2015 and 2030 (one-third above the *medium trend* scenario). The adjustment procedure for other age groups follows the same approach as in the medium trend scenario.

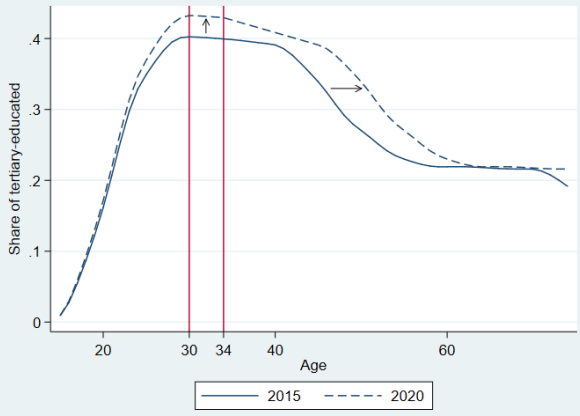
Figure 12 illustrates the process of ageing and updating the share of tertiary-educated individuals between 2015 and 2020 for the baseline and medium trend scenarios. For the baseline scenario (panel a), there is no change in the share of tertiary-educated among individuals aged 30-34 (or younger) but all individuals are 5 years older. For example, individuals aged 40 in 2015 are 45 in 2020; the share of tertiary-educated at 45 has to shift upward between 2015 and 2020 to reflect the fact that this cohort is better educated than those who were 45 in 2015. For the medium trend scenario (panel b), this ageing factor is compounded with the upward shift in the share of tertiary-educated aged 30-34. This shift is also applied to individuals immediately younger and older, so that there is no abrupt break in the share of tertiary-educated as a function of age.

Figure 12 Adjustment of the share of tertiary-educated by age between 2015 and 2020 in the baseline scenario and the medium trend scenario

a. Baseline education



b. Medium trend education



Scenarios for labour force participation of the 15-74 population are as follows:

- *Baseline labour force participation.* The labour force participation rates observed in 2015, which are disaggregated by 5-year age group, gender, educational attainment and place of birth, are assumed to remain constant until 2030.
- *Gender convergence.* The participation gap between men and women is reduced incrementally for each group over the period 2015-2030 until it reaches zero in 2030, by increasing the labour force participation rate of women when it is lower than that of men.

- *Origin convergence.* The participation gap between native-born and immigrants is reduced incrementally for each group over the period 2015-2030 until it reaches zero in 2030, by increasing the labour force participation rate of immigrants when it is lower than that of natives.
- *Gender and origin convergence.* This scenario combines the two variants outlined above, thus allowing to set both the gender gap and the gap between native-born and immigrants to zero by 2030.