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Research Article

On the contribution of foreign-born populations to overall population change in Europe: Methodological insights and contemporary evidence for 31 European countries

Christos Bagavos

Contents

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Christos Bagavos[1]

Abstract

BACKGROUND
Within the context of significant migration flows, persisting low fertility settings, and population ageing in more developed areas, increased focus has been placed on the impact of migration on population change in receiving countries.

OBJECTIVE
This paper examines the contributions of migrants and natives to population change in 31 European countries for the 2014–2019 period.

METHODS
Based on a standardisation method, we provide evidence derived from births, deaths, and net migration for the size and diversity of the contributions to overall population change of the two population groups.

RESULTS
The results show that the foreign-born population has been the driving force behind overall population change in Europe, as this population has attenuated overall population decline; turned the expected population decline into population growth; or, less frequently, accelerated population growth. Additionally, the differences between countries in the indirect effect of the foreign-born population on population change have been driven more by the differences in the population age structure of migrants than by the timing and level of fertility or by the level of mortality among migrants.

CONCLUSIONS
Our findings suggest that the contribution of the foreign-born population to overall population change in Europe has been pronounced and goes far beyond the contribution of net migration, the commonly used indicator for measuring the effect of the foreign-born population on population change.

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CONTRIBUTION

The study provides empirical evidence as regards the increasing importance of foreign-born population for population change in Europe.

1. Introduction

Europe's population has grown consistently over time. According to the European Commission (2020), the total population of the EU-27[2] has grown by a quarter since 1960. At the same time, net migration has gained in importance as a component of population change. Thus, in the EU-27 since 2012, the number of deaths has exceeded the number of births, which means that without positive net migration, Europe's population would have already started to shrink. Of course, these trends have differed between countries. While Belgium, Ireland, Cyprus, Luxembourg, Malta, and Sweden have experienced relatively steady population increases, Bulgaria, Croatia, Latvia, Lithuania, and Romania have reported population declines since 1990. Over the last five years, natural change has been negative in more than half of the EU-27 countries (Eurostat 2020a). However, due to positive net migration figures, the total population of each of these countries has continued to grow.

In general, net migration has become the main component of population growth in Europe because shifts in migration over time have been combined with restricted or even declining overall natural change (Coleman 2008; MacKellar and McNicoll 2019). However, while overall net migration can be considered a good proxy for migration flows, it is not a fully appropriate indicator for approximating the impact of migration on overall population change. There are at least two reasons why this is the case. First, the overall level of net migration hides the great diversity in the countries of birth (or of citizenship) of migrants since the overall level of net migration usually results from a combination of the positive net migration of foreign-born individuals and the negative net migration of native-born individuals. Second, this direct effect of the foreign-born population on population change is combined with an indirect effect related to births and deaths among migrants and, therefore, to their contributions to the overall level of natural change. Thus, the contributions of migrants to population change can differ from those of natives or across countries because of the differences between these populations in terms of their fertility (Bagavos 2019; Sobotka 2008; Sevak and Schmidt 2008), mortality (Aldridge et al. 2018), and age structure (Alho 2008).

[2] EU-27 refer to EU-28 Member States without the UK.

The lack of reliable data on demographic events (births, deaths, immigrants, and emigrants) for migrants and natives that would allow researchers to perform robust estimations explains why the contributions of migrants to shifts in the overall population size are less explored than other demographic issues related to migration (Abel and Sander 2014; de Beer at al. 2010; Murphy 2016; van Nimwegen and van der Erf 2010; Voets, Schoorl, and de Bruijn 1995; Wiśniowski 2017).[3] Of course, population estimates by migration status can provide evidence of the effects of migration on population change in the host countries (Rendall and Salt 2005). However, when a person's country of birth is used as a proxy for his/her migration status (foreign- vs. native-born) – a feature which, in contrast to citizenship, remains unchanged over time – births to foreign-born mothers are, by definition, included in the native-born population (US Census Bureau 2014). This means that changes in the foreign-born population can result only from deaths and net migration among foreign-born individuals. In addition, it means that the changes in the foreign-born population also affect changes in the native-born population. Consequently, using data on population estimates by country of birth for computing the contributions of foreign- and native-born individuals to overall population change can be misleading. To understand these contributions, an analysis based on demographic events by migration status is needed.

In this study, we quantify in a systematic way how much migrants and natives contribute to overall population change and growth in Europe by breaking down the population by country of birth. In particular, we distinguish the contributions of the foreign-born population to overall population change attributable to births and deaths from those due to net migration. This approach allows us to highlight the indirect and direct effects of the foreign-born population. Furthermore, to investigate whether differences in the indirect effects of the foreign-born population across countries or in the contributions of migrants and natives derived from natural change can be attributed to differences in the levels and the timing of fertility, the levels of mortality, or the population age structure, we use a mixed standardisation and decomposition approach. This approach enables us to underline the relevance of three aspects of the population age structure for the abovementioned differences: namely, the age structure of women of reproductive age, the share of women of reproductive age in the total population, and the share of the elderly in the total population.

[3] It is worth noting, however, that migration's contribution to population change has been covered in demographic literature in terms of reproduction and replacement, particularly of the replacement-level fertility, the intergenerational replacement, and the replacement for birth cohorts (for example, Poveda and Ortega 2010; Ediev, Coleman, and Scherbov 2013; Wilson et al. 2013).

2. Terminology, data, and methods

In this study, we generally use the term 'migrants' and contrast these individuals with people we define as 'non-migrants.' However, since an individual's country of birth is used to identify his/her migration status, we also contrast individuals who are foreign-born with those who are native-born or are simply natives. Consequently, the terms 'migration' and 'international migration' refer only to the foreign-born population and its effects. Thus, these terms are used to refer to the effect of the foreign-born population on overall population change. This effect depends on the net migration of and the births and deaths among the foreign-born population. The former effect, which results from migration flows, is the direct effect, whereas the effect due to births and deaths is the indirect effect, which is mostly related to migration stocks.

The contribution of the foreign-born population attributable to the indirect effect might be estimated in two different ways. First, the difference between births and deaths among migrants is divided by the country's overall population; this ratio is usually expressed per 1,000 persons of the overall population. Alternatively, this effect might be estimated by multiplying the difference between the crude birth and crude death rates of migrants (usually per 1,000 persons of migrant population) by their share in the country's overall population; in this case, the contribution is directly expressed per 1,000 persons of the overall population. This means that we have to distinguish the indirect effect from the contribution due to the indirect effect. In this paper, the term 'indirect effect' expresses the effect due to births and deaths that is reflected in the difference between the two, and it is often presented in terms of the crude birth and death rates of the foreign-born population. It is worth noting that the indirect effect does not represent the 'natural change' of the foreign-born population since, as we mentioned above, when the country of birth is used as a proxy for migration status, the natural change in the foreign-born population depends only on deaths. For this reason, we also use the term the 'contribution' (e.g., of the foreign-born population to the overall level of population change attributable to natural change) to indicate the contribution that results from the indirect effect. Finally, we use the term 'overall' to refer to the country's level (e.g., the country's population); and we use the term 'total' to refer to the population of a specific group (i.e., of the foreign-born or native-born population).

We use several sets of data extracted from the Eurostat database to estimate the effect of the foreign-born population on overall population change, to compare this effect to that of the native-born population, and to provide quantified evidence regarding the importance of the direct and indirect effects of the foreign-born population. These data are also used to highlight the demographic factors behind the differences in the contributions to overall population change attributable to natural change between migrants and non-migrants, among migrants, and across countries. In particular, we use datasets that include information on (a) overall population change and the overall population components (Eurostat 2020a); (b) the population by sex, age, and country of birth (Eurostat 2020b); and (c) the demographic events broken down by sex, age, and country of birth, particularly live births (Eurostat 2020c),[4] deaths (Eurostat 2020d), immigration (Eurostat 2020e), and emigration (Eurostat 2020f).

Data quality is a central issue of migration, related in particular to whether or not there is a population register in the receiving countries. Migration is also presented in various forms, such as economic migrantion, family reunification, informal migration, refugees, asylum seekers, and seasonal migration. The literature devoted to the complexities and difficulties of migration data (e.g., Poulain, Perrin, and Singleton 2006; Raymer and Willekens 2008) suggests that poor migration data quality is less relevant for stocks than for flows, in particular when migration stocks are approximated on the basis of the country of birth than citizenship. Given the importance of migration issues for the EU, Eurostat has undertaken efforts over the last years for providing harmonised data on migration stocks. For the population, Eurostat's data refer to the usually resident population, which includes persons who have lived in their place of usual residence for a continuous period of at least 12 months before the reference time or persons who arrived in their place of usual residence during the 12 months before the reference time with the intention of staying there for at least one year (Eurostat 2021).

The analysis includes 31 European countries (the EU-27 member states, the United Kingdom, Iceland, Norway, and Switzerland). However, the low numbers of demographic events and the high percentages of missing information we found when combining the age group with the country of birth led us to include only 10 of the 31 countries in the part of the analysis on the indirect effect of migration (last part of Section 3.1) and on the factors behind the differences in the contributions to overall population change attributable to natural change between migrants and natives, among migrants, and across countries (Section 3.3). This is also the case for the analysis regarding births to foreign-born mothers, which can be seen as a component of changes in the native-born population (last part of Section 3.2). For the same reason, although the analysis is based on average figures estimated for the entire 2014–2019 period, different periods are considered for Germany (2018–2019), Ireland (2017–2019), Finland (2014–2016), and Switzerland (2018–2019).

[4] Births to the foreign-born population generally refer to foreign-born mothers giving birth, which means that if, for instance, a native-born male has a child with a foreign-born woman in the country of the male, this counts as a foreign-born offspring. In general, the number of births to the foreign-born population does not significantly differ when foreign-born mothers or fathers are taken into account. For example, the share of births to foreign-born fathers to the total number of births in France (INSEE 2021) and in the United Kingdom (ONS 2021) would have been higher by less than 1 percentage point as compared to the corresponding share to foreign-born mothers.

Based on data on demographic events by country of birth, we estimated the contributions of both population groups to overall population change by distinguishing the effect due to net migration from the effect attributable to births and deaths. Given that data on emigration by country of birth were available only for 19 of the 31 countries, we have chosen to proceed with estimations of the numbers of foreign-born and native-born emigrants for the 12 countries with missing information. To check the consistency of the data on population and population by country of birth, we compared the level of overall population change reported in the Eurostat data to that derived from data on population by country of birth. Then, we considered the real change in the foreign-born population and a fictitious change in the population that would have occurred if births to foreign-born mothers had been included in the real change in the foreign-born population. Finally, based on the fundamental equation of population change, we estimated the number of foreign-born emigrants as the residual of the fictitious population change, the number of deaths of foreign-born persons, and the number of foreign-born immigrants. The same procedure was applied to the native-born population, as we considered births only to native-born women. This approach allowed us to estimate for missing information and to adjust for provided information on emigration by country of birth.[5]

As we mentioned above, quantifying the indirect effect of the foreign-born population on overall population change is one of the main aims of this paper. Thus, we investigate several aspects of this effect, in particular the importance of this effect, the comparison of this effect with the direct effect, the differences between this effect and the effect attributable to the births and deaths of the native-born population of a single host country, and the differences in this effect among the foreign-born population and across countries.

In this analysis, we applied a simple mixed standardisation and decomposition method for investigating to what extent the differences in the crude birth and death rates and in the crude rate of natural change, either between migrants and natives or among migrants and across countries, are attributable to differences in fertility (timing and level) and mortality levels or in the population age structure. The latter is reflected in the differences in the age structure of women of reproductive age, the share of women of reproductive age in the total population, and the share of persons by age in the total population.

The most common standardisation method consists of estimating the expected variation in an indicator (e.g., the birth rates) between populations that would have resulted from the component under consideration (e.g., the level of fertility) if this

[5] Estimates for the 19 countries where data on emigration by country of birth were available were close to the provided figures. Differences between provided and estimated figures in emigration rate (i.e., the ratio of the number of emigrants to the average population for both natives and migrants) were close to zero; the level of diversity in emigration rates of the foreign-born population in Bulgaria – which is 3 percentage points – is an exception.

component had been equal between the two populations (Kitagawa 1955; Canudas Romo 2003). It can then be inferred that the difference between the real and expected variation in birth rates reflects the impact of that component on the difference in the birth rates between the two populations. A disadvantage of this approach is that it does not allow us to separate the impact of each component from the impact due to interactions between components. In practice, the interaction effects may be important when three or more components are taken into consideration and when the differences in these components are quite pronounced. In addition, the typical standardisation method is a two-stage procedure: It first estimates the expected variation and then the variation due to a specific component. To deal with these disadvantages, we use a mixed standardisation and decomposition approach that allows us to assess in a direct way how variation between populations or across countries in one component affects the differences in the examined indicator (Bagavos 2019; Giannantoni and Strozza 2015). It also allows taking into account the various interaction effects.

In order to proceed with our mixed standardisation and decomposition exercise, we first estimated five-year age-specific fertility and mortality rates. Then, we computed total fertility rates, the age pattern of fertility, and life tables for the foreign-born and the native-born population, respectively. We used Norway as the reference country for computing the differences between countries in the contribution of the foreign-born population to the country's population change. This choice is conducted by the fact that Norway exhibits the highest difference in the crude rate of natural change attributable to the foreign- and native-born populations and the highest level of crude rate of natural change attributable to migrants among countries under consideration.

Below, we present the formulas we used for the decomposition of the crude birth and death rate and the crude rate of natural change.

2.1 Decomposition of changes in the crude birth rate

The components of the crude birth rate (i.e., the ratio of the number of births to the average population) can be identified as follows:

$$\frac{B}{P} = \sum_x \frac{B_x}{P} = \sum_x \frac{f_x * W_x}{P} = \sum_x f_x * S_x^w \quad (1),$$

where B and P refer to births and population, respectively; B_x represents births by mother's age; f_x is the age-specific fertility rate at age x; W_x refers to women of reproductive age (15 to 49 years) at age x; $S_x^w = \frac{W_x}{P}$ is the share of women of reproductive age at age x in the total population; and x signifies the age of the individuals.

Changes (Δ) over time (i.e., between two years) in the crude birth rate can be decomposed as follows:

$$\Delta(\tfrac{B}{P}) = \sum_x \Delta\,(f_x * S_x^w) = \sum_x S_x^w * \Delta f_x + \sum_x f_x * \Delta S_x^w + \sum_x \Delta f_x * \Delta S_x^w \quad (2).$$

The first term ($S_x^w * \Delta f_x$) of Equation 2 represents the fertility effect (timing and level of fertility combined), the second term ($f_x * \Delta S_x^w$) represents the population age structure effect, and the third term ($\Delta f_x * \Delta S_x^w$) represents the interaction effect relative to fertility and population age structure.[6]

Note that in Equation 2, the rates and shares (weights) refer to the initial (reference) year, whereas their changes (Δ) refer to those that occur between the two years.

Given that

$$f_x = \frac{f_x}{TFR} * TFR = S^{f_x} * TFR \quad (3),$$

where $S^{f_x} = \frac{f_x}{TFR}$ is the share of fertility at age *x* compared to the average fertility (*TFR*), the fertility effect as presented in Equation 2 can be further decomposed as

$$\sum_x (S_x^w * \Delta f_x) = \sum_x S_x^w * \Delta(S^{f_x} * TFR)$$
$$= \sum_x [S_x^w * (TFR * \Delta S^{f_x}) + S_x^w * (S^{f_x} * \Delta TFR) + S_x^w * (\Delta S^{f_x} * \Delta TFR)] \quad (4).$$

The first term ($S_x^w * TFR * \Delta S^{f_x}$) of Equation 4 represents the fertility timing effect, the second term ($S_x^w * S^{f_x} * \Delta TFR$) represents the fertility level effect, and the third term ($S_x^w * \Delta S^{f_x} * \Delta TFR$) represents the interaction effect related to fertility timing and level.

In addition, given that

$$S_x^w = \frac{W_x}{P} = \frac{W_x}{W}\frac{W}{P} = S^{W_x} * S^W \quad (5),$$

where $S^{W_x} = \frac{W_x}{W}$ is the share of women of reproductive age at age *x* in the total number of women of reproductive age and $S^W = \frac{W}{P}$ is the share of women of reproductive age in the total population, the population age structure effect presented in Equation 2 can be further decomposed as

[6] It is worth noting that the size of the interaction effects depends on the amplitude of variations in the various components and on how long the time period is under consideration. Given that our analysis refers to a short period of time, the interaction effects are rather limited, accounting in general for less than 3% of the overall variations.

$$\sum_x (f_x * \Delta S_x^w) = \sum_x f_x * \Delta(S^{W_x} * S^W) =$$
$$= \sum_x [f_x * (S^W * \Delta S^{W_x}) + f_x * (S^{W_x} * \Delta S^W) + f_x * (\Delta S^W * \Delta S^{W_x})] \quad (6).$$

The first term $(f_x * S^W * \Delta S^{W_x})$ of Equation 6 represents the female population of reproductive age structure effect (e.g., a women's age structure effect), the second term $(f_x * S^{W_x} * \Delta S^W)$ represents the share of female population of reproductive age effect, (e.g., a women's share effect), and the third term $(f_x * \Delta S^W * \Delta S^{W_x})$ represents the interaction effect related to women's age structure and share.

2.2 Decomposition of changes in the crude death rate

The components of crude death rate (i.e., the ratio of the number of deaths to the average population) can be identified as follows:

$$\frac{D}{P} = \sum_x \frac{D_x}{P} = \sum_x \frac{m_x * P_x}{P} = \sum_x m_x * S_x \quad (7),$$

where *D* and *P* refer to deaths and population, respectively; D_x represents deaths by age; m_x is the age-specific mortality rates at age *x*; $S_x = \frac{P_x}{P}$ is the share of persons by age *x* in the total population; and *x* signifies the age of the individuals.

Changes (Δ) over time (i.e., between two years) in crude death rate can be decomposed as

$$\Delta(\frac{D}{P}) = \sum_x \Delta\, (m_x * S_x) = \sum_x S_x * \Delta m_x + \sum_x m_x * \Delta S_x + \sum_x \Delta m_x * \Delta S_x \quad (8).$$

The first term $(S_x * \Delta m_x)$ of Equation 8 represents the mortality effect, the second term $(m_x * \Delta S_x)$ represents the population age structure effect, and the third term $(\Delta m_x * \Delta S_x)$ represents the interaction effect relative to mortality and population age structure.

2.3 Decomposition of changes in the crude rate of natural change of population

Based on Equations 1 and 7, the components of the crude rate of natural change of the population (*N*) – that is, the ratio of the natural change (live births minus deaths) to the average population or equally the difference between the crude birth and death rate – can be identified as follows:

$$N = \frac{B}{P} - \frac{D}{P} = \sum_x f_x * S_x^w - \sum_x m_x * S_x \quad (9).$$

By taking into account Equations 2 and 8, changes (Δ) over time (i.e., between two years) in the crude rate of natural change of population can be decomposed (for more details see Appendix) as

$$\Delta N = \Delta\left(\frac{B}{P} - \frac{D}{P}\right) = \Delta\left(\frac{B}{P}\right) - \Delta\left(\frac{D}{P}\right) =$$
$$= \Sigma_x \left[(S_x^w * \Delta f_x) - (S_x * \Delta m_x) \right] + \Sigma_x \left[(f_x * \Delta S_x^w) - (m_x * \Delta S_x) \right] +$$
$$+ \sum_x \left[(\Delta f_x * \Delta S_x^w) - (\Delta m_x * \Delta S_x) \right] \quad (10).$$

In other words, changes (Δ) over time (i.e., between two years) in the crude rate of natural change of population rely on the first term $[(S_x^w * \Delta f_x) - (S_x * \Delta m_x)]$ of Equation 10, which represents the difference between the fertility and mortality effects; on the second term $[(f_x * \Delta S_x^w) - (m_x * \Delta S_x)]$, which refers to the difference between the population age structure effects related to crude birth and death rates; and on the third term $[(\Delta f_x * \Delta S_x^w) - (\Delta m_x * \Delta S_x)]$, which represents the difference between the interaction effects.

When the analysis comes to differences (i.e., crude births rates) between foreign- and native-born persons, the term Δ represents the difference in crude births rates between the foreign- and native-born populations – instead of the changes over time in crude birth rates of the same population – and the rates and shares refer to native-born population, which is the reference population. For instance, in the formula $S_x^w * \Delta f_x$ used for estimating the fertility effect (timing and level of fertility combined) on the difference in crude births rates between foreign- and native-born populations, the term Δf_x represents the difference in fertility between migrants and natives and S_x^w is the share of native-born women of reproductive age at age *x* in the total native-born population. It is also worth noting that differences in the crude rate of natural change express the differences in the natural change attributable to the foreign- and native-born populations and not the differences in the natural change of each population group.

2.4 Decomposition of the differences in the contribution due to the indirect effect of the foreign-born population across countries

Let *C* be the total contribution of the foreign-born population to the overall level of population change attributable to the indirect effect, which can also be called the overall indirect effect; *I* refers to the indirect effect expressed as the difference between the crude birth and death rates; and *S* refers to the share of the foreign-born population in the overall population.

Then, the total contribution (*C*) due to the indirect effect is the indirect effect (*I*) weighted by the share of the foreign-born population in the overall population (*S*):

$$C = I * S \tag{11}$$

Therefore, the difference in the contribution (ΔC) of migrants derived from the overall indirect effect between two countries is

$$\Delta C = \Delta(I * S) = (S * \Delta I) + (I * \Delta S) + (\Delta I * \Delta S) \tag{12}$$

The first term $(S * \Delta I)$ of Equation 12 represents the impact of the difference between countries in the indirect effect, the second term $(I * \Delta S)$ represents the impact of the difference in the share of the foreign-born population in the overall population in each country, and the third term $(\Delta I * \Delta S)$ represents the interaction between the difference in the indirect effect and in the share of the foreign-born population in the overall population of each country.

The term Δ represents the difference in the indirect effect or in the share of the foreign-born population between the selected and the country considered as a reference country, where I and S refer to the indirect effect and the share of the foreign-born, respectively, in the reference country.

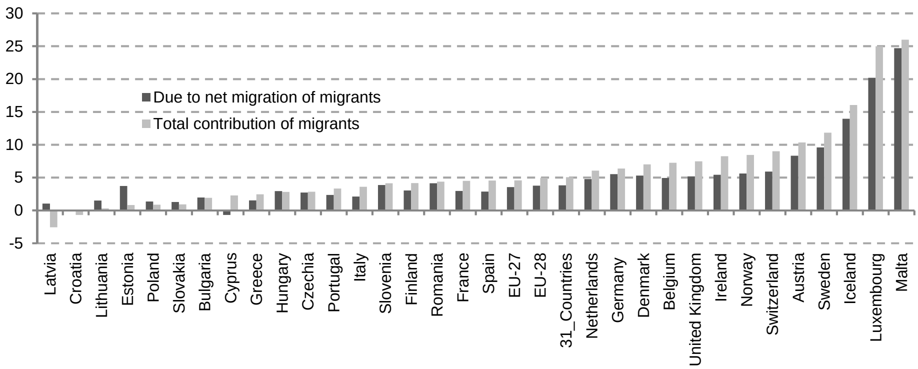
3. Results

3.1 The contribution of the foreign-born population to overall population change

We detected a certain number of common features in terms of the size and the components of the contribution of the foreign-born population to population change across the countries under consideration. In all these countries, with the notable exception of Latvia and, to a much lesser extent, Croatia, the foreign-born population contributed to overall population growth by increasing its size from a very low rate of 0.3 in Lithuania to an extremely high rate of 26 per 1,000 in Malta (Figure 1).

Apart from Malta, Luxembourg, and Iceland, the Western European and Nordic countries exhibited the highest levels of the foreign-born population effect on overall population growth, ranging from 4.1 (Finland) and 4.5 (France) to 11.8 (Sweden) and 10.3 (Austria). Although the most moderate effect occurred in Eastern European countries, in some countries, such as in Slovenia and Romania, the level of overall population growth attributable to the foreign-born population was more pronounced than it was in the majority of Southern European countries. Indeed, we found that despite the 2014 refugee crisis, the foreign-bon population did not seem to greatly affect the overall population in the South, unlike in other parts of Europe. However, we should keep in mind that including refugees in the international migration flows and stocks to fully approximate the corresponding demographic effect is a recent exercise that is still under evaluation (Eurostat 2017). On the whole, the foreign-born population would have increased the overall population of the 31 countries, or of the EU-28 or EU-27, by around 5 per 1,000 and per year over the second half of the 2010s.

Figure 1: The contribution of the foreign-born population to overall population change in Europe (annual average for the 2014–2019 period,* per thousand of the overall population)



Notes: *2018–2019 for Germany and Switzerland, 2017–2019 for Ireland, 2014–2015 for Finland. The difference between bars is due to natural change attributable to migrants.
Source: Own calculations based on data provided by Eurostat (2020a–2020f).

As expected, the results displayed in Figure 1 indicate that the contribution of the foreign-born population to overall population change in Europe mainly reflected the corresponding effect of foreign-born net migration (the direct effect of the foreign-born population). It is evident that within the foreign-born population, inward migration exceeded outward migration from the receiving countries, although the level of negative net migration in Cyprus and Croatia seems to be of limited importance. In reality, the highest levels of foreign-born net migration were accompanied by the highest levels of overall population change attributable to the foreign-born population.

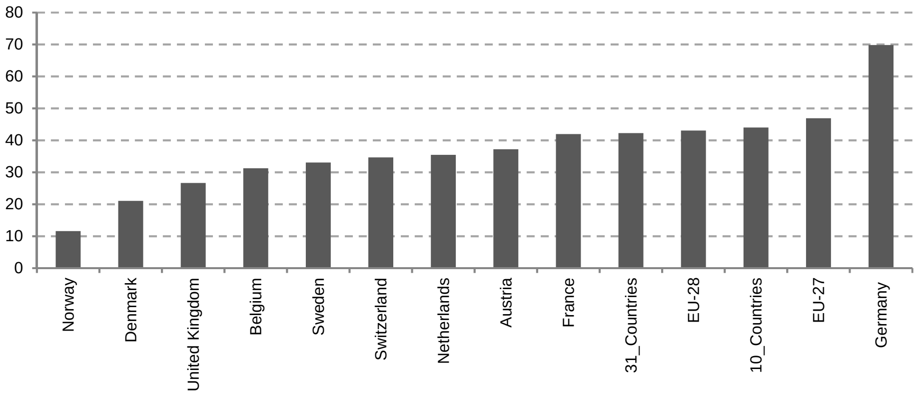
However, the contribution of the foreign-born population to overall population change that resulted from the difference between the births and deaths of foreign-born persons – the so-called indirect effect of international migration – merits further attention. Surprisingly enough, there were countries – in particular, the Eastern European countries – where the number of deaths among migrants exceeded (or was very close to) the number of births among migrants, which implies that the impact of the indirect effect of the foreign-born population on population change was negative (or was very limited) (Figure 1). This effect should probably be attributed to the definition of foreign-born; in the case of Eastern European countries, many of those who are classified as foreign-born are – and always were – nationals of a given country but weren't born within the borders established after World War II. Since this affects a specific portion of the population, in particular those in the highest age categories, the age distributions and hence the number of deaths and the crude death rates are likely to be affected systematically. For the remaining countries, the indirect effect varied from 1 per 1,000 in Germany, Greece, and Portugal – a figure that was very close to the figure observed in the 31 countries as a whole – to around 5 per 1,000 in Luxembourg.

Obviously, countries under consideration differ in terms of their experiences as receiving countries; countries such as Switzerland, the United Kingdom, France, Belgium, the Netherlands, Germany, and Austria are examples of long-standing destination countries with many settled migrants; Italy, Greece, and Spain are considered examples of new host countries with many recent migrants; Norway, Sweden, and Finland can be seen as examples of countries that experience significant levels of humanitarian migration; and Eastern European countries, as it has been already mentioned, are countries where foreign-born people weren't born within the borders established after World War II. This implies differences not only in terms of the stocks of migrants but also in terms of their age structure, which in turn affects crude birth and death rates and the crude rate of natural change.

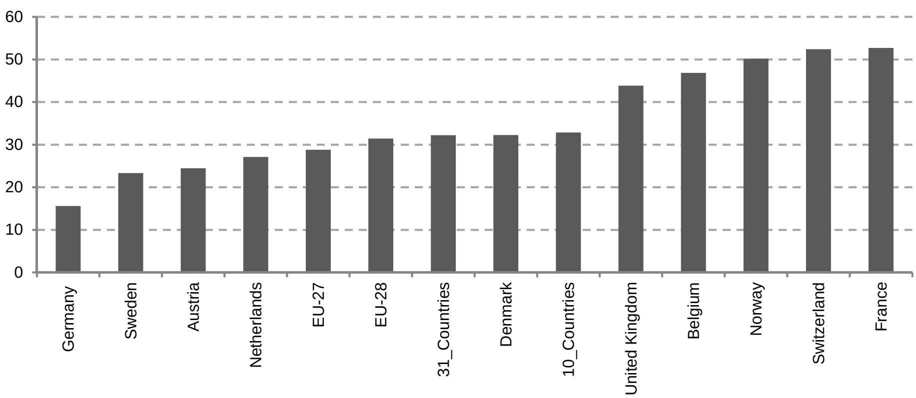
Given that the indirect effect of international migration – which mainly refers to migration stocks – was subsequent to migration flows, the contribution of migrants to overall population change derived from their births and deaths might have been connected to the corresponding effect that resulted from the foreign-born net migration. Nevertheless, this relationship did not always hold since it depended on the fertility, mortality, and age structure of the foreign-born population. For instance, despite the fact that Germany, a long-standing receiving country, was among the top eight countries in terms of the contribution of foreign net migration to overall population change, the indirect migration effect was quite limited. To better approximate the differences between countries in terms of the contributions of migrants to overall population change derived from their vital events, we simply compared the number of births to the number of deaths by considering only our 10 countries and country groups under study (Figure 2a). The simple ratio plotted in Figure 2a also reflects the ratio of births to deaths among migrants and the ratio of the contribution to overall population change attributable to births among migrants to those attributable to deaths among migrants. We note that there were large differences between countries as regards the magnitude of the excess of births over deaths among the foreign-born population: For example, in Norway, the number of deaths to 100 births among migrants was around 12, whereas the corresponding figure for Germany was 70.

Figure 2: Indicators related to the contribution of the foreign-born population to overall population change through births and deaths (annual average for the 2014–2019 period*)

a. Number of deaths per 100 births within the foreign-born population



b. Ratio** of the natural change to net migration within the foreign-born population (per 100 net migrants)



Notes: *2018–2019 for Germany and Switzerland. **The ratio expresses how many persons are added to the population of the receiving country through births and deaths to the foreign-born population for every 100 net migrants born abroad.
Source: Own calculations based on data provided by Eurostat (2020a–2020f).

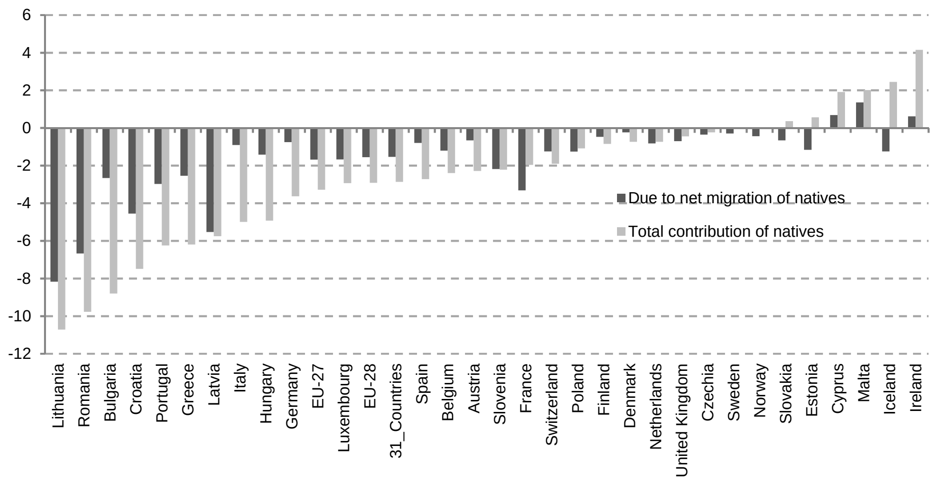
As well as its amplitude, there is an additional issue regarding the importance of the indirect effect compared to that of the net migration. To better highlight this issue, we present for the population born abroad the ratio of the difference between births and deaths to net migration (Figure 2b). This ratio reflects how many individuals were added to the population of the receiving country due to births and deaths among the foreign-born population for 100 net migrants born abroad. In reality, it was the indirect effect of migration not in relation to the total foreign-born migration effect but to the net foreign-born migration effect. We observe pronounced differences among countries, with the figures varying from 16 to 53. This also means that the indirect effect of the foreign-born population varied between 13% and 35% of the total effect of the foreign-born population on overall population change. For the 31 countries as a whole, the excess of births over deaths implies that there were 32 persons added to the overall population for every 100 net foreign-born migrants, or 24% of the total migration effect.

3.2 Comparing the contributions of native- and foreign-born populations to overall population change

Up to now, we have provided evidence on the contributions of the foreign-born population to overall population change in European host countries. However, the relevance of the foreign-born population for overall population change was also connected to the corresponding contribution of the native-born population, and more broadly, to the demographic situation in the receiving countries. Obviously, the persistent low fertility and the acceleration of population ageing in European countries has made international migration a core component of overall population change.

Figure 3 displays the contributions of the native-born population to overall population change in Europe. We note that in the large majority of cases, this contribution had a negative sign or was close to zero. There were only four countries – Cyprus, Malta, Iceland, and Ireland – where the overall population would have increased only due to the contributions of the native-born population. The negative net migration of native-born individuals was the main factor underlying the contributions that were very low or that had a negative sign. In addition, the excess in the number of deaths over the number of births that occurred in a large number of countries amplified the overall population decline. Indeed, for the 31 countries as a whole, the contribution of the native-born population to overall population change was situated at –2.9 per 1,000 as a result of negative net migration (–1.5 per 1,000) and an excess of deaths over births (–1.4 per 1,000). We note that without migration, the expected overall population decline would have been particularly pronounced in Eastern and Southern European countries.

Figure 3: The contribution of the native-born population to overall population change in Europe (annual average for the 2014–2019 period,* per thousand of the overall population)

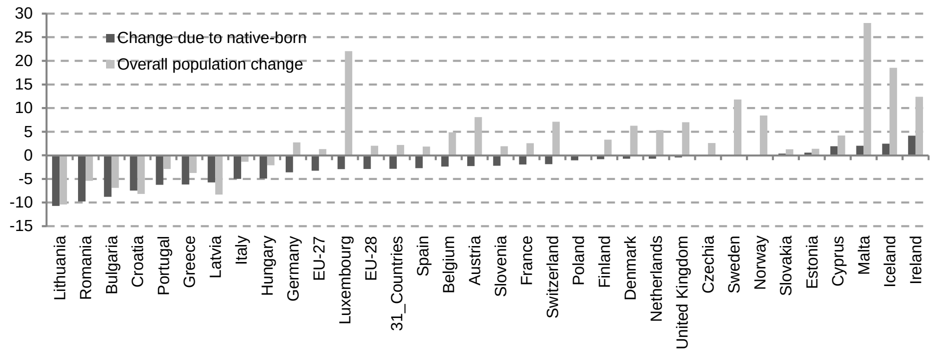


Notes: *2018–2019 for Germany and Switzerland, 2017–2019 for Ireland, 2014–2015 for Finland. The difference between bars is due to natural change attributable to natives.
Source: Own calculations based on data provided by Eurostat (2020a–2020f).

Obviously, the contribution to overall population change attributable to the native-born population largely contrasted with that of the foreign-born population. Given the pattern of the contribution of the native-born population to overall population change in Europe, we note that the foreign-born population has either attenuated overall population decline in Eastern and Southern European countries or has accelerated population growth in a limited number of countries, such as Cyprus, Ireland, Iceland, and Malta (Figure 4a). However, in what might be its most telling effect, the foreign-born population has turned the expected population decline into population growth in Western European and Nordic countries. On the whole, the foreign-born population has undoubtedly been the driving force behind overall population change and growth in Europe.

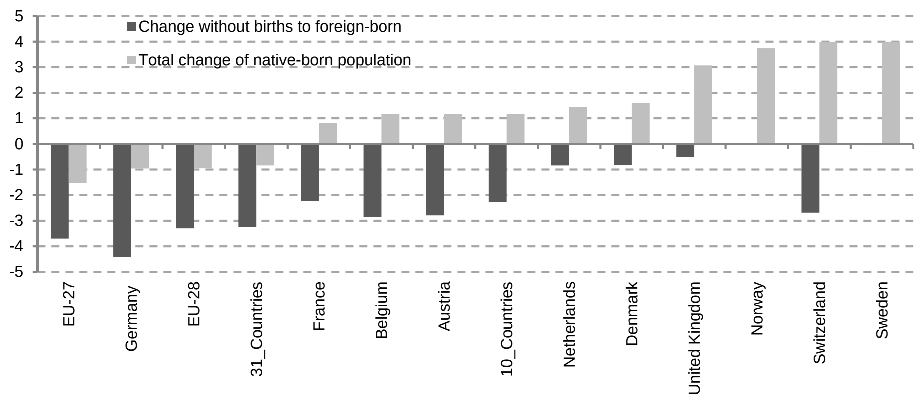
Figure 4: The contribution of the foreign-born population to overall and native-born population change in Europe (annual average for the 2014–2019 period*)

a. The contribution to overall population change (per thousand of the overall population)



Note: The difference between bars reflects the change due to foreign-born.

b. The contribution to the native-born population change through the number of births (per thousand of the native-born population)



Notes: The difference between bars reflects the change due to births to the foreign-born population. *2018–2019 for Germany and Switzerland, 2017–2019 for Ireland, 2014–2015 for Finland.
Source: Own calculations based on data provided by Eurostat (2020a–2020f).

A final aspect concerning births to foreign-born mothers merits further attention. Although this aspect has mainly been examined in the context of the reproductive behaviour and the socioeconomic integration in the host countries of second-generation migrants, it can also be seen as a component of changes in the native-born population. In other words, the shifts in the native-born population change in Europe would likely have been different without the births to foreign-born mothers. In Figure 4b, we compare the real changes in the native-born population to those that would have been occurred without births to migrant women in our selected Western European and Nordic countries, where, except for Germany, the native-born population grew over the 2014–2019 period. We observe that the recent increases in the size of the native-born population in these countries were attributable to births to foreign-born women or to second-generation migrants. In particular, without births to migrants, the native-born population would have decreased from a minimum of –0.5 per 1,000 in the United Kingdom to a maximum of –3 per 1,000 in Belgium and Austria or remained stable in Norway and Sweden. By contrast, due to births to women born abroad, the native-born population grew at a rate ranging from 0.8 per 1,000 in France to 4 per 1,000 in Switzerland and Sweden. We also note that in Germany and in the 31 countries as a whole, decline in the size of the native-born population has been largely attenuated by births to migrants.

3.3 Contribution to overall population change: the role of differentials

3.3.1 Demographic factors behind the differences in the birth, death, and natural change rates attributable to the foreign-born and the native-born populations

To better analyse the importance of demographic factors for differentials in birth and death rates and, therefore, in the natural change attributable to each population, we first present some relevant fertility, mortality, and population age structure indicators for both populations and for our 10 countries and country groups under study. The results displayed in Table 1 confirm the findings of previous studies (e.g., Bagavos 2019; Sobotka 2008), which show that the fertility of migrants is often higher than that of non-migrants but there is considerable variation in the excess fertility across countries. We note that in terms of the TFR among the countries under study, the excess fertility varied from zero – it was even slightly negative in Denmark – to 1.3 (in France), and it was mostly situated between 0.3 and 0.5. As regards findings on mortality, they are in line with the so-called migration paradox, which implies that migrants have lower mortality levels than non-migrants (e.g., Aldridge et al. 2018).

Table 1: Fertility, mortality, and population age structure indicators by country of birth in selected European countries (annual average for the 2014–2019 period*)

	Fertility indicators				Mortality indicators		Population age structure indicators						
	TFRs		Mean age at childbearing		Life expectancy at birth		Mean age of women of reproductive age		Share of women of reproductive age in total population		Share of persons aged 60 or over in total population		Share in the overall population
	Foreign-born	Native-born	Foreign-born	Native-born	Foreign-born	Native-born	Foreign-born	Native-born	Foreign-born	Native-born	Foreign-born	Native-born	Foreign-born
Belgium	2.2	1.5	33.9	32.3	82.0	81.2	29.7	29.9	30	21	19	25	16
Denmark	1.7	1.8	33.0	32.2	82.1	80.8	30.7	30.4	34	21	13	26	11
Germany	2.3	1.4	35.3	32.2	82.0	80.7	28.3	31.1	25	19	27	28	18
France	3.1	1.8	34.6	32.3	82.5	82.7	29.4	29.9	25	21	30	25	12
Netherlands	1.7	1.6	34.4	32.2	81.9	81.7	30.3	30.8	31	21	18	25	12
Austria	1.9	1.4	34.2	32.7	81.8	81.6	28.8	30.4	31	21	19	26	18
Sweden	2.2	1.8	33.7	32.0	82.8	82.3	29.5	30.7	29	20	20	27	17
United Kingdom	2.0	1.7	33.5	32.2	81.6	81.1	30.0	29.8	34	21	15	25	14
Norway	1.9	1.6	33.4	32.1	84.5	82.3	30.0	30.3	33	21	9	24	15
Switzerland	1.8	1.4	35.3	31.9	85.0	83.5	30.3	32.0	29	20	20	26	29
10_Countries	2.2	1.6	34.4	32.2	82.3	81.5	29.4	30.3	28	20	23	26	15
31_Countries	2.0	1.5	34.5	32.8	82.2	80.7	29.3	30.2	29	21	21	26	12
EU-28	2.1	1.5	34.5	32.8	82.1	80.7	29.2	30.2	29	21	21	26	12
EU-27	2.1	1.5	34.7	32.9	82.2	80.6	29.1	30.3	29	21	22	26	11

Note: *2018–2019 for Germany and Switzerland.
Source: Own calculations based on data provided by Eurostat (2020a–2020f).

It is well-known that population ageing tends to be lower among migrants than among non-migrants. Indeed, in the majority of the countries we studied – with the notable exception of France and, to a lesser extent, Germany – the percentage of the population aged 60 years or older was lower among migrants than among non-migrants (Table 1). In addition, given that, in general, relatively low population ageing is coupled with a relatively high share of women of reproductive age in the total population, the difference in the latter between migrants and non-migrants was found to be rather pronounced. In the countries under consideration, this difference varied from 3 to 13 percentage points (Table 1). There are two other aspects we addressed in our analysis. The first aspect concerns the age structure of the female population of reproductive age. This issue should be considered in conjunction with the second aspect, which is the timing of fertility. Thus, migrant women of reproductive age exhibited a later timing of fertility, which is reflected in higher mean age at childbearing than non-migrant women (Table 1). This pattern was generally coupled with a relatively younger age structure of foreign-born women of reproductive age among migrants than among non-migrants. Therefore, there were larger differences between the mean age of women of reproductive age and the mean age of women at childbearing among migrants than among natives. The importance of these aspects for the differentials in crude birth rates, and, therefore, in the contributions of each population group to the crude rates of natural change, will be further addressed below.

The findings plotted in Table 2 (columns 13 and 14) allow us to detect a quite common – and, to a great extent, expected – feature of the differences in the birth and death rates of the foreign-born and the native-born populations.[7] At the country level, migrants had higher crude birth rates and lower crude death rates and, therefore, higher crude rates attributable to natural change. For instance, in Belgium, the crude birth rate of migrants exceeded that of natives by 117 (per 10,000 migrants), whereas the corresponding figure for the crude death rate was –38, which means that the difference in the level of natural change due to each population was on the order of 155. The results of the decomposition analysis highlight the role of each of the various components that contributed to this diversity; indeed, despite the differentials in fertility and mortality, the differences in the natural change attributable to both populations were driven by the diversity in the population age structure (Table 2, columns 10 and 11). For example, in Belgium, a country where migrants had much higher fertility than natives, of the entire difference of 155, 44 were attributable to the diversity in fertility and mortality, 92 were linked to the differentials in the age structure, and 19 resulted from the interaction

[7] Results presented at Table 2 are based on our analysis considering the native-born population as the reference population. It is worth noting that the use of the foreign-born population as a reference population does not modify our findings (see Appendix Table A-1) in a sense that differences in crude birth and death rates as well as in the crude rate of natural change attributable to each population group are mainly due to the differences in population age structure than in demographic phenomena (fertility and mortality).

between the two factors. Of course, these findings might be expected given that by definition, birth and death rates are heavily affected by the age structure of a population. However, among the outcomes that were less expected were the magnitude of the population age structure effect; the multifaceted character of this effect; and the country's specific features, which led it to diverge from the common pattern in which the population age structure is a key component of variations in the birth and death rates between migrants and non-migrants.

Table 2: Demographic factors behind the differences in crude rates of natural change attributable to the foreign- and native-born populations in selected European countries (annual average for the 2014–2019 period,* per 10,000 population, native-born population considered as a reference population)

	Differences attributable to diversities in:								
	Crude birth rates						Crude death rates		
	Fertility			Population age structure					
	Timing	Level	Total	Age structure of women of reproductive age	Share of women of reproductive age	Total	Mortality level	Population age structure	Total
	(1)	(2)	(3) = (1) + (2) + inter.	(4)	(5)	(6) = (4) + (5) + inter.	(7)	(8)	(9) = (7) + (8)
Belgium	0	41	41	14	38	58	–3	–34	–37
Denmark	1	–3	–2	31	60	110	–9	–55	–64
Germany	0	48	47	10	24	37	–8	4	–3
France	0	80	80	9	16	26	1	5	6
Netherlands	1	3	4	17	45	70	–2	–32	–34
Austria	0	31	31	14	36	57	2	–35	–32
Sweden	2	24	26	16	41	64	–4	–32	–36
United Kingdom	0	19	19	21	61	95	0	–34	–34
Norway	1	17	19	28	52	95	–14	–57	–71
Switzerland	1	25	27	17	34	58	–9	–25	–34
10_Countries	0	35	35	14	36	55	–3	–12	–16
31 Countries	–1	32	31	11	35	50	–8	–21	–30
EU-28	–1	32	31	11	34	49	–8	–20	–28
EU-27	–1	34	33	9	30	42	–9	–18	–27

Table 2: (Continued)

	Differences attributable to diversities in:				
	Crude rates of natural change attributable to each population				
	Fertility and mortality	Age structure	Total	Birth rates	Death rates
	(10) = (3) – (7)	(11) = (6) – (8)	(12) = (10) + (11) + inter.	(13) = (3) + (6) + inter	(14) = (9) + inter
Belgium	44	92	155	117	–38
Denmark	7	165	157	98	–59
Germany	55	33	83	79	–4
France	79	22	113	118	5
Netherlands	6	103	103	69	–34
Austria	29	91	131	96	–35
Sweden	30	96	125	90	–35
United Kingdom	19	129	164	129	–35
Norway	33	152	183	121	–63
Switzerland	36	83	116	84	–32
10_Countries	39	67	115	99	–16
31_Countries	39	71	118	89	–29
EU-28	39	70	117	89	–28
EU-27	42	60	109	82	–26

Note: *2018–2019 for Germany and Switzerland.
Source: Own calculations based on data provided by Eurostat (2020a–2020f).

Thus in Table 2, columns 10 and 11, we show that with the notable exception of France and Germany, the population age structure effect accounted for the largest part of the difference in natural change attributable to each population group (between 60% and 95% of the total variation). In addition, this effect (in absolute terms) was mainly attributable to the population age structure effect affecting crude birth rates – that is, the age structure of women of reproductive age and the share of women of reproductive age in the total population (Table 2, column 6) – rather than to the age structure of the total population (Table 2, column 8), which affected the crude deaths rates. We also note that variations in fertility were more relevant than variations in mortality (Table 2, columns 3 and 7, respectively) for the differences in terms of crude rates of natural change due to each population. Obviously, these findings, and particularly those related to the role of the population age structure, underlie the observation that the differences between the two population groups were more pronounced in terms of birth rates than of death rates.

The results also highlight the importance of the differences in the age structure of women of reproductive age, reflected in the lower mean age of migrant than native women of reproductive age population, for the difference in crude births rates (Table 2, column 4). We observe that the effect of this diversity was lower than the effect attributable to the shares of women of reproductive age. We also note that the later fertility timing of foreign-born women relative to that of native-born women had limited impact on the differences in crude births rates (Table 2, column 1).

3.3.2 Demographic factors behind the differences in the indirect effect of the foreign-born population across countries

The population age structure effect was also the driving force of the differences in the indirect effect of the foreign-born population across the various countries (Table 3, columns 10 and 11). For instance, when Belgium is compared to Norway, we note that the lower (by –48 per 10,000) indirect effect of migration in the former compared to the latter was mainly due to the diversity in the population age structure of migrants residing in the two countries, which represented a difference of –62 per 10,000, rather than to the lower fertility of the foreign-born population in Norway than in Belgium (the corresponding effect is 24). In practice, even in the cases of countries such as Belgium, France, Germany, and Sweden, where fertility and mortality combined would have led to higher crude rates of natural change attributable to the foreign-born population than those in Norway, the population age structure effect led to a largely higher indirect effect of migration in Norway than in the former countries.

In terms of demographic phenomena, our findings indicate that in line with the results observed for the comparison between migrants and non-migrants, the diversity across countries in the indirect effect of the foreign-born population was more attributable to fertility than mortality differentials (Table 3, columns 3 and 7). However, we found no strong evidence that the population age structure effect related to crude birth rates had a greater importance than that related to crude death rates. In line with the findings regarding the differences between population groups, the effect due to the variations in the age structure of the female population of reproductive age was much lower than the effect attributable to the differentials in the share of women of reproductive age in the total population (Table 3, columns 4 and 5, respectively). In terms of the role of the timing of fertility, we found no clear-cut evidence of a corresponding effect on country differentials in the level of natural change attributable to the foreign-born population.

Table 3: Demographic factors behind the differences in the indirect effect of the foreign-born population in selected European countries (annual average for the 2014–2019 period,* per 10,000 population, Norway considered as a reference country)

	Differences attributable to diversities in:								
	Crude birth rates						Crude death rates		
	Fertility			Population age structure					
	Timing	Level	Total	Age structure of women of reproductive age	Share of women of reproductive age	Total	Mortality level	Population age structure	Total
	(1)	(2)	(3) = (1) + (2) + inter.	(4)	(5)	(6) = (4) + (5) + inter.	(7)	(8)	(9) = (7) + (8)
Belgium	–4	35	30	–13	–23	–34	6	28	34
Denmark	5	–25	–21	–1	5	4	7	8	14
Germany	–15	40	22	–19	–51	–65	6	67	73
France	–7	130	119	–24	–53	–71	6	61	66
Netherlands	2	–25	–23	–19	–13	–31	6	22	28
Austria	–10	0	–11	–12	–16	–27	7	27	34
Sweden	–6	28	21	–13	–29	–40	4	30	34
United Kingdom	–3	11	7	2	5	7	7	23	30
Switzerland	1	–8	–8	–21	–28	–46	–2	36	34

	Differences attributable to diversities in:				
	Crude rates of natural change attributable to foreign-born population of each country				
	Fertility and mortality	Age structure	Total	Birth rates	Death rates
	(10) = (3) – (7)	(11) = (6) – (8)	(12) = (10) + (11) + inter.	(13) = (3) + (6) + inter	(14) = (9) + inter
Belgium	24	–62	–48	–8	39
Denmark	–27	–4	–37	–22	16
Germany	16	–132	–140	–53	87
France	113	–132	–60	9	68
Netherlands	–29	–53	–84	–52	33
Austria	–17	–55	–77	–36	41
Sweden	18	–70	–61	–22	38
United Kingdom	0	–16	–21	15	36
Switzerland	–6	–81	–82	–50	32

Note: *2018–2019 for Germany and Switzerland.
Source: Own calculations based on data provided by Eurostat (2020a-2020f).

3.3.3 Decomposing the factors behind the differences in the contribution of the foreign-born population to overall population change due to the indirect effect

Having identified the factors that drove the variation in the indirect effect of the foreign-born population across countries, there is a last point that merits attention: namely, the differences in the contribution of the foreign-born population to overall population change due to the indirect effect. As was already mentioned, this contribution depended on the magnitude of the indirect effect and the share of migrants in the total population of the host country, which means that the differences in the contribution relied on the difference in the latter two aspects across countries.

The findings of the mixed decomposition and standardisation analysis plotted in Table 4 indicate that, with the exception of the comparison between Norway and Switzerland, where the share of foreign-born in the overall population is of the highest level, the diversity in the contributions of the foreign-born population to overall population change due to the indirect effect of migration was driven by differences in the magnitude of the indirect effect. Indeed, the differentials in the shares of migrants in the countries' populations were of limited importance in terms of the variation in the contribution due to the indirect effect of the foreign-born population across countries.

Table 4: Differences in the contribution of the foreign-born population to overall population change across selected European countries (annual average for the 2014–2019 period,* per 10,000 population, Norway considered as a reference country)

	Differences in the contribution attributable to diversities in the:				
	Indirect effect	Share of foreign-born in the overall population	Interactions	Total contribution due to the indirect effect	Contribution due to net migration
Belgium	–7	3	–1	–5	–7
Denmark	–6	–7	1	–11	–3
Germany	–21	5	–4	–20	–1
France	–9	–5	2	–13	–27
Netherlands	–13	–5	2	–15	–9
Austria	–12	6	–3	–8	27
Sweden	–9	5	–2	–6	40
United Kingdom	–3	–3	0	–5	–4
Switzerland	–12	27	–12	3	3

Note: *2018–2019 for Germany and Switzerland.
Source: Own calculations based on data provided by Eurostat (2020a–2020f).

The latter observation calls for an additional remark. Although at the country level the effect of migration on overall population change relied more on the net migration of migrants than the natural change attributable to migrants, the latter gained in importance when the effect of migration was seen in terms of differentials across countries. As we show in the last column of Table 4, in almost half of the countries under study, the differences in the contribution of the foreign-born population to the overall population were mainly attributable to the diversity in the indirect effect – practically, to the diversity in the age structure – rather than to the differentials in net migration.

Findings plotted in Tables 3 and 4 allow for some comments as regards the role of migration stocks and flows for the contribution of the foreign-born population to the overall population change. For example, let's compare Norway, a country with relatively short experience a as host country, to Switzerland, a country with a long experience as a receiving country. Obviously, migration stocks are larger in numbers in the latter than in former; the share of the foreign-born population in country's population was 29% in Switzerland and 15% in Norway. This implies a stronger population ageing for migrants residing in Switzerland than Norway; indeed, the mean age of the foreign-born population and the share of persons aged 60 year or over within migrants were around 44 years and 20% respectively in Switzerland whereas in Norway they were 37 years and 9%. This diversity in population ageing is reflected in a pronounced difference in crude death rates of migrants (5.6 per 1,000 in Switzerland and 2.5 per 1,000 in Norway). By contrast, the younger age structure of migrants in Norway as compared to Switzerland, mainly reflected in relatively high shares of women of reproductive age (33% vs. 29%) implies higher crude birth rates in the former than in the latter (21.3 vs. 16.3 per 1,000). Given that fertility and mortality of migrants were of similar levels in the two countries (a TFR of 1.8 to 1.9 and a life expectancy at birth of 84.5 to 85.0), difference in crude birth and death rates, and therefore in the corresponding crude rate of natural change, are due – and this is in line with the results displayed at Table 3 (last line) – to diversities in the population age structure, mainly resulted from diversities in migration stocks than flows.

However, difference in crude rate of natural change attributable to migrants is one of the two factors behind the differences in the contribution of the foreign-born population to the overall population change; the second one is the share of that population in the country's population. In our example the difference in crude rate of natural change is of the order of –8.2 per 1,000 or –82 per 10.000 (Table 3, column 12). Nevertheless, this difference is counterbalanced by the diversity – which is of the order of 14 percentage points – in terms of the share of the foreign-born population in each country; and this implies a rather similar total contribution due to the indirect effect of migration to the overall population change in the two countries.

Last, the role of migration flows is clearly reflected in the great diversity in the contribution due to net migration between Norway and Austria or Sweden (last column of Table 4), two host countries for the recent refugee flows.

4. Conclusions and discussion

There can be no doubt that in a context of accelerating population ageing and low fertility, international migration has become the main component of overall population change over time in Europe. The results of our analysis suggest that especially for the most recent period, the foreign-born population has driven the shifts in the overall populations of the European host countries, albeit with varying patterns. Specifically, we found that the foreign-born population attenuated trends in population decline in Eastern and Southern European countries; it accelerated population growth in a very limited number of countries; and, more significantly, it turned expected population decline into population growth in Western European and Nordic countries. On the whole, the foreign-born population is undoubtedly the driving force behind overall population change and growth in Europe, and this effect is mostly attributable to net migration (direct effect) rather than to natural change (indirect effect) due to migrants.

Although it was not within the main scope of the paper, the analysis highlighted some inherent demographic features of the migrant population that are of particular importance for estimating the magnitude of the effect of the foreign-born population on overall population change in the host countries. These features are also relevant for differentiating between the foreign-born and native-born populations at the country level, and among the foreign-born population and across countries, in terms of their contributions to the shifts in the overall population size. In purely demographic terms, the foreign-born population is not, in practice, a typical population, mainly because the population changes that occur over time in this population result only from net migration and deaths, and not from births. Thus, when migration flows occur, the close connection between net migration and the change in the foreign-born population of a country implies that there are steady differences in the age structure of migrants and of natives or of migrants residing in another country. Those differences are usually reflected in differentials in the age pattern of women of reproductive age, the share of women of reproductive age, and the share of the elderly in the total population of each group. Inevitably, this implies that there are differences in the crude birth and death rates, and, therefore, that there are differences in terms of the contribution to overall population change attributable to the corresponding crude rate of natural change. The results of our analysis suggest that in addition to the contrast between the positive and negative net migration of the foreign-born and native-born populations, respectively, the differences in the contributions of the two population groups to shifts in the overall population were attributable to the differences in the population age structure, while the differences in fertility and mortality were less important. This also held true when migrants were compared across countries. Moreover, the differences between countries in the contribution of the foreign-born population to overall population change were often driven by the diversity in the age structure of the foreign-born population, rather than by varying patterns relative to the net migration of the foreign-born population.

In addition, the close relationship between migration flows and the foreign-born population affected the period fertility outcomes of foreign-born women. Given the selectivity of the migrants' age pattern, it is likely that the period fertility of the migrant women depended more on the duration since migration, the age at arrival in the host country, and the ethnic composition of the migrants than on the ages of the women (Lübke 2015; Robards and Berrington 2016; Tønnessen 2020; Toulemon 2004; Toulemon and Mazuy 2004). This probably means that net migration led to migrants having higher fertility than native women, native-born women having a younger age pattern than foreign-born women of reproductive age, and the latter having a later fertility timing than the former. It also implies that the differences between the mean age of women of reproductive age and the mean age at childbearing were greater among migrants than among natives. These observations likely help to explain the apparent contradiction between the excess fertility of migrants relative to that of natives in a period perspective and the limited diversity in fertility in a cohort perspective (Burkimsher, Rossier, and Wanner al. 2018; Wilson 2020), as well as our finding that the later fertility timing of migrants led to a lower contribution to overall population change than would have occurred if they had an early timing of fertility that was similar to that of natives.

What the future developments will be and the extent to which our results reflect temporary or long-lasting effects of the foreign-born population on population change in Europe are relevant questions. It is true that the recent period has been characterised by pronounced migration flows that resulted from the refugee crisis, and also from intra-European migration flows that were related to a great extent to the economic crisis of the 2010s. As these conditions are not expected to prevail in the near future, the effect of the foreign-born population per se on the population change attributable to net migration is expected to be of less importance. At the same time, a slowdown of migration flows will be coupled with the ageing of the age structure of the foreign-born population, which will mainly be reflected in reduced shares of women of reproductive age and increasing shares of the elderly in the total population and will lead to decreasing trends in the (positive) indirect effect of migration. However, the foreign-born population as a component of overall population change and growth will continue to play a major role in the future because of the projected low and probably negative contributions of natives to shifts in the overall size of the population in their respective countries that will result from negative net migration schemes, and the restricted or even negative natural change attributable to them. In practice, even if there is some recovery of low fertility levels and further decreases in mortality, the ageing of the native population resulting mainly from the ageing of the baby boom generations will likely lead to limited or even negative natural change. Therefore, the foreign-born population is expected to be the main and most likely only source for preventing future population decline.

Our paper has touched on some topics that were not analysed but that might be of interest for future research. First, given the decisive contribution of the foreign-born population to overall population change and to the overall number of births in particular, the question of the role of second-generation migrants merits further attention as these migrants are likely to have an impact on the shifts in the overall size and composition of the native-born and overall population. Second, the ethnic dimension might be further analysed. For EU countries in particular, the distinction between EU-born migrants and those born in third countries might shed light on the effect of the intra-European mobility on population developments in each country. Third, it is quite evident that the conventional tools are not fully appropriate for investigating the various demographic aspects of non-typical populations, such as the foreign-born population. Therefore, research on the inherent characteristics of that population could substantially improve the existing tools of demographic analysis.

This study has a number of strengths. It quantifies the contributions of the foreign-born and native-born populations to changes over time in the overall population size of European receiving countries, an aspect that has rarely been investigated in a systematic way. It also provides a simple method for examining the various aspects of the indirect effect of migration. The added value of the methodological aspects of the study relies on the fact that the proposed method allows us to decompose the demographic factors underlying the changes over time in the natural change rates between populations and across countries. This study also has some weaknesses, which are mainly related to the lack of data. Although the period under consideration covered the recent refugee crisis, the analysis for some countries referred to a shorter period and often to the most recent years (i.e., after the refugee crisis). Thus, for a limited number of countries, the effects of the foreign-born population related to the refugee crisis were not fully reflected in the obtained results. In addition, our analysis on the differences across countries in the indirect effect of the foreign-born population did not cover all the countries under study. In practice, the indirect effect was analysed only in contexts where the foreign-born population turned the expected overall population decline into population growth, and not in contexts in which it attenuated population decline.

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Appendix

Decomposition of changes (Δ) over time (i.e., between two years) in crude rate of natural change of population (N)

The components of crude rate of natural change of population (*N*), that is, the ratio of the natural change (live births minus deaths) to the average population or equally the difference between the crude birth and death rate, can be identified as follows:

$$N = \frac{B}{P} - \frac{D}{P} \qquad (1),$$

where *B*, *D*, *P*, $\frac{B}{P}$, and $\frac{D}{P}$ refer to births, deaths, population, crude birth rate, and crude death rate, respectively.

Equation 1 can be formulated as follows:

$$N = \frac{B}{P} - \frac{D}{P} = \sum_x \frac{B_x}{P} - \sum_x \frac{D_x}{P} = \sum_x \frac{f_x * W_x}{P} - \sum_x \frac{m_x * P_x}{P} =$$
$$= \sum_x f_x * S_x^w - \sum_x m_x * S_x \qquad (2),$$

where B_x and D_x represent births by mother's age and deaths by age, respectively; f_x is the age-specific fertility rate at age *x*; W_x refers to women of reproductive age (15 to 49 years) at age *x*; $S_x^w = \frac{W_x}{P}$ is the share of women of reproductive age at age *x* in the total population; m_x is the age-specific mortality rates at age *x*; $S_x = \frac{P_x}{P}$ is the share of persons by age *x* in the total population; and *x* signifies the age of the individuals.

Based on Equation 2, changes (Δ) over time (i.e., between two years) in the crude rate of natural change of population can be decomposed as

$$\Delta N = \Delta\left(\frac{B}{P} - \frac{D}{P}\right) = \Delta\left(\frac{B}{P}\right) - \Delta\left(\frac{D}{P}\right) =$$
$$\sum_x \Delta\,(f_x * S_x^w) - \sum_x \Delta\,(m_x * S_x) =$$
$$\left[\sum_x S_x^w * \Delta f_x + \sum_x f_x * \Delta S_x^w + \sum_x \Delta f_x * \Delta S_x^w\right]$$
$$- \left[\sum_x S_x * \Delta m_x + \sum_x m_x * \Delta S_x + \sum_x \Delta m_x * \Delta S_x\right] =$$

$$\sum_x [(S_x^w * \Delta f_x) - (S_x * \Delta m_x)] + \sum_x [(f_x * \Delta S_x^w) - (m_x * \Delta S_x)] + \sum_x [(\Delta f_x * \Delta S_x^w) - (\Delta m_x * \Delta S_x)] \quad (3).$$

In other words, changes (Δ) over time (i.e., between two years) in the crude rate of natural change of population rely on the first term $[(S_x^w * \Delta f_x) - (S_x * \Delta m_x)]$ of Equation 3, which represents the difference between the fertility and mortality effects; on the second term $[(f_x * \Delta S_x^w) - (m_x * \Delta S_x)]$, which refers to the difference between the population age structure effects related to birth and death rates; and on the third term $[(\Delta f_x * \Delta S_x^w) - (\Delta m_x * \Delta S_x)]$, which represents the difference between the interaction effects.

Table A-1: Demographic factors behind the differences in crude rates of natural change attributable to the foreign- and native-born populations in selected European countries (annual average for the 2014–2019 period,* per 10,000 population, foreign-born population considered as a reference population)

	Differences attributable to diversities in:								
	Crude birth rates						Crude death rates		
	Fertility			Population age structure					
	Timing	Level	Total	Age structure of women of reproductive age	Share of women of reproductive age	Total	Mortality level	Population age structure	Total
	(1)	(2)	(3) = (1) + (2) + inter.	(4)	(5)	(6) = (4) + (5) + inter.	(7)	(8)	(9) = (7) + (8)
Belgium	9	–65	–59	–20	–62	–76	4	35	39
Denmark	6	6	12	–41	–75	–100	4	50	54
Germany	28	–59	–42	6	–36	–32	9	–3	5
France	8	–96	–92	–9	–30	–38	0	–3	–4
Netherlands	6	–5	1	–19	–53	–66	1	32	33
Austria	13	–49	–40	–15	–55	–65	0	37	37
Sweden	13	–37	–27	–13	–55	–64	2	31	33
United Kingdom	2	–36	–34	–37	–87	–110	2	35	37
Norway	10	–34	–25	–39	–77	–102	6	48	54
Switzerland	18	–39	–26	–11	–49	–57	7	23	30
10 Countries	12	–53	–44	–14	–53	–64	4	13	17
31 Countries	9	–47	–40	–12	–50	–59	8	21	29
EU-28	9	–47	–40	–12	–50	–58	7	20	28
EU-27	11	–48	–40	–7	–44	–49	9	17	26

Table A-1: (Continued)

	Differences attributable to diversities in:				
	Crude rates of natural change attributable to each population				
	Fertility and mortality	Age structure	Total	Birth rates	Death rates
	(10) = (3) – (7)	(11) = (6) – (8)	(12) = (10) + (11) + inter.	(13) = (3) + (6) + inter	(14) = (9) + inter
Belgium	–63	–111	–155	–117	38
Denmark	8	–150	–157	–98	59
Germany	–51	–28	–83	–79	4
France	–92	–35	–113	–118	–5
Netherlands	–1	–97	–103	–69	34
Austria	–40	–102	–131	–96	35
Sweden	–29	–95	–125	–90	35
United Kingdom	–35	–145	–164	–129	35
Norway	–31	–150	–183	–121	63
Switzerland	–33	–80	–116	–84	32
10 Countries	–48	–76	–115	–99	16
31 Countries	–48	–79	–118	–89	29
EU-28	–48	–78	–117	–89	28
EU-27	–49	–67	–109	–82	26

Note: *2018–2019 for Germany and Switzerland.
Source: Own calculations based on data provided by Eurostat (2020a–2020f).