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THE CHALLENGES OF IMMIGRATION IN THE EUROPEAN UNION: ESSAYS ON SOCIAL IMPACTS AND FUTURE OUTLOOKS

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CO-AUTHOR STATEMENT

Three of the four chapters of the present dissertation are co-authored. Reflecting my relative contribution to the papers, I am listed as first author in all three. Here follows a detailed account of my contribution to each of the co-authored chapters:

Chapter 1 – Foreign-born households in the income distribution and their contribution to inequality and income polarization, co-authored with Alessio Fusco (Luxembourg Institute of Socio-Economic Research, LISER) and Philippe Van Kerm (Institute of Socio-Economic Research, LISER, and University of Luxembourg).

Alessio and Philippe are at the origin of the research question that was born out of their collaboration with the Third Network for the Analysis of EU-SILC (Net-SILC3). I conducted the data analysis and drafted the text, with contributions, reviews, and advice from Alessio and Philippe. Philippe notably provided the derivation of the influence functions used in the analysis and contributed the commands to estimate those effects using the statistical software Stata. A previous version was published as Chapter 5 in European Commission & Eurostat (2021). *Improving the understanding of poverty and social exclusion in Europe: 2021 edition*. Nolan, B., Marlier, E., Guio, A. (eds.). Publications Office of the European Union, Luxembourg. The second part of the paper, which looks at cross-national variations, is my contribution and was not part of the previously published version.

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INTRODUCTION:
**RESEARCHING MIGRATION IN A CHANGING WORLD – MORAL
CHALLENGES AND PARADIGMATIC ADVANCES**

Rhea Ravenna Sohst¹

This dissertation explores different aspects of immigration in Europe and the impacts it can have on host societies.

It is tempting to view one's life as the sole product of our efforts and ability. We work hard and put our dedication, time, and sacrifice into the things we strive to achieve. Yet, historical circumstance and accidents of birth shape our lives more than we like to think. As Warren Buffet – one of the most successful investment magnates of our time – notes: “the womb from which you emerge determines your fate” (CBS News, 2013). It is in fact the womb but also the times, gender, race, and birthplace that together draw the lines of what you can hope to achieve one day. The overwhelming importance of these factors on our lives is frustrating, as they are random and independent of any individual efforts and episodic luck (Roemer, 2000). Yet despite those limitations beyond our control, there are precious few decisions we can take that have the potential to fundamentally alter one's outlook on life.

The present work posits on a recognition of the moral arbitrariness that is the birthplace of every human being, and the right of each person to aspire for the betterment of their live. This is far from consensual. Since its birth in 2005, the annual budget of the European Border and Coast Guard Agency *Frontex* has grown from 6 to a whopping 758 million euros in 2022, chiefly with the goal to deter prospective migrants (Frontex, 2022).² Other efforts to keep people in place are plentiful too, including Europe's deals with neighbouring countries and its information campaigns attempting to dissuade people on the move (Brekke and Thorbjørnsrud, 2018).

Yet, for many people in the world, the single most promising way to improve their outlook and happiness in life is migration. In fact, the differences in living standards between countries are so pronounced that – unless they suddenly and miraculously equalize – we can be all but certain that ambitions to migrate will remain high (Ravaillon, 2018; Crawley, 2018).

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² In October 2021, the European Parliament voted to freeze a part of that budget, 90 million euros, until the agency fulfills several conditions linked to the respect of fundamental rights and monitoring (European Parliament, 2021).

More than two-thirds of our lifetime income is determined by where we live (Milanovic, 2015), and just by changing location, migrants can expect to make multiple times the amounts they earn in their country of birth. A Haitian worker willing to work in the United States will earn 700% of what they would make working the same job in Haiti – and this is a conservative estimate accounting for a variety of potential biases (Clemens, Montenegro and Pritchett, 2008). Perhaps the most powerful factor from a global view to reduce poverty and inequality is thus international migration. It is indeed so much of a pervasive strategy that even the strictest, most deterrent migration and border policies do not manage to stop immigration flows entirely but rather lead to a substitution of flows to other geographic routes or into other legal categories (de Haas et al., 2018).

Yet despite the overwhelming evidence that migration is likely to have vast positive impacts on global poverty reduction and individual life chances, local differences matter. Migration takes place embedded in social, historical, and geopolitical contexts, and affects a variety of population groups. This includes the communities left behind by migrants, communities through which migrants are transiting along their journey, and communities in countries where they arrive and settle. Among those effects, the so-called ‘brain drain’ has long been feared as a major negative side effect of international migration on the development of low-income countries. Yet, the evidence suggests that despite some support of the brain drain hypothesis, prospects to emigrate produce an overall positive effect on human capital formation in countries of origin (Beine, Docquier and Rapoport, 2008). In a recent study on nurse emigration from the Philippines, it has been shown that for each leaving nurse, 10 more would pass their qualifying exam and on the way support a growing economy of private training providers (Theoharides and Abarcar, 2021). In addition, international migrants are also enhancing productive knowledge diffusion, meaning that exports of goods they know to produce are increasing in both sending and receiving countries following migration flows (Bahar and Rapoport, 2016). Yet, the effects of emigration can also be challenging. Remittances have become lifelines that entire economies depend on, especially low-income countries. In Kirgizstan for instance, they amount for a whopping 30% of GDP (World Bank, 2022). And although outflows of skilled migrants may not have aggregate negative effects on a country’s development, it does not mean that individual families or communities don’t suffer negative effects, or that the positive effects may come with a time lag that can still be hurtful, even intermittently, to sending countries (Collier, 2013).

I focus on international migration flows towards Europe and their impacts on receiving communities. In Europe, migration has become an increasingly decisive political factor,

shaping elections, and steering public opinion. Two distinct tribes seem to have formed in the wider public, one asserting that immigration is good and one that it is terrible and the downfall of our societies. Both views lack a nuanced understanding of migration and crucially ignore the decisions that contribute to making migration beneficial or harmful. Clearly, the effects of immigration on host countries depend on a plethora of factors and many of those can be influenced by policy decisions. This includes policies governing the entry and stay of third-country nationals but also concerns decisions on barriers migrants face along their journey and the type of integration policies – access to labour markets, recognition of foreign qualifications, support for language learning, etc. – they encounter upon arrival. If conclusions were drawn from decades of research on migration, one would have to frame immigration not as a hazard to evade, but rather as process that needs to be managed (Czaika and de Haas, 2013). This is even more important since the benefits and costs of migration are unevenly distributed among receiving communities. Evidence shows that population groups like employers, consumers of many services, and workers with complementary skills tend to benefit from immigration in terms of wages or incomes while those competing with new arrivals and those afraid of cultural disappropriation tend to lose. However, if and where negative effects can be found at all, they tend to be modest and localized (Card, 2005; Peri, 2014). Yet, those consequences still underscore the importance of designing targeted policies that support those affected or perceived to be affected.

The ongoing focus on the impact of immigration on native wages – which is probably the single most researched topic in migration economics – further draws attention to the conceptual limitations within the field. It conceptually over-simplifies immigrants as factors of production, which then leads to widespread expectations that immigration exerts downward pressure on wages. Yet, the economy is spectacularly more complex than this view suggests, and immigrants not only sell their labour, but they also buy, invest, start their own businesses, and innovate (Pethokoukis, 2020). While this is intuitively clear to most, it is less frequently represented in the field than the common immigrants-as-labour view. (In Chapter 2 of this dissertation, I assess the impact of immigration on well-being, one potential alternative to a purely labour-focused view.) Besides the moral implications of migration, a major challenge faced by migration economics is thus of conceptual and methodological nature.

This is nowhere clearer than in its reliance on a single theoretical model, the Roy model of location choice (Borjas, 1987). Not only does the model predict direct harm for native workers through immigration, as discussed above, it also has proven wrong in relation to several other critical issues concerning migration in the past decades. Based on the simple idea

that workers with different skills choose among a selection of countries to maximize their earnings, the Roy model predicts for example that economic development in poor countries should lower migration pressures over time, leading to ultimately fewer outflows. The logic of the model is so widely accepted that a large share of international development aid continues to be linked to its reasoning. The (misleading) idea is that development aid should target the ‘root causes of migration’ by creating economic opportunity in countries of origin (see for example the EU Emergency Trust Fund for Africa; European Commission, 2022). While the concept of ‘root causes’ is flawed in itself – focusing solely on selected push factors and discounting pull factors altogether – addressing those factors through development aid also does not produce the intended effect, which is to reduce emigration.

One reason the Roy model is flawed in that context is that it ignores the crucial difference between aspirations to migrate, and the ability to do so in practice, as well as the positively reinforcing effects of migration and development. Poverty, especially extreme poverty, can act as a barrier which keeps people stuck in place. As a result, it is usually not the poorest who migrate. This can also be observed across countries, with evidence showing that emigration rates actually *increase* as countries develop, and only start to go down once countries have reached level of about 10,000 USD in purchasing power parity (Clemens, 2020; Carling and Talleraas, 2016). So, while the Roy model is not wrong to assume that income differentials are an important driver of international migration, it would be naïve to assume that this translates seamlessly in reality. Instead of seeing development as a cure to migration, one finds the same factors triggering development to also trigger migration, thus making migration a positive sign that development is happening (Clemens, 2022).

As it stands now, migration economics is faced with both a moral and a paradigmatic challenge. The moral underpinnings of the field oblige researchers to recognize the deeply human desire to seek a better life, including through migration, and to develop approaches that facilitate such research even in a highly polarized political context. The paradigmatic challenge will demand of migration researchers to go beyond the standard model and common research questions that have proven insufficient to explain the realities of the past half century. Instead, it could start understanding migration more broadly as an investment in human capital and focus on developing and evaluating policy interventions needed to reap its benefits for all involved. Given the growing relevance of migration as a topic shaping world politics there is no doubt that migration research will be dearly needed to equip the debate with evidence and propose new solutions and best practices.

As I am terminating my dissertation and starting a new position at the forefront of European migration, asylum, and developmental policy, I want to situate my research within a dedicatedly global perspective and further ensure this brief introduction reminds readers of the sometimes uncomfortable but necessary questions surrounding research on migration. The remaining part of this introduction will focus more narrowly on a summary of each chapter, and a brief assessment of their contributions.

The Challenges of Immigration in the European Union: Essays on Social Impacts and Future Outlooks

In this dissertation, I present three empirical studies and one systematic literature review on the social impacts and future outlooks of immigration in the European Union. The studies are methodologically diverse and, in some parts, rather exploratory. Yet overall, they are united by treating immigration mostly from a European perspective and linking research questions and findings to potential policy implications.

Chapter 1 provides new evidence on the contribution of immigrants to income inequality and polarization in 21 European countries. The relationship between immigration and inequality has attracted attention for some time (Card, 2001, 2009; Blau and Kahn, 2015). Indeed, in a time of widening inequality, any potential relationship between immigration and inequality has direct practical relevance as equal societies tend to be safer, more productive, less violent, and overall healthier (Tamar et al., 2006; World Bank, 2013; Stewart, 2010; Dewan et al., 2019; Ray, 2018). Income polarization too has become an increasingly salient topic, especially in view of the apparent absence of immigration policies across Europe that seek to attract middle class immigrants, instead focusing on either high-skilled ‘talent’ or humanitarian immigration without educational or income requirements (European Parliament, 2021a).

Using EU-SILC data for 2008, 2013 and 2018, Chapter 1 estimates the relative differences in the disposable incomes of natives and foreign-born households. Using influence function regression, it derives the implications thereof for the contribution of foreign-born households to income inequality and polarization in the host country. Individuals living in foreign-born households tend to be concentrated in the lower tails of the income distribution in almost all countries examined. Although there is heterogeneity in the incomes of foreign-born households, their generally disadvantaged positions tend to push national income inequality upward. This effect persists in many countries, albeit mitigated in magnitude, when we account

for the different socio-demographic characteristics of foreign-born households compared to natives. The effects on polarization are more mixed with immigrants in many countries showing no contribution at all. Using tools adapted from meta-analysis, we find a strong association between welfare regimes and the risk of immigrants to contribute negatively to inequality and polarization.

Chapter 2 explores the impacts of immigration on the well-being of natives, exploiting variation in the share of immigrants at the municipal level in Luxembourg. Given the overall large immigrant population – nearly half of Luxembourg’s inhabitants are foreign-born – the benefits of immigration appear evident for Luxembourg. In fact, the growth of Luxembourg’s economy and wealth in the past decades was only possible due to large-scale immigration and the daily inflow of cross-border workers. Yet, immigration also brought several tangible (e.g., rents, congestion, competition) and less tangible (e.g., cultural identity) challenges, raising questions about its overall impact on natives.

To answer the question of how immigration impacts natives’ well-being, I analyse differences across all 102 Luxembourgish municipalities which offers an extraordinary level of granularity. In contrast to typical outcomes analysed in the context of immigration, such as wages, schooling, or crime, I further focus on subjectively defined well-being which has been shown to provide valid and meaningful information capturing a more holistic relationship (Kapteyn et al., 2015; OECD, 2018; Fischer, 2009; Diener, Oishi and Tay, 2018; Krueger and Schkade, 2008). Finally, to empirically estimate the relationship and address potential endogeneity, I develop a novel instrument that is a combination of the classic shift-share instrument (Card, 2001) and a geographic instrument based on the observation that natural resources historically determined the location early immigrant settlements in Luxembourg.

The results suggest a perhaps surprising dynamic: Despite the vastly positive contribution of immigrants to Luxembourg’s economy and indeed its dependency on a constant inflow of foreign workers, there is no overall positive impact of immigrants on the well-being of natives. What is more, I also find that younger, college-educated Luxembourgers experience small negative effects. I hypothesize that this effect is driven by labour market competition and find support for it by showing that in the public sector, where there is very little international competition, the effect completely disappears. The findings contribute to a growing number of country studies on the impact of immigration on natives’ well-being and offer nuance for future analysis.

Finally, **Chapters 3 and 4** turn toward future migration inflows to the European Union, by predicting the volume and composition of five groups of immigration in 2030: total immigration, labour, high-skilled, asylum applications and irregular border crossings. Especially since the 2015/16 arrival of asylum seekers, European policy makers have started investing substantially in research and on-the-ground operations that aim to improve their planning and help them prepare for future arrivals. A large number of approaches have thus been developed in recent years, sometimes driven by practitioners rather than academia. To gain a systematic understanding of the rapidly evolving field, Chapter 3 presents a systematic literature review of immigration forecasts and scenarios. In addition, I propose distinguishing three groups of approaches to future migration based on how far into the future they look and which methods they apply: (a) short-term early warning systems that are meant to provide operational support by allocating staff and resources, (b) forecasts and projections that can cover medium-term time horizons, and lastly (c) strategic foresight that is based on long-term developments and so-called mega-trends (Sohst and Tjaden, 2020).

Based on Chapter 3, Chapter 4 combines two approaches, migration scenarios and a Delphi expert survey, to produce estimates of future immigration separately for five groups. By combining both methods, the chapter builds on the work of qualitative scenario studies and then translate their implications into quantitative estimates of future inflows. To collect immigration estimates, one workshop and a two-round survey with migration experts from across Europe were organized in 2019-20. The results suggest that labour and high-skilled immigration are expected to rise substantially whereas the number of asylum applications and irregular border crossings will remain constant or increase only marginally. In none of the scenarios that were evaluated, estimates of forced and irregular migration exceed levels observed at the high of the so-called migration crisis in 2015-16.

While these results are interesting and offer additional value compared to standard projections of international immigration such as the EU's Eurostat projections and the United Nation's World Population Prospects, the analysis also emphasizes methodological drawbacks. Experts tend to have little confidence in their estimates, disagree substantially on the size of international immigration and stick to their original estimates when presented with the responses of their peers. Those caveats underline the importance of wisely matching the prediction method with the relevant policy question and being aware of the uncertainty surrounded with any assessment of the future. The analysis in Chapter 4 suggests that the scenario-Delphi approach is comparatively well-suited for mid-term predictions of smaller, more volatile flows such as high-skilled or asylum migration. Yet for larger, more stable flows

(such as total or labour immigration) or shorter time frames, other approaches may be preferable.

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CHAPTER 1

FOREIGN-BORN HOUSEHOLDS IN THE INCOME DISTRIBUTION AND THEIR CONTRIBUTION TO INEQUALITY AND INCOME POLARIZATION

Rhea Ravenna Sohst, Philippe Van Kerm, Alessio Fusco³

1.1 Introduction

The general public notoriously holds incorrect views about the foreign-born population in their country – most notably, the share of immigrants is often vastly overestimated and the perception of their impact on various social and economic areas exaggerated (Alesina et al, 2018). The debate about the impact of immigration on the distribution of incomes in host countries is contentious too (see, e.g., Card, 2001, 2009; Blau and Kahn, 2015). Multiple studies have indeed found a concentration of immigrants at both tails of the income, occupation, and skills distributions in the host country, e.g., in Luxembourg (Amétépé and Hartmann-Hirsch, 2011; Fusco et al, 2014), in Switzerland (Müller and Ramirez, 2009) and in the United Kingdom (Dustmann et al, 2013). However, the implications of this concentration on the overall shape of the host country income distribution remain unclear.

Against this backdrop, we exploit EU-SILC data for 2008, 2013 and 2018 to provide new, descriptive evidence on the position of foreign-born households within the income distributions of twenty-one European countries. Using influence function regression, we derive the implications thereof for the contribution of foreign-born households to national host country indicators of income inequality and polarization. We then used meta-analysis to estimate a combined “European” cross-country effect of immigration on inequality and polarization, and then explore the role of mediating factors including welfare regimes and economic clout.

Inequality – and its operationalisation in Gini indices or income share ratios – is a much-examined characteristic of the distribution of household incomes and frequently discussed in connection with immigration (Card, 2009; Frattini, 2012; Kahanec and Zimmermann, 2014; Hibbs and Hong, 2015). Polarization is a closely related, yet different and much less researched

³ Ravenna Sohst is with the University of Luxembourg, Philippe Van Kerm with the University of Luxembourg and the Luxembourg Institute of Socio-Economic Research and Alessio Fusco with the Luxembourg Institute of Socio-Economic Research. This work has been supported by the third Network for the analysis of EU-SILC (Net-SILC3), funded by Eurostat. A previous version of the paper has been published in Guio, Marlier and Nolan (2021). Ravenna Sohst is supported by the Luxembourg National Research Fund (MINLAB DTU 10949242). Email address for correspondence: ravenna.sohst@uni.lu.

dimension of income distributions. Yet, assessing the influence of immigration on income polarization may be especially insightful since immigration channels themselves tend to be polarized at the tails of the income and skills distributions. In fact, few legal migration pathways currently exist in the European Union for low- and medium-skilled migrants that would constitute a working or middle class (Newland and Riester, 2018).

Our analyses show that individuals living in foreign-born households have lower income and tend to be concentrated at the lower tails of the income distribution in almost all countries examined. Although there is much heterogeneity in the income of foreign-born households, their generally disadvantaged situation implies that, on the whole, they tend to push inequality upwards – sometimes substantially. This effect persists in many countries, albeit mitigated in magnitude, when we account for the different demographic, education and employment characteristics of immigrants compared to natives. The effects on polarization are more mixed, with immigrants in many countries showing no contribution at all. Across countries, we find a strong association between welfare regimes and the risk of immigrants to contribute negatively to inequality and polarization. However, this effect could also capture differences in the composition of immigrants and particularly the share of humanitarian and family immigrants.

The paper is structured as follows. Section 2 outlines the main theoretical mechanisms through which immigrants can influence the distribution of income according to the recent literature. Section 3 introduces the concepts of inequality and polarization and the influence function regression methodology and develop hypotheses about the influence of immigrants on inequality and polarization. Section 4 presents our EU-SILC data extracts. Our first set of empirical results are presented in Section 5: we first compare average incomes of foreign-born and native-born households and then use RIF regression to quantify the contribution of foreign-born households on host country income inequality and polarization. In Section 6, we show how tools adapted from meta-analysis can be used to identify common combined effects across EU countries and further relate the contribution of immigrants to country-level differences in immigrant composition, economic performance, and welfare regimes. Section 7 concludes.

1.2 How can immigrants shape the income distribution? The theoretical background

Despite years of interest in the topic, it remains an open question whether and how immigration influences economic inequality – both theoretically and empirically. Generally speaking, two channels have been identified through which immigrants can have an effect on inequality: (1)

individual displacement effects in which immigrants replace natives who then take other jobs or remain without work, and (2) compositional effects in which immigrants change the overall availability of skills on the labor market because they have different ‘profiles’ than natives.

Perhaps most contentious is the impact of immigration on native wages, particularly the fear of natives to experience wage or employment losses. Wage adjustments prompted by immigrants are indeed documented (e.g. Borjas, 1999, 2003; Lull, 2014) and can lead to changes of a country’s income distribution. Yet, their extent and whether those adjustments expand or reduce inequality depend notably on the degree of substitutability and complementarity between natives and immigrants across occupation and skill groups, and across the income distribution (Dustman, Frattini and Preston, 2013; Dustmann, Schönberg and Stuhler 2016). While the debate is still ongoing, the evidence today suggests that the effects of immigration on natives, are small, heterogeneous, or short-lived (Card, 2009; Ottaviano and Peri, 2012; Peri, 2014; Clemens and Hunt, 2017).

Besides the individual displacement effects of immigration, compositional changes in the host population induced by immigration can have an effect on economic inequality. Differences between immigrants and natives in terms of education, demographics and human capital are well documented and can lead to immigrants earning more or less than natives (OECD, 2018; Blau and Kahn, 2012). Immigration then changes the joint immigrant-native income distribution and of course inequality, a summary measure of the income distribution. The potential of that difference to affect inequality naturally depends on the extent of the immigrant-native differential and on the overall size of the immigrant population. The literature suggests that the compositional change induced by immigration is likely to play only a minor role in the growth of inequality in the past decades in the United States (Blau and Kahn, 2012; Card, 2009). Yet, in the United Kingdom Advani et al. (2020) show that 85% of the growth in the top 1% income share over the past 20 years can be attributed to immigrants and their particular concentration in finance and other high-paying industries. Slettebak (2021) finds evidence that immigration led to an increase of inequality in Norway following the Eastern EU enlargement. She suggests that the Norwegian labor market expanded the number of low-paying jobs that require little formal skills in response to the inflows and therefore structurally adapted to more unequal income distribution, in particular by increasing the number of jobs available at the lower tail of the income distribution.

Overall, the effect of immigration on inequality is likely to combine both mechanisms and to be influenced by all aspects of the immigration and integration process. For example, the role of voter preferences for redistributive policies and the effect of immigration on them has

recently received some attention (Alesina, Murad and Rapoport, 2019; Elsner and Concannon, 2020). There is some evidence, however, that migrants select into countries with higher levels of inequality because they envisage greater rewards for their efforts (Borjas, 1987; Kahanec and Zimmermann, 2008). These questions also contribute to the overall puzzle of how immigration affects inequality.

The analysis presented in this paper focuses on the compositional effect of immigrants. This accounts notably for differences in human capital which can be mirrored in differences in income and employment. We do not make claims regarding causal or general equilibrium impacts of immigration, nor do we aim at identifying the parts of the native population that are harmed or that benefit from immigration. Fortunately, our focus on compositional effects is not expected to distort results to a large extent since, as described above, the evidence suggests mostly negligible effects of immigrants on native wages.

1.3 Income inequality and polarization

1.3.1 Two related but distinct facets of the income distribution

Our analysis is concerned with two closely related--yet distinct--facets of the income distribution: income inequality and income polarization.

Inequality – as is well-known – captures the relative dispersion of incomes. It is generally seen at its maximum if one individual owns all the income in a population and, inversely, at its minimum if all individuals earn the exact same amount of income.⁴ Relative inequality is left unchanged by a proportionate change in all incomes, and it is reduced by a transfer of income from a richer to a poorer person (according to the Pigou-Dalton transfer principle). We measure inequality here by the Gini index. One of its many alternative formulations is as (half of) the average absolute income difference relative to the mean

$$G = \frac{1}{2N^2\mu} \sum_{i=1}^N \sum_{j=1}^N |y_i - y_j| \quad (1)$$

Inequality measures, and the Gini coefficient in particular, are headline social indicators and need no further discussion.

The concept of (bi-)polarization is distinct from inequality and is much less commonly examined. Bi-polarization describes the splitting of a society into two opposing groups based on their income. Societies in which the two groups are (1) more distant and (2) more

⁴ For a discussion of the Gini coefficient and inequality see for example Milanovic (1997), Jenkins and Van Kerm (2009) or Cowell (2011).

consolidated are considered more polarized than societies in which the spread is low and consolidation loose.⁵ Formally, Foster and Wolfson (2010) define a bi-polarization measure P as

$$P = \frac{\mu}{m} (G^B - G^W) = \frac{\mu}{m} (T/2 - G) \quad (2)$$

where μ and m are the mean and median incomes; G^B is the Gini coefficient when all incomes above/below the median take the value of their respective group means (the average income of incomes below/above the median); G^W is a weighted average of Gini coefficients calculated *within* the two groups; and $T = (\mu^U - \mu^L)/\mu$ is the difference in average incomes above and below the median relative to mean incomes.⁶

In contrast to inequality, polarization thus relates to the position of income *groups* whereas inequality describes the income distribution among *individuals*. Polarization as measured by P will increase with the income distance between individuals with income on either side of the median, but it would also increase with a reduction of the average income distances within the groups. More formally, while a mean-preserving Pigou-Dalton transfer would unambiguously *reduce* inequality, a mean-preserving Pigou-Dalton transfer between two individuals on the same side of the median would *increase* polarization (since it would reduce G^W and leave all other terms unchanged). Interest in polarization has been motivated with respect to inter-group conflict and social exclusion (see Duclos, Esteban and Ray, 2004). It is particularly relevant in the context of immigration because immigrants are known to settle at either tail of the income distribution and may be prone to cluster around polar incomes.

How foreign-born households' income contribute to inequality and polarization is not trivial. Generally, both inequality and polarization will increase if the distance between those above and below the median increases. This is the case if immigrants settle predominantly at the very top and bottom. However, under a scenario of rising within-group inequality, overall inequality would *increase* while polarization would *decrease* (Foster and Wolfson, 2010). Polarization is thus conditional on the presence of a gap between rich and poor whereas inequality is based on the overall distribution of income, with concentrations among either the rich or the poor but not necessarily both (Deutsch, Fusco and Silber, 2012).

⁵ Because of these features, bi-polarization is also interpreted as capturing the presence or absence of a middle class (Roope, Nino-Zarazua and Tarp, 2018).

⁶ Expression (2) gives the 'standardized' version of Foster and Wolfson's index which varies between 0 and 1, like the Gini coefficient (see, e.g., Kovacevic & Binder 1997).

1.3.2 Measuring contributions for foreign-born households to inequality and polarization using influence function regression

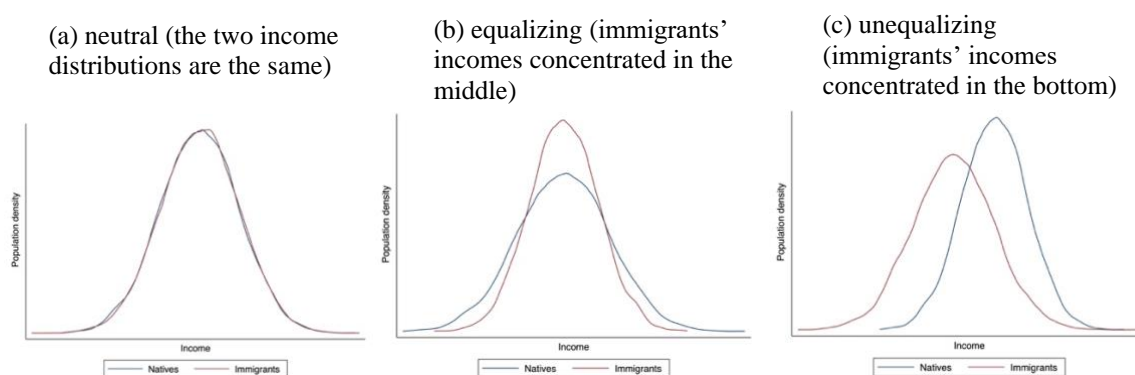
To illustrate how immigrants can alter economic inequality in our methodological framework, it is useful to imagine three hypothetical scenarios: one in which immigrants are “neutral” regarding inequality, one where they are equalizing incomes and one where they are increasing inequality. We take as a starting point a given income distribution of natives. Immigrants are ‘neutral’ if their distribution of incomes is indistinguishable from the distribution of natives, meaning that immigrants and natives have the exact same share of high, middle, and low incomes and that looking at their income distributions separately or together does not alter its shape (Figure 1a).

On the other hand, immigrants can have an equalizing effect if their incomes are more concentrated in the middle than native incomes. Why? Because if the share of immigrants in the population was to increase – holding incomes of natives and immigrants unchanged – the overall population share in the middle of the income distribution would increase and we would observe an equalizing effect, i.e., more individuals earning a similar amount of income (Figure 1b).

Lastly, immigrants can have an inequality-increasing effect if their incomes are relatively more concentrated at the bottom of the income distribution than natives. This is because increasing the share of the population that earns very low incomes would make the overall distribution less equal (1c).

Similar scenarios can be developed for polarization. Increasing the share of immigrants in the middle (Figure 1b) would decrease polarization since it would bolster the middle class. In contrast, a scenario in which the immigrant population was relatively more concentrated among both the rich and poor than natives would increase polarization.

Figure 1: Three hypothetical scenarios of how immigrants can impact the income distribution



The above examples can be formally described using influence function (IF) regression analysis.

The influence function of v (a social indicator, here G or P) is a function of y (income) and F (the cumulative distribution function of incomes) which captures the effect on $v(F)$ of an infinitesimal “contamination” of F at income y , that is, of an infinitesimal increase in probability mass of the cumulative distribution function at y (Hampel, 1974). In other words, the influence function $IF(y; v, F)$ maps, for any level of income y , how the social indicator $v(F)$ would change if there were marginally more individuals with income y in the population.

Expressions for $IF(y; v, F)$ can be derived for a wide range of statistics. For example, the influence function for the Gini coefficient can be written as (Essama-Nssah and Lambert, 2012):

$$IF(y; G, F) = -\frac{\mu + y}{\mu}G + 1 - \frac{y}{\mu} + \frac{2}{\mu} \int_0^y F(x)dx \quad (3)$$

The influence function for the ‘standardized’ Foster-Wolfson bi-polarization index can be written as

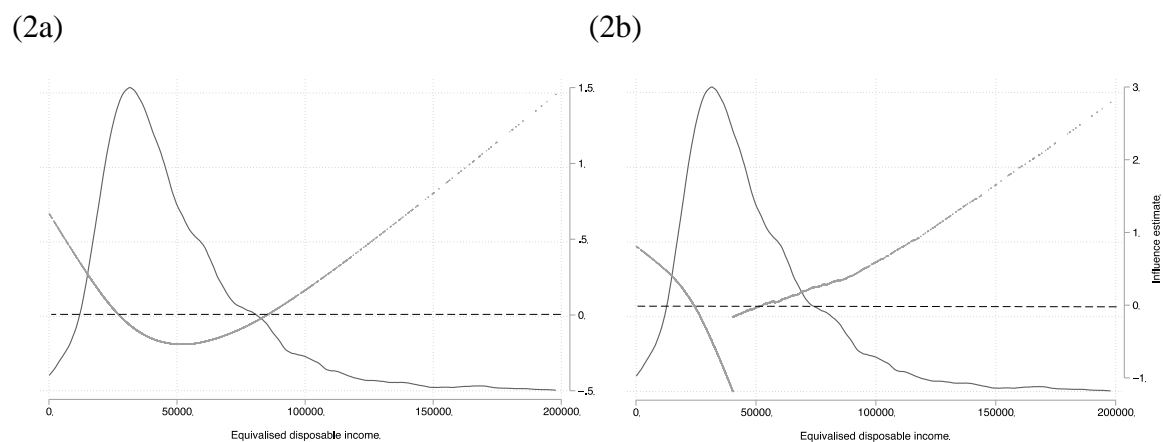
$$IF(y; P, F) = \frac{1}{m} \left(P \frac{H - m}{f(m)} - 2(yH + m(0.5 - H)) + 2(1 - F(y))(y - \mu^+) \right) - P \quad (3)$$

where $f(m)$ is the density function at the median, H is an indicator equal to 1 if $y < m$ and 0 otherwise, and μ^+ is the average income of individuals with income larger than y (Verma & Betti, 2011).

A plot of the two influence functions helps visualising the differences in the two indicators. Figure 2 shows the influence function for both the Gini coefficient (Figure 2a) and for the polarization index (Figure 2b) estimated with F taken to be the distribution of income in Luxembourg in 2018. Where the influence function is positive (above the dashed horizontal line), an increase in the number of individuals would lead to an increase in inequality or polarization. For the Gini index, the influence function is positive for income levels in both tails of the distribution, namely below circa 30 000 euros per annum and above circa 90 000 euros per annum. Adding individuals in those ranges would thus increase the Gini. On the contrary, an increase in the number of individuals with income between 30 000 and 90 000 income would lead to a decrease in the Gini coefficient. For polarization, the shape of the influence function suggests a discontinuity at the median income that the polarization coefficient ‘uses’ to split individuals into two groups. Increasing the number of individuals

with an income between 25 000 and 50 000 would bolster the middle class and therefore reduce the polarization index. Pulling the two groups further apart by adding individuals earning less than 25 000 and more than 50 000, in contrast, would increase the polarization index. It is in the range from 50 000 to approximately 75 000 euros that the difference in the influence functions for inequality and polarization is most marked: it negative for the Gini coefficient but it is positive for polarization. An increase in the number of individuals in this income range would have opposing effects on polarization and inequality.

Figure 2: Illustrative example for the equivalised disposable income distribution in Luxembourg in 2018 and the corresponding influence function for the Gini coefficient and Foster-Wolfson polarization index



Source: Author’s computation, EU-SILC cross section 2018 of Luxembourg (UDB 2018 – version 1 September 2019 release)

One key advantage of influence function regression is that it does not require direct estimation of income distributions for each group separately, so it does not hinge on having access to a sufficiently large sample of foreign-born residents. This is particularly useful for analyses of medium-sized nationally representative survey data such as EU-SILC which usually contain a relatively small number of immigrants. Another advantage is that it is easy to additionally “control” for differences in some observable characteristics between natives and immigrants. As shown in Choe & Van Kerm (2018), adding covariates in influence function regression models allows us to measure the effect of a notional increase in the share of immigrants that leaves the distribution of other characteristics unchanged. This reveals how much of the difference in income positions is due to differences in observable characteristics between immigrants and natives (such as education, age and household demographic

characteristics) and how much, if anything, is due to differences in income that are left unexplained by observable characteristics.

1.4 Data

1.4.1 Coverage

Our analysis uses 2008, 2013 and 2018 cross-sectional datasets from the European Union Statistics on Income and Living Conditions (EU-SILC). We examine the distribution of twenty-one countries: Austria (AT), Belgium (BE), Switzerland (CH), Czechia (CZ), Greece (EL), Spain (ES), Finland (FI), France (FR), Croatia (HR), Hungary (HU), Ireland (IE), Italy (IT), Lithuania (LT), Luxembourg (LU), Netherlands (NL), Norway (NO), Poland (PL), Portugal (PT), Sweden (SE) and United Kingdom (UK). Countries were selected based on three criteria: First, we chose countries based on adequate coverage of their immigrant populations. To assess coverage, we compared the population shares of immigrants in the EU-SILC with proportions published in official counts by Eurostat, separately for EU and non-EU-born immigrants (Appendix B, Figure B1). Cyprus and Denmark show gaps of over 4 percentage points between official counts and EU-SILC and were therefore excluded. Second, our analysis is based on a distinction between immigrants born in EU countries or outside of the EU. Germany, Malta, Slovenia, Estonia and Latvia do not reveal this information and are therefore excluded. Third, even though the methodology that we employ does not necessarily require large samples, we set a threshold of at least 50 observations in the unweighted sample to be in line with the reliability levels defined by the EU-SILC publishing guidelines (European Commission, 2020). Bulgaria and Romania each have less than 50 individuals reportedly living in fully foreign-born households and are therefore excluded from our analysis.⁷ Together, these restrictions leave us with 21 European countries in 2018 and 2013, and 20 countries in 2008 (Croatia was not covered in the 2008 EU-SILC).

1.4.2 Identifying foreign-born households in EU-SILC

There is no single definition of an “immigrant”. Two concepts are typically used, both of which are available in the EU-SILC: country of birth or citizenship. We use the country of birth

⁷ We apply the exclusion rule to the total number of immigrants. When split by EU/non-EU origin, samples are below 50 observations for individuals living in fully EU-born households in Croatia, Lithuania and Poland and for individuals living in non-EU-born households in Hungary.

definition because, unlike citizenship, it remains fixed throughout a person's life.⁸ Furthermore, the legal frameworks regulating access to citizenship vary widely across countries which hampers comparability.

Our analysis is performed at the individual level, but all conditioning variables are constructed at the household level. There are two reasons for this: First, the EU-SILC collects information on the country of birth only for persons aged at least 16 years. To keep children in our analysis, we constructed an "immigrant status" indicator at the household level based on the country-of-birth composition of all adult household members. Second, income, a key variable of our analysis, is constructed at the household level. Like for the immigrant indicator, the same income value is attributed to each member of a household. We also compute the years since immigration for the household head and assign its value to all members of the household. Most other conditioning variables are constructed as continuous or quasi-continuous within-household shares (Brzezinski, 2018): the share of women in the household, share of married or separated members, share of household members falling into two age groups (working age 26-64 and seniors above 64), share of tertiary educated and activity status shares. Finally, we also include the household composition (number of adults + number of minors) among our conditioning variables.

To construct a household-level indicator of immigration status, we combine the individual country-of-birth information of all household members. In the EU-SILC users' database, country of birth information is aggregated into three groups: (1) local, i.e. same country as country of residence, (2) EU, i.e. any European country except country of residence, and (3) non-EU. On this basis, we distinguish five non-overlapping groups based on the country of birth of each household member aged 16 and older:

- 1) Native: all 16+ household members are native-born;
- 2) Mixed foreign/native: mix of foreign- and native-born household members;
- 3) EU: all 16+ members were born abroad in an EU country;

⁸ However, borders can be redrawn, and countries can come into existence or disappear over the course of history. The EU-SILC identifies the country of birth using national boundaries in place at the time of the survey, not at the time of birth, in most cases (except where national minorities live abroad, see the EU-SILC 2018 codebook for more details). In regions where boundaries have shifted a lot, the EU-SILC strategy might lead to an incorrect identification of immigrants. For example, a person born in former Yugoslavia might be categorized as an immigrant if they were born on territory that now belongs to Croatia but live on territory now belonging to Serbia. At the time of Yugoslavia's existence, their move happened within national boundaries but according to the EU-SILC definition, that person would be considered foreign-born.

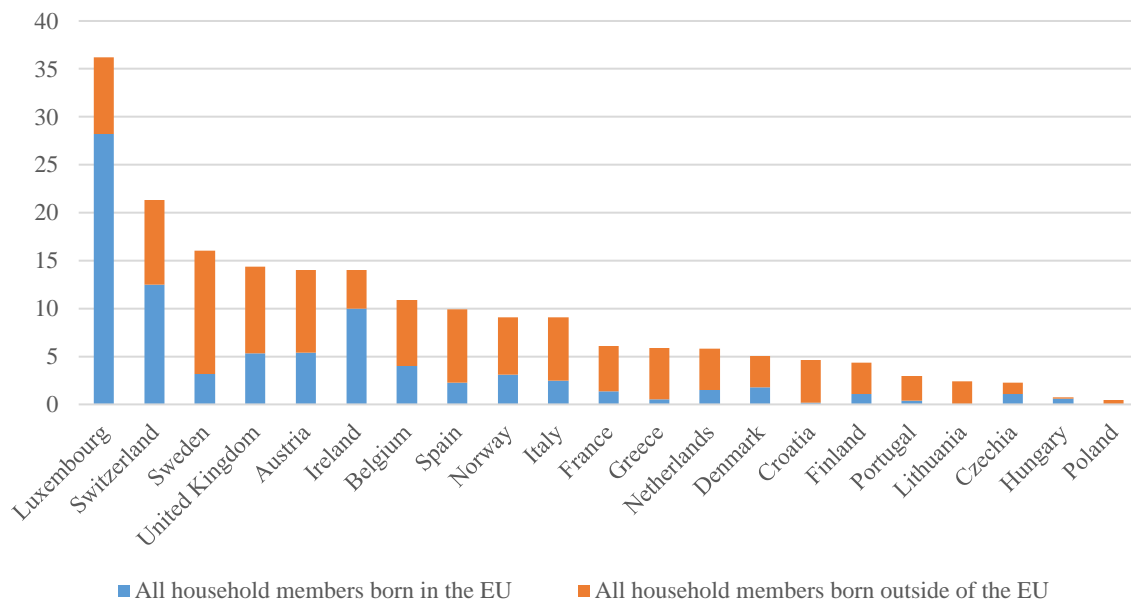
- 4) Mixed EU/non-EU: all 16+ members were born abroad in both EU and non-EU countries;
- 5) Non-EU: all 16+ members were born in non-EU countries.

Sample size concerns are critical for mixed households, and we therefore focus only on how groups 3 (fully EU-born) and 5 (fully non-EU-born) compare to group 1 (natives) in our analysis.

Figure 3 shows the share of individuals living in fully EU-born or fully non-EU-born households based on the 2018 EU-SILC sample.

Figure 3: Share of individuals living in foreign-born households by country, 2018

(% of weighted sample)



Note: Poland's share of persons living in fully EU-born households is 0.07% and therefore not visible in the figure

Source: Authors' computation, EU-SILC cross section 2018 (UDB 2018 – version 1 of September 2019)

1.5 Country-level estimates

1.5.1 Foreign and native-born incomes compared

Table 5.1 shows estimates of the ratio between foreign-born and native-born average equivalised disposable household incomes. Foreign-born households, both EU and non-EU, are on average worse off than fully native-born households. For example, 15 out of 21 countries reveal significantly lower average incomes among non-EU-born households than native

households, and in 11 out of 21 countries EU-born households also fare significantly worse than natives. In many countries, those households earned on average less than two-thirds the amount that native households earn. Although both EU- and non-EU-born immigrants appear to be disadvantaged in terms of income, the gap is significantly larger for immigrants from outside of the EU in over one third of countries.

Table 1. Ratio of average income between foreign-born and native households in 2018

	EU-born to natives	Non-EU- born to natives
Belgium	(0.96)	0.58
Czechia	(1.1)	(0.99)
Denmark	(1.03)	0.67
Ireland	0.85	(0.90)
Greece	0.72	0.62
Spain	0.68	0.57
France	0.83	0.68
Croatia	(0.81)	0.78
Italy	0.67	0.61
Lithuania	(0.84)	0.81
Luxembourg	0.86	0.66
Hungary	(1.25)	(1.09)
Netherlands	0.89	0.66
Austria	0.77	0.6
Poland	(0.86)	(0.99)
Portugal	(1.05)	(0.92)
Finland	0.87	0.68
Sweden	0.79	0.6
United Kingdom	(1.03)	(0.97)
Norway	0.77	0.64
Switzerland	(0.99)	0.73

Note: Statistically insignificant ratios at the 0.05 level are reported in brackets.

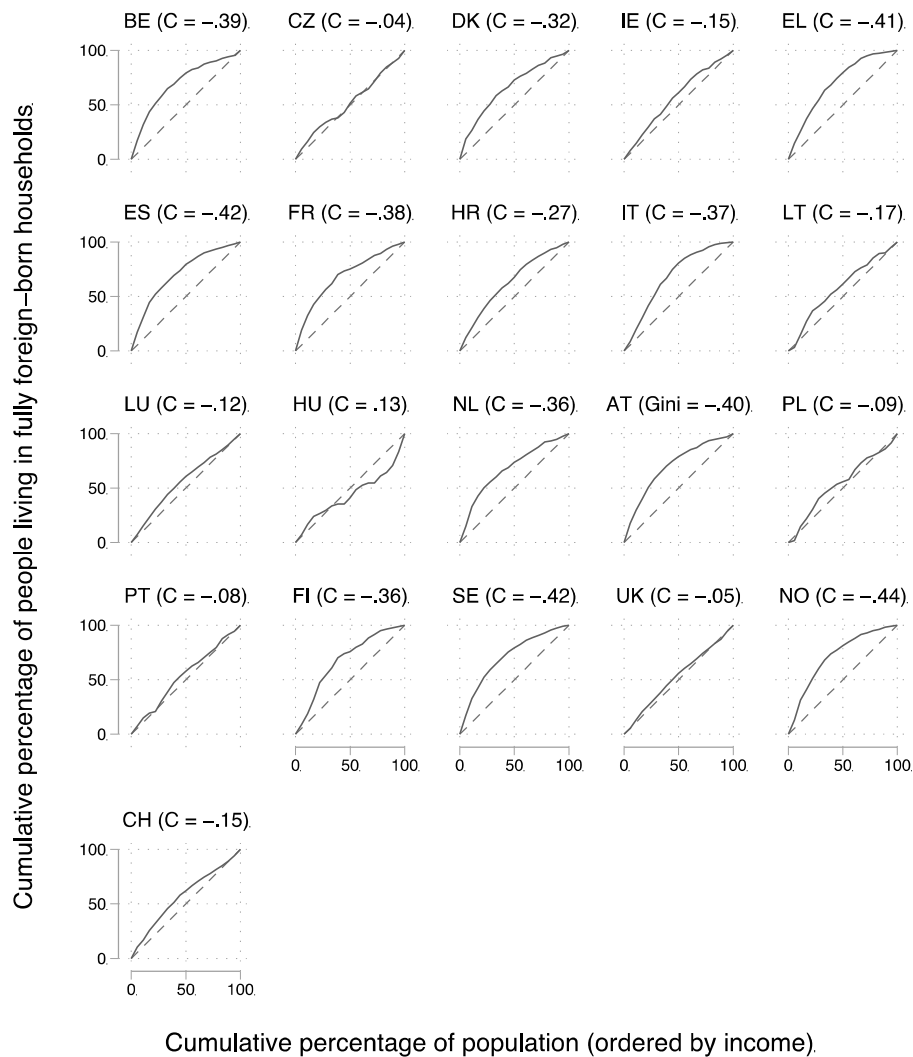
Source: Authors' computation, EU-SILC cross section 2018 (UDB 2018 – version 1 September 2019 release)

Observing lower average living standards among foreign-born populations hardly comes as a surprise. Given their diversity, averages may however hide more than they reveal. Figure 4 shows the concentration of the foreign-born population ranked along the income distribution (in 2018 only for brevity). The figure plots the cumulative percentage of people living in fully foreign-born households (along the y-axis) against the cumulative percentage of the total population, ranked by disposable income from the lowest to the highest (x-axis). For example, the curves show at $x=50$ the percentage of people living in foreign-born households that have an income at or below the national median. Foreign-born households are therefore over-represented in the bottom half of the income distribution if this percentage is larger than 50. The dashed 45° line marks the ‘line of equality’, i.e., a reference situation in which the foreign-born would be equally distributed along income positions. The higher the concentration curve lies above the 45° line the more concentrated foreign-born households are among the poorest. The concentration coefficient, also reported in Figure 4, is a numerical summary of the concentration curve. The concentration coefficient is equal to one minus twice the area between the diagonal and the concentration curve. It varies between -1 (all foreign-born concentrated among the poorest) and +1 (all foreign-born concentrated among the richest). A concentration coefficient of 0 describes a situation in which the foreign-born and native-born are equally distributed along the income distribution.

Most concentration curves are bent above the 45° -line. This reflects immigrants’ overall lower income and their concentration at the lower tails of the income distribution since their population share is larger than their income share at the same point. Yet there is nuance to the picture. The foreign-born are most concentrated among the poorest in Norway (concentration coefficient of -0.44), Sweden (-0.42) and Spain (-0.42), and least concentrated in Czechia (-0.04) and the United Kingdom (-0.05). One exception to the broadly negative concentrations is Hungary (0.13) whose curve crosses the 45° line, indicating that the foreign-born are overrepresented both among the poor and among the rich.⁹

⁹ As noted earlier, the EU-SILC definition of “country of birth” can be challenging in countries where borders have shifted, or national minorities live abroad. Hungary might be affected by this particular difficulty.

Figure 4: The concentration of immigrants along the income distribution by country, 2018 (concentration curves and coefficients (C))



Source: Authors' computation, EU-SILC cross section 2018 (UDB 2018 – version 1 September 2019 release)

1.5.2 The contribution of foreign-born households to inequality and polarization indicators

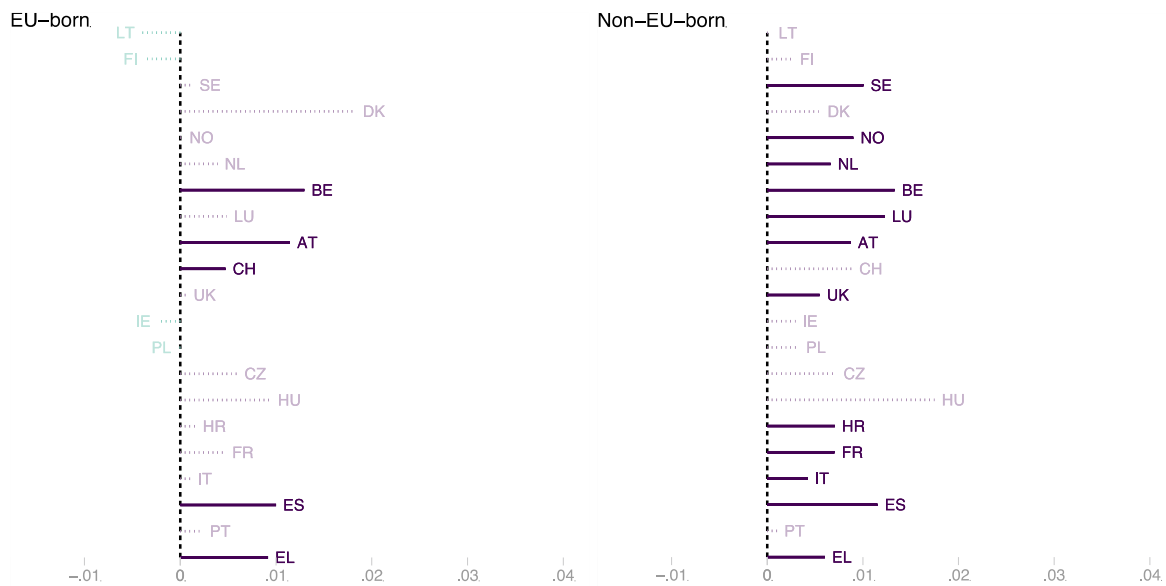
Having established that EU-SILC reasonably covers the immigrant population and outlined the overall income disadvantage of immigrants, we can now move to the main part of our analysis. How do foreign-born residents contribute to income inequality and polarization? How much is their contribution explained by differences in educational levels, employment, and other demographic characteristics?

Inequality

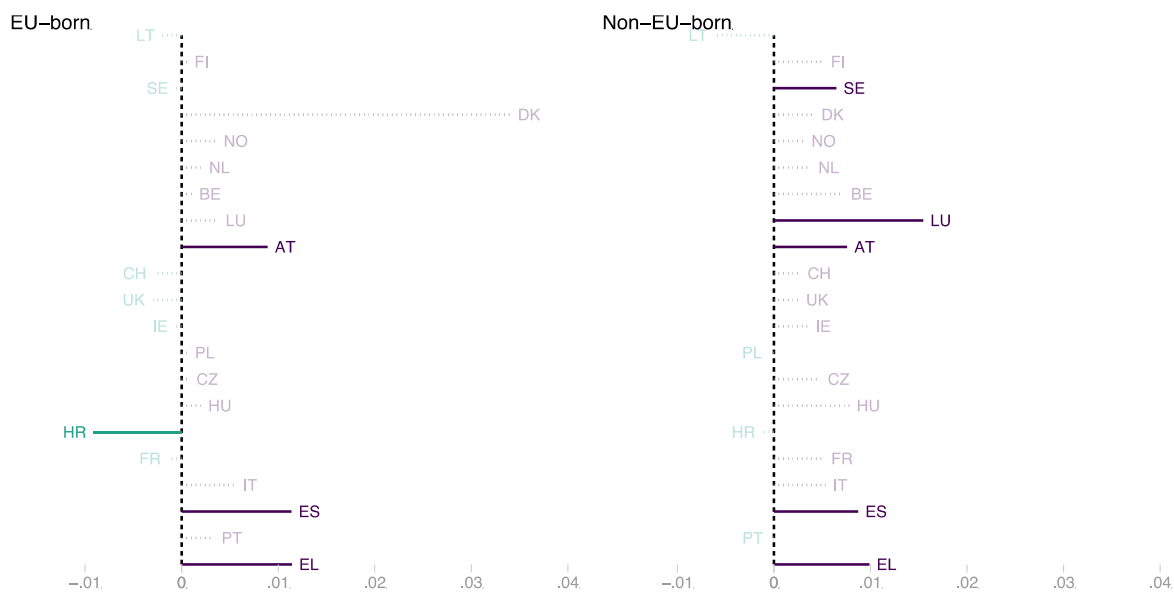
Figure 5 shows the RIF regression results for the Gini coefficient. The upper panel (Panel A) refers to unconditional results and the lower panel (Panel B) to conditional results. The interpretation of the effects is parallel to how linear regression coefficients without and with controls would be interpreted. For interpretation, effects should be seen in relation to 2018 base Gini and polarization coefficients (Appendix C, Tables C1 and C2). The size of the estimated coefficient is represented by the horizontal bars with positive coefficients sticking out on the right and negative coefficients on the left. Statistically insignificant results are represented by dashed lines.

Figure 5: Unconditional and conditional effects of EU and non-EU-born households on the Gini coefficient by country, 2018

Panel A. Unconditional effects:



Panel B. Conditional effects:



Source: Authors' computation, EU-SILC cross section 2018 (UDB 2018 – version 1 September 2019 release)

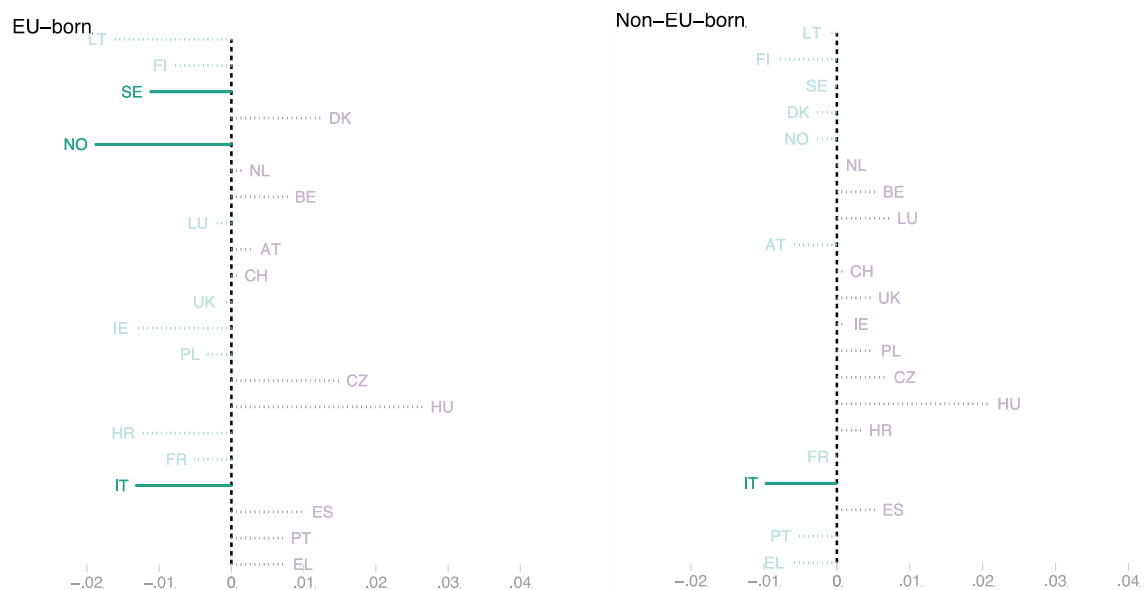
Overall, the marginal contribution of foreign-born residents on the Gini coefficient tends to be positive, revealing an inequality-increasing effect of foreign-born households. The raw effect of non-EU households is significant in 12 out of 21 countries, with Belgium, Spain and Luxembourg displaying the largest effects. In Belgium, a 10-percentage point increase of non-EU households in the population (with a simultaneous 10-percentage point decrease of natives, holding income distributions in each group constant) is thus expected to increase the Gini by 0.013. Given Belgium's base Gini of 0.25 (see Appendix C), this would result in a hypothetical new Gini of 0.263 – a small accentuation of inequality. However, the effect in most countries is even smaller. In Italy, a 10-percentage point increase of non-EU-born immigrant households is associated with an increase of the Gini from 0.33 to 0.334.¹⁰ EU households also tend to have inequality-increasing effects, although their contribution is significant in only 5 out of 21 countries. As would be expected, the effect tends to be more often statistically significant in the raw estimates than in the conditional results. Yet, looking at conditional results, we still find that three countries report inequality-increasing effects of their EU-born households on the Gini coefficient with magnitudes around 0.01 (Austria, Spain, Greece). The same three countries plus Luxembourg and Sweden show also inequality-increasing conditional effects of

¹⁰ The unconditional RIF coefficient is estimated to be 0.004 for non-EU immigrants in Italy, as shown in Table 5, Panel A.

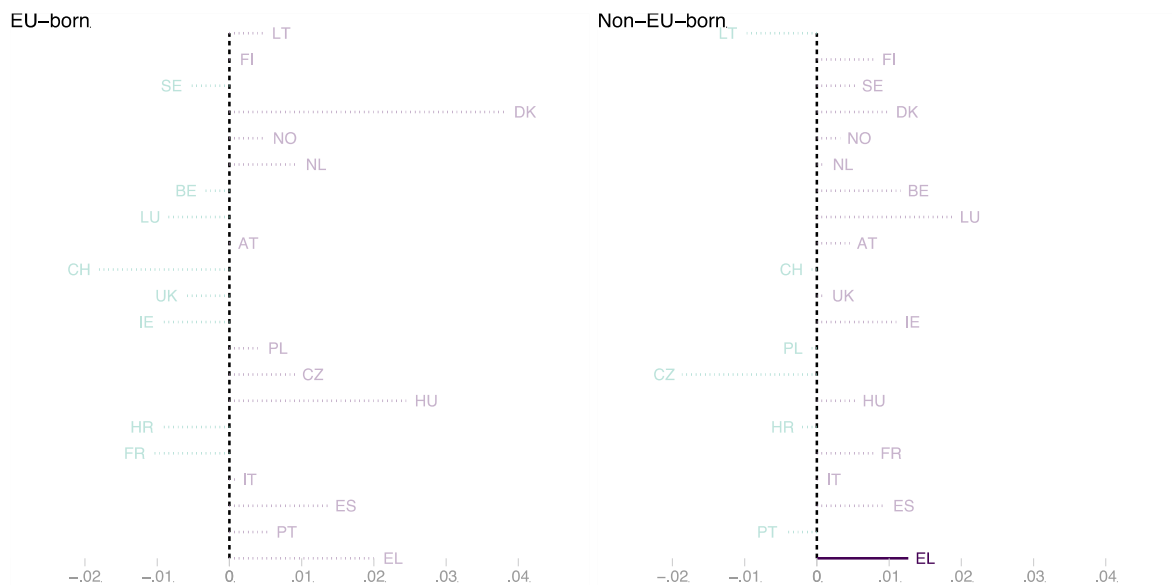
their non-EU households. Luxembourg in particular stands out with an estimated 0.016 increase in its Gini coefficient for a 10-percentage point increase of non-EU households. Croatia is the only country in which EU-born households appear to have an equalizing effect when accounting for differences in household characteristics. In earlier years, 2008 and 2013, there are similarly few countries that show positive raw or conditional effects. Austria is the only country that shows positive effects in all three years and for both EU and non-EU-born immigrants. In 2008, immigrants from outside the EU show inequality-increasing effects in 7 out of 20 countries whereas that is only true for 5 countries in 2013 and 2018. Yet, overall there is no clear trend of magnitudes increasing or decreasing over the years (see Appendix D for the 2008 and 2013 results).

Figure 6: Unconditional and conditional effects of EU and non-EU-born households on the the Foster-Wolfson index of polarization by country, 2018

Panel A. Unconditional effects:



Panel B. Conditional Effects:



Source: Authors' computation, EU-SILC cross section 2018 (UDB 2018 – version 1 September 2019 release)

Polarization

Compared to the widespread effects found among foreign-born households on inequality, markedly fewer countries show statistically significant effects on polarization (see Figure 6). However, whereas most countries experience an inequality-increasing effect of their foreign-born households, EU households in Norway, Sweden and Italy are actually mitigating bipolarization. In Norway, where the effect is largest, a 10-percentage point increase in EU-born immigrant households is associated with a -0.019 decrease of polarization. Given its already low degree of polarization (0.45, see Appendix C), Norway would hypothetically reach a polarization index of 0.431. Yet when we control for household characteristics, the polarization-reducing effect all but vanishes. This is true for most countries where these effects disappear in Panel B. In the conditional results, only non-EU households in Greece show a significant polarization-increasing effect. However, the picture looks different when comparing those results with 2013 and 2008. It appears that more countries experienced positive (i.e. polarization-increasing) effects in 2013 and/or 2008 and that in comparison, 2018 paints a more muted picture. The results also emphasize that raw effects are mixed across countries and years but that conditional effects tend to be more consistently positive. In fact, there is only one instance (non-EU-born immigrant households in 2008 in Italy) where the conditional effect of immigrants is polarization-decreasing (Appendix D).

Overall, the results from our RIF regression indicate a clear inequality-increasing effect of immigrants in many European countries, with the effect being more salient for non-EU-born immigrant households compared to EU-born households, and stronger in raw comparison than when accounting for differences in educational achievement, employment and demographics. The effects on polarization are more mixed. Many countries reveal no effect at all and some show polarization-increasing effects, particularly when accounting for background characteristics. Overall, the RIF regression results thus suggest that the distribution of foreign households tend to be sufficiently polarized at the tails of the income distribution as to drive inequality upwards but without affecting significantly bi-polarization.

1.6 Cross-national variations: Estimation of common effects and moderators using a meta-analysis approach

1.6.1 Combining national estimates: a meta-analysis approach

Using influence function regression, we have estimated 42 identically specified models for each of the countries.¹¹ We are now interested in determining how much the effect of immigrants varies across countries, and which factors contribute to those differences.

Country effects on outcomes for individuals are frequently analysed using multilevel models. Yet, it has been shown that this can be problematic, especially when done in one single step where a parameter is estimated at the unit level (e.g. individuals) and across clusters (e.g. countries). Whereas individual effects can be reliably estimated in multilevel models given their large sample sizes within each country, analysts usually rely on only a small number of countries to estimate country effects. As a consequence, the results are likely to be unreliable (Bryan and Jenkins, 2016).

Recent work moves towards separating such analyses into two steps, in which the second step recognizes that the outcome is an estimate (Giesecke and Kohler, 2021).

We follow yet another approach here, transposing methods developed for meta-analysis. Meta-analysis has been designed to combine results from a small number of similar studies and to provide unbiased estimates of their unified or common effect (see for example Vasquez-Polo, Negrin-Hernandez and Martel-Escobar, 2020; Günhan, Röver and Friede, 2020; Michael et al, 2019). Meta-regression considers the number of observations in each study and weights the estimates according to their precision using inverse-variances. Given that we want to allow for residual heterogeneity beyond the included regressors, we further specify a random

¹¹ Two for each country since we estimate separate models for EU-born and non-EU-born immigrants.

effects model for the meta-analysis.¹² Our model assumes not one common European effect, but rather expects that true RIF coefficients to be different from each other and that the countries in the study represent a random sample from a larger population of countries. Random effects is generally the recommended model for meta-regressions given the restrictive assumptions imposed by other models and the model we use in our analysis (Borenstein et al., 2009; Thompson and Higgins, 2002).

This requires extracting the IF coefficients and standard errors from the first step of our analysis (two estimates per country and year, one for EU- and one for non-EU-born immigrant households) and using those as regressands in a second step. Each country IF estimate thus corresponds to what would be a separate study in a typical meta-analysis. Although it is still rare to see meta-analysis used this way, the approach has recently been discussed in detail by Liefbroer and Zoutewelle-Terovan (2021).

Besides establishing an overall estimate of the effect size and assessing the degree of cross-country variation, we use meta-regression to determine the impact of country level covariates, such as GDP and the population share of third country immigrants, on our IF estimates. The number of parameters that can be reliably fitted in a meta-regression is naturally limited by the number of countries. In our analysis, we focus on economic performance as an indicator of a country's capacity to absorb immigrants on the labour market. Low unemployment rates and a thriving economy not only attract immigrants but also make them more likely to be employed and have a job that is matched to their skills level (Brücker and Siliverstovs, 2006; Dustmann, Frattini and Preston, 2013). In times of economic crises, however, immigrants tend to be more vulnerable than natives to unemployment and poverty, underlining the fact that the economic contribution of immigrants is closely tied to overall economic performance (Chaloff, Dumont and Liebig 2010; Papademetriou et al. 2009). We therefore hypothesize that stronger economic performance (higher GDP and low unemployment) are associated with smaller contributions of immigrants to inequality and polarization.

A second factor we investigate is the composition of immigrant populations. We speculate that the combination of origin countries is related to differences in productivity and income. Unfortunately, EU-SILC only reveals information on whether an immigrant is born in

¹² Note that the terminology of meta-analysis is not consistent with the usual meaning of some terms in statistics. This concerns notably the terms "heterogeneity" and "fixed-effects regression", which have particular vions in meta-analysis (see Borenstein et al., 2009 for a discussion).

another EU country or outside of the EU, but hides the specific country of origin. Our analysis is therefore restricted by this broad definition.

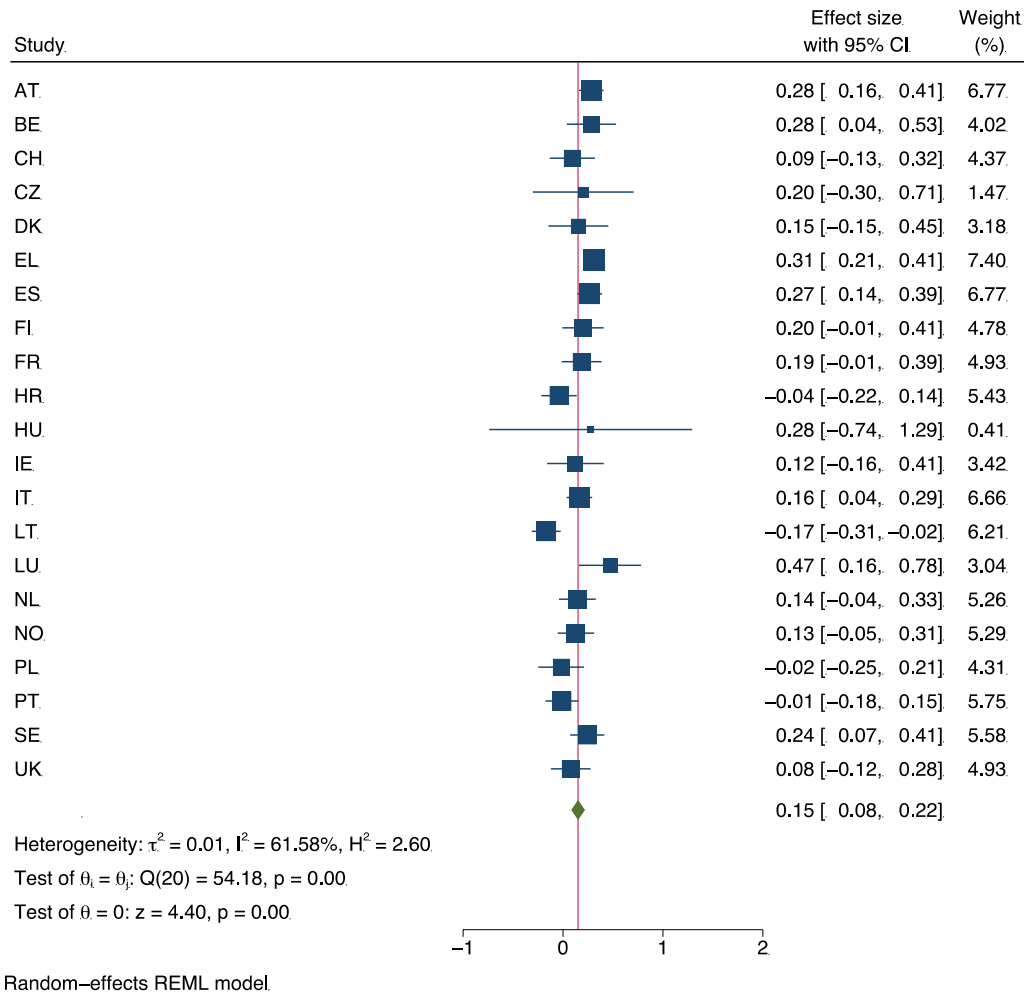
Lastly, research on welfare regimes and their incorporation of immigrants suggests that more generous access to social benefits contributes to the overall well-being of immigrants and plays a role in reducing poverty among immigrants (Sainsbury, 2012). We investigate the role of welfare regimes in shaping the contribution of immigrants to inequality and polarization by drawing on the welfare typology developed by Ferrera (1996).

1.6.2 Combined effects

We compute the combined effect size (θ) of immigrant households on the Gini and polarization index as the weighted average of the country specific IF coefficients, with more weight given to more precisely estimated coefficients based on larger samples (StataCorp, 2021). Note that the RIF coefficients are scaled by dividing them with the Gini coefficient. We find that the overall effect size for EU-born immigrants on the Gini index is 0.07 (with a confidence interval of [-0.01,0.15]) and 0.15 [0.08, 0.22] for immigrants from outside the EU (Figure 7 below and Appendix E). Increasing the share of non-EU immigrant households by 10-percentage points while simultaneously decreasing the share of native households by the same amount is thus associated with a 15% expansion of the Gini.

Yet, there is heterogeneity across countries. The indicator of heterogeneity I^2 suggests that 58% and 62% of the variability in RIF coefficients respectively are due to between-‘country’ differences, not sampling variation (Higgins, 2003). Our null hypothesis ($H_0: \theta = 0$) and tests of homogeneity ($H_0: \theta_1 = \theta_2 = \dots = \theta_{21}$) are statistically significant for non-EU immigrants, underlining the influence of cross-country differences. Yet, the null hypothesis cannot be rejected for EU-born immigrants, questioning whether the true combined effect is different from zero. The results for non-EU-born immigrant households are summarized in Figure 7 that shows the 2018 effect sizes, their confidence intervals and weights. Results for EU-born immigrants are reported in Appendix E.

Figure 7: Forestplot of the cross-national variation in the association between immigration and the Gini coefficient, non-EU-born immigrant households 2018



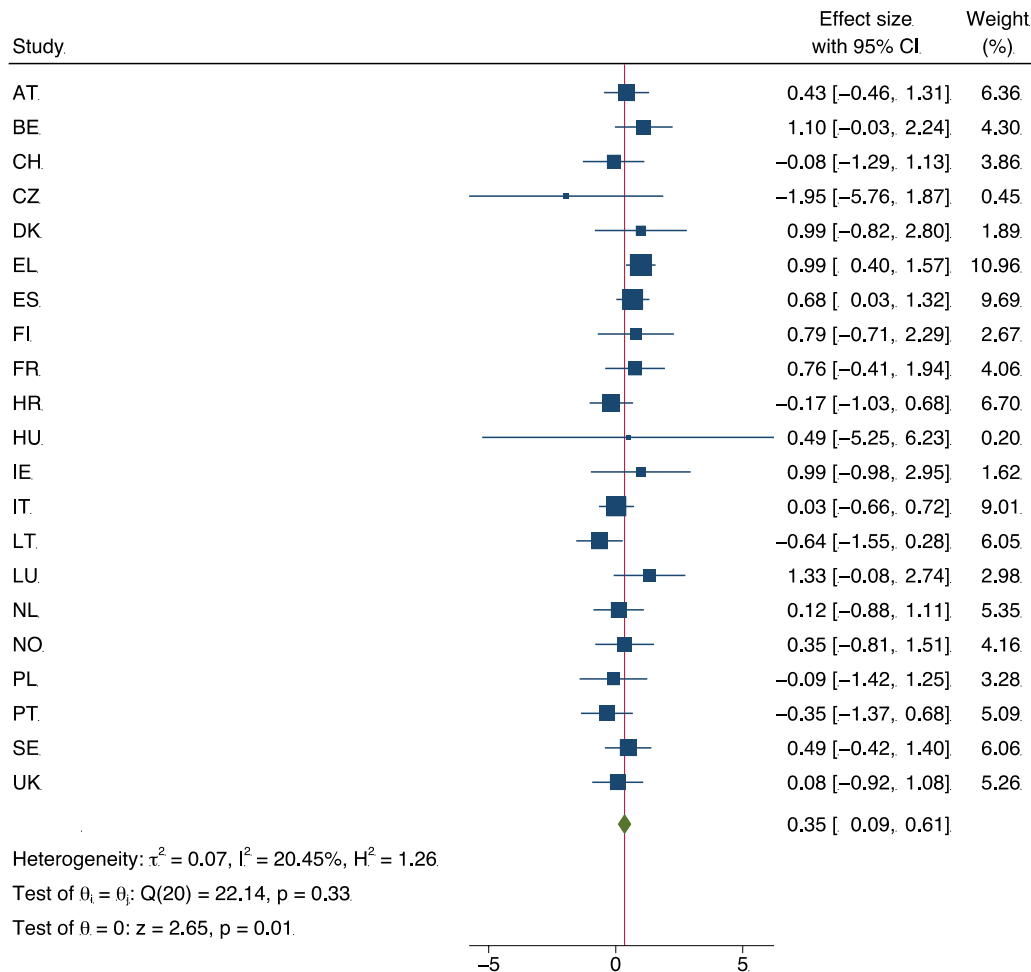
Note: Each square represents one immigration coefficient estimated in the first part of the paper using RIF regression. For example, the association between immigrants and the Gini coefficient is estimated at 0.28 in Austria with a confidence interval of [0.16, 0.41]. The size of the square is related to the precision of the estimate. The horizontal lines show confidence intervals.

Source: Authors' computation, EU-SILC cross section 2018 (UDB 2018 – version 1 September 2019 release)

Results concerning the Foster-Wolfson index of bi-polarization are similar to the results of the Gini in that we find a statistically significant combined effect for non-EU-born immigrants on polarization, but not for EU-born immigrants (Figure 8 and Appendix E). The combined effect size of non-EU-born immigrants on the Foster-Wolfson polarization coefficient is larger compared to the Gini index, suggesting a substantial effect of non-EU immigrants on polarization. Yet, we cannot reject the test of homogeneity across countries and find only a relatively small amount, $I^2=20\%$, of the variability in RIF coefficients to be due to between-study differences. In contrast, the effect of EU-born immigrants is statistically insignificant and

small (0.01), and both the test of heterogeneity and the null hypothesis cannot be rejected (Appendix E).

Figure 8: Forestplot of the cross-national variation in the association between immigration and the Foster-Wolfson polarization coefficient, non-EU-born immigrant households 2018



Random-effects REML model

Note: Each square represents one immigration coefficient estimated in the first part of the paper using RIF regression. For example, the association between immigrants born outside the EU and the Foster-Wolfson polarization coefficient is estimated at 0.43 in Austria with a confidence interval of [-0.46, 1.31]. The size of the square is related to the precision of the estimate. The horizontal lines show confidence intervals.

Source: Authors' computation, EU-SILC cross section 2018 (UDB 2018 – version 1 September 2019 release)

1.6.3 Effect heterogeneity: Meta-regressions with macro-level factors

Given the variation we find between countries in terms of effect sizes, particularly for the Gini index, we perform meta-regressions to examine factors that may help us explain those cross-country differences.

First, we examine the effect of population shares of EU and non-EU-born immigrants. Although we estimated separate effects for the two immigrant groups in the RIF regressions earlier, we suspect there could be an additional effect coming from the overall composition of the immigrant population in each country. Ideally, we would prefer a more detailed decomposition of the immigrant population by legal category of entry and residence since those guide the access of immigrants to social services and redistribution benefits (Koning, 2019; Römer, 2017; Sainsbury, 2012). Unfortunately, those data are not available for all countries.¹³ We therefore include information on legal categories in the discussion where it is available but leave it out of the regression analysis.

Second, economic conditions are likely to influence how immigrants contribute to inequality and income polarization. In particular, we would expect that in prosperous countries with low unemployment rates, immigrants contribute relatively less to inequality and polarization. Immigrants often hold jobs that are less stable, making them more vulnerable to becoming jobless or slip into poverty at times of economic downturns (Fix et al., 2009). Low-skilled migrants often occupy precarious position in the labour market (Tilly, 2011).

Third, we examine the effect of welfare regimes and their role in shaping the contribution of immigration to inequality and polarization. Welfare policies can play a considerable role in reducing net income inequality, so it is only plausible that difference in benefit generosity and access impact our RIF results. Yet, the access may be different for immigrants than for natives since the rules guiding them depend on the legal status of the immigrant.

For the meta-regression, we combine cross-sectional EU-SILC data from three years, 2008, 2013 and 2018, which produces a combined 121 country-years.¹⁴ We then regress conditional country RIF estimates on selected country-level covariates: GDP, unemployment rate, population shares of EU and non-EU immigrants as well as the welfare state classification based on Ferrera (1996). Because not all of the countries covered in our analysis are included in Ferrera's work, we expanded his classification to include Iceland in the group of Nordic regimes and added a separate category for countries from Eastern Europe (see Appendix F for sources and details on the country groups). In addition, we include an indicator to distinguish RIF-regression coefficients pertaining to EU- or non-EU-born immigrant households, as

¹³ The OECD generally collects information about the distribution of residence permits. Yet, these are not available for the Eastern European countries in our study (CZ, HU, LT, PL) nor Iceland or Greece (OECD, 2020).

¹⁴ This includes two IF coefficients (EU and non-EU) per country-year, three years and 21 countries. The total number of observations is 121 because Croatia and Slovakia do not have data available in all three years.

previously in our analyses, and year fixed-effects. Table 2 shows which factors are related to the impact of immigrants on the Gini coefficient (left) and the Foster-Wolfson index of polarization (right).

Table 2: Meta regression results for RIF of Gini and Foster-Wolfson polarization indices, 2008, 2013 and 2018 pooled cross-section

	RIF Gini	RIF Foster-Wolfson
EU-born (ves/no)	-0.09*** (0.03)	-0.23 (0.16)
EU share	0.01*** (0.00)	0.03** (0.02)
Non-EU share	-0.01** (0.01)	-0.10** (0.03)
GDP (log)	-0.17* (0.10)	-1.27** (0.55)
Unemployment rate	-0.00 (0.00)	-0.02 (0.02)
Welfare state :		
Scandinavian	0.20*** (0.07)	0.70* (0.36)
Bismarckian	0.23*** (0.06)	0.86*** (0.29)
Southern	0.15** (0.07)	0.01 (0.34)
Eastern	-0.07 (0.11)	-0.49 (0.59)
Year fixed-effects :		
2013	0.08** (0.04)	0.38* (0.21)
2018	0.00 (0.04)	0.16 (0.21)
Constant	1.87* (1.03)	13.85** (5.76)
<i>N</i>	121	121
Residual heterogeneity :		
Tau ²	0.01	0.31
I ² (%)	57.87	48.64
R-squared (%)	37.66	18.34
Wald chi ² (7)	47.38	27.42
Prob > chi ²	0.00	0.00

Note: Standard errors are reported in parentheses. *, **, *** indicates significance at the 90%, 95%, and 99% level, respectively.

Source: Authors' computation, EU-SILC cross section 2018 (UDB 2018 – version 1 September 2019 release)

The left column of the table shows that EU-born immigrant households contribute less to income inequality than immigrant households where all members are born outside of the EU – a difference of -9%. This is in line with our previous findings from the individual regressions and the analysis of effect sizes that showed immigrants from outside the EU to be more concentrated at the bottom of the income distribution. It is also true even though we use conditional RIF coefficients as regressands and thereby account for differences in household characteristics (see Section 5.1 above). We also find a small positive association between the

population share of EU-born immigrants and the contribution of immigrants to inequality. In contrast, the larger the share of immigrant households from outside the EU, the smaller is the impact of immigrants on inequality. Furthermore, the results suggest that a higher GDP is associated with lower impacts of immigrants on inequality, indicating a 17% decrease in the RIF Gini.

Lastly, welfare states appear to have important consequences for the contribution of immigrants to inequality. Compared to the liberal welfare model found in the United Kingdom and Ireland, Scandinavian, Bismarckian and Southern welfare states are associated with a 20%, 23% and 15% increase in the impact of immigrants on the Gini respectively. This relative advantage of the Anglo-Saxon model might seem counterintuitive since previous research underlines the benefits of generous welfare for immigrants (Römer, 2017; Sainsbury, 2012). Yet the nascent literature on the impact of welfare states on immigrants suggests that a high migrant disadvantage often results from the combination of large shares of humanitarian and family immigrants with generous social policies (Hooijer and Picot, 2015). Although natives may benefit from generous benefits in those countries, less favoured immigrants can suffer from diminished access. This is mirrored in our results, where the Scandinavian and Bismarckian countries of Northern and Western Europe display the largest negative effects compared to Ireland and the United Kingdom. Both the United Kingdom and Ireland have particularly low shares of humanitarian and family migrants compared to other European countries. In 2016, only 1.5% of all immigrant inflows in Ireland were humanitarian and 3.7% in the UK. In comparison, 28.9% of all inflows to Austria were humanitarian, 17.9% in the Netherlands and 51.8% in Sweden (OECD, 2018). In addition, Hooijer and Picot (2015) note that the design of social benefits in Sweden creates strong disincentives for one-earner married couples with children. While this family type is not common among natives who mostly adopt a dual-earner family model, it is widespread among low-skilled immigrants. Despite supportive integration policies and a large welfare state, non-EU immigrants in Sweden thus face a systematically higher risk of poverty, increasing inequality. Our analysis lends support to the results of Hooijer and Picot (2015) in that they show a larger contribution of immigrants to inequality among welfare states that tend to be more generous. It appears likely that this is connected to the composition of those countries' immigrant populations and particularly their rights in accessing social benefits.

The lower panel of the table reports model summary statistics and tests. T^2 is an estimate of the variance of the true effect sizes and small in our case. We find moderate levels of between-country variation to remain even after accounting for immigrant shares, GDP and

unemployment ($I^2=58\%$). The regressors explain 38% of the between-country variance (R^2). Wald χ^2 tests whether all coefficients in our model other than the intercept are equal to zero, which we can reject.

The RIF polarization results are shown on the right column and are overall similar to the results of the RIF Gini. Larger population shares of non-EU-born immigrants and higher GDP are associated with a decreasing impact of immigrants on polarization. Furthermore, the Scandinavian and Bismarckian welfare regimes appear to intensify the impact of immigrants on polarization, by 70% and 86% compared to the Anglo-Saxon model. However, higher prevalence of poverty among immigrants alone cannot explain the increasing impact on polarization. Instead, the results point towards a simultaneous concentration of immigrants at both the bottom and the top of the distribution (holding the distributions of income and household characteristics constant) which appears to be more prominent in Scandinavian and Bismarckian countries compared to Anglo-Saxon, Southern or Eastern European countries.

The model leaves 49% of the between-country variation unexplained (I^2), and only 18% are explained by the regressors. T^2 is much larger than for the Gini, suggesting more important variance of the true effect size. Based on the Wald χ^2 we can reject the hypothesis that all coefficients in our model other than the intercept are equal to zero.

Overall, it is interesting to note that the direction of effects is the same for both inequality and polarization. Factors that are associated with an increasing contribution of immigrants to inequality are thus also associated with an increasing impact on polarization, in particular GDP and welfare regimes.

1.7 Summary and conclusions

Our results show a large degree of variation across years, countries and indicators. However, a few conclusions can be drawn.

First, we find significant disadvantages in the position of foreign-born households relative to natives. The implication of their position is that foreign-born households tend to contribute negatively to inequality. The effect of immigrants on inequality is more salient than on income polarization, where many countries show no effect.

Second, foreign-born households are clearly a heterogenous group. Unfortunately, EU-SILC data do not reveal detailed information about the country of origin of foreign-born residents, one potential source of variation. The best we can therefore do is to distinguish between immigrants born in another EU country versus those born outside the EU. Perhaps

surprisingly, the direction of the effects remains the same for both subgroups across most of our indicators, despite a decade of EU integration. However, the (absolute) size of the effects is almost always smaller for EU-born residents, indicating a greater similarity to natives. Controlling for household characteristics further shows that the effect of EU-born residents shrinks starkly or disappears completely across most countries. This confirms that the estimated contribution of immigrants to inequality and polarization can be largely attributed to observed differences in education, employment and household composition for those born in other EU countries. However, the effect remains partly unexplained for those born outside of the EU.

Third, the combined cross-country effects of immigration on inequality and polarization, retrieved through meta-analysis, are significant for immigrants born outside of the EU but not for EU-born immigrants. In countries with a higher GDP, immigrants tend to contribute less to both inequality and polarization. However, unemployment appears to play no role. Most importantly, the meta regressions show how welfare regimes are involved in shaping the contribution of immigrants to inequality and polarization. Immigrants in Anglo-Saxon and Eastern-European countries contribute relatively less to inequality- and polarization than immigrants in Western and Nordic countries, despite their typically more generous social benefit schemes. However, it can be speculated that the composition and legal status of immigrant populations in Anglo-Saxon countries, with particularly few humanitarian and family immigrants, is one major reason for this observation.

Our analysis naturally does not cover all factors that could influence the position of immigrants in the income distribution. Future research could possibly focus on the economic sectors and industries that immigrants work in or further explore the role of immigration channels, data permitting. It is particularly noteworthy that no major immigration channel explicitly aims to attract middle-class immigrants, who would likely have an equalizing effect. Instead, immigration channels tend to be polarized – like the immigrant population – at either the high-earning, high skilled or the low-earning, little remunerated tail.

Our influence function regression results portray a purely descriptive picture from which the causal effect of immigrants on the total income distribution should not be inferred. Our contribution is instead to carefully document where foreign-born residents stand in the distribution of income, and to quantify their effect on inequality and polarization. From a larger viewpoint, the immigrant populations and their contribution to measures of poverty, inequality and deprivation are naturally embedded in each country's history and policy framework that ultimately determine who comes to a country and how they work and live.

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Appendix A. Definition of the effect of interest

Let $F(y)$ be the cumulative distribution function of the random variable y – in our case incomes – and $F_x(y)$ be the cumulative distribution function of y among each nativity group x taken separately – in our case natives, EU- and non-EU-born – which form a partition over K types. We can express the distribution F as a combination of the income distributions of different groups weighted by their respective population shares:

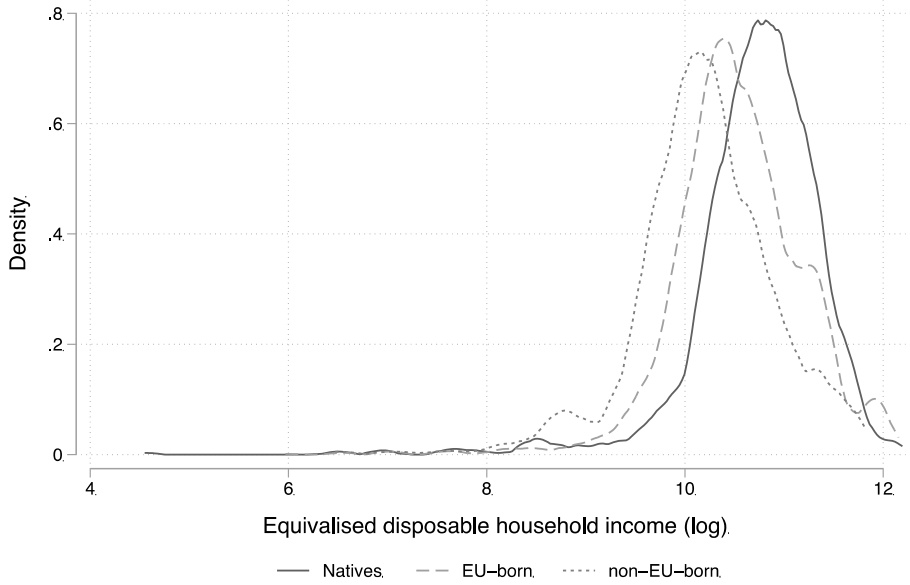
$$F(y) = \sum_{x \in \Omega_X} s_x F_x(y)$$

where Ω_X represents a set of K nativity groups and s_x the proportion of individuals each nativity group x in the population.

Figure 2 gives an illustration of this based on our two-group partition and using Luxembourg for the year 2018 as an example. It shows the density function of the equivalised disposable income distribution (on a logarithmic scale) for the native population along with the income distributions of EU- and non-EU-born households. The three groups exhibit slightly different distributions of income both in location and in spread.¹⁵ Given this complex configuration, the contribution of foreign-born households to overall inequality is far from obvious and is difficult to capture wholly from subgroup summary indicators.

Figure A1. Equivalised disposable income distribution in Luxembourg, 2018, by group (native, EU-born, non-EU-born households)

¹⁵ Note that the income definition used here, namely the equivalised disposable household income, is the most expansive available income definition and reveals relatively less differences between groups than other definitions like market income. This is because it considers taxes and social transfers and is further distributed across all members of a household.



Reading Note: Households in which at least one member is native-born show the overall highest mean equivalised disposable income and the lowest level of income inequality as measured by the Gini coefficient. In comparison, households in which all members are foreign-born have a lower mean income and a higher level of income inequality.

Source: Author's computation, EU-SILC cross section 2018 of Luxembourg (UDB 2018 – version 1 September 2019 release)

From there, a swap of native (the reference group r) for foreign-born (the group k) individuals holding conditional distributions constant would lead to the following distribution $G_0^{F,t,r,k}(y)$:

$$G_0^{F,t,r,k}(y) = (s_k + t)F_k(y) + (s_r - t)F_r(y) + \sum_{x \in \Omega_X \setminus \{k,r\}} s_x F_x(y)$$

The distributions F and G_0 are obtained swapping shares and differ only in the relative proportions of nationality groups r and k . They can conveniently be mixed in a distribution $H_\varepsilon^{F,G_0}(y)$:

$$H_\varepsilon^{F,G_0}(y) = (1 - \varepsilon)F(y) + \varepsilon G_0^{F,t,r,k}(y)$$

Where ε represent an infinitesimal change between distributions. Let us finally define $v(F)$ as the functional of interest related to F which refers here to the Gini coefficient and the polarization index. Our measure of interest is the functional derivative of $v(F)$ in the direction of G_0 which can be labelled the unconditional effect (UE) of an increase of the migrant group k on the social indicator $v(F)$:

$$UE(v(F), k) = \lim_{\varepsilon \downarrow 0} \frac{v(H_\varepsilon^{F, G_0}) - v(F)}{\varepsilon}$$

Conditional effects

Our approach has the advantage that it allows to assess the contribution of given characteristics conditionally on other relevant characteristics such as human capital or household characteristics that may actually account for differentials between migrants and natives.

Starting from previous notations, let z refer to a (set of) covariate(s) of interest. We can then write the following conditional distribution:

$$F_z(y) = \sum_{x \in \Omega_x} s_{x|z} F_{x|z}(y)$$

Consider a swap of native for foreign born residents while keeping constant the conditional distributions $F_{x|z}$ and the distribution of covariates ζ :

$$G_1^{F, t, r, k}(y) = \int_{\Omega_z} \left((s_{k|z} + t) F_{k|z}(y) + (s_{r|z} - t) F_{r|z}(y) + \sum_{x \in \Omega_x \setminus \{k, r\}} s_{x|z} F_{x|z}(y) \zeta(z) dz \right) \zeta(z) dz$$

From there, we can define the conditional effect (CE), or unconditional *partial* effect, on the social indicator $v(F)$ as:

$$CE(v(F), k) = \lim_{\varepsilon \downarrow 0} \frac{v(H_\varepsilon^{F, G_1}) - v(F)}{\varepsilon}$$

Estimation by the influence function

UE and CE can be estimated by using the *influence function* (IF). In a nutshell, the influence function of v is a function of y and F which captures the effect on $v(F)$ of an infinitesimal *contamination* of F at income y (Hampel, 1974).

Choe and Van Kerm (2018), extending Firpo et al (2009), show that:

$$UE(v(F), k) = (E[IF(y; v, F)|X = k] - E[IF(y; v, F)|X = r]) \times t$$

A regression-based estimator is provided by:

$$E[IF(y; v, F)|X = x] = \alpha + x\beta$$

Where x is a vector of $K - 1$ nativity types dummies with the reference type r (natives) excluded,

Similarly, the unconditional partial effect can be re-expressed as a function of expected influence functions:

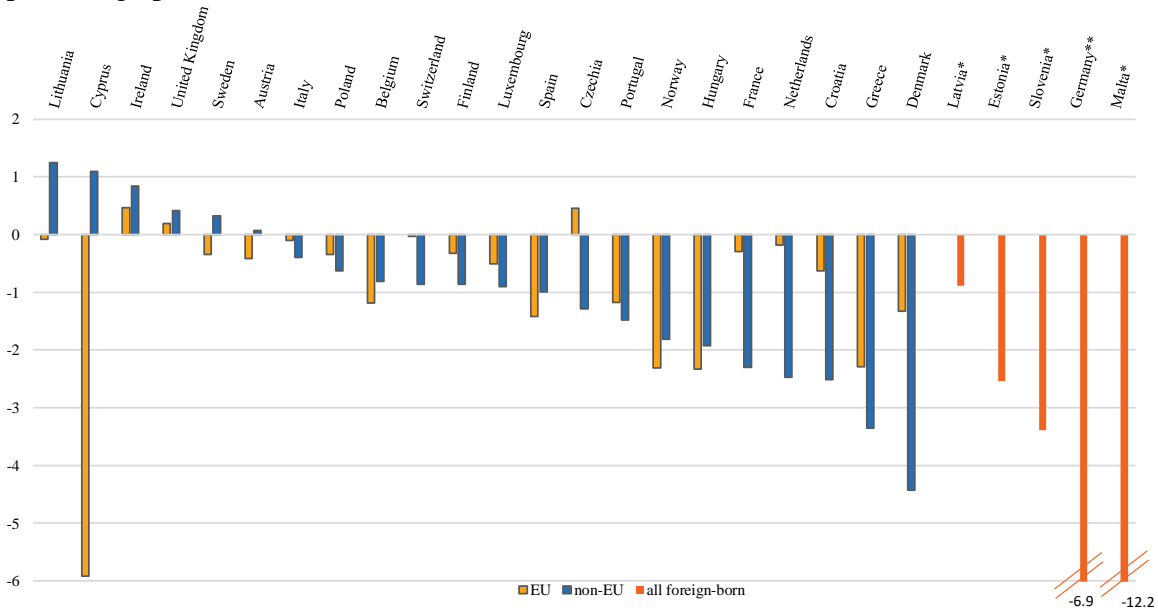
$$CE(v(F), k) = t \times \int_{\Omega_z} E[IF(y; v, F)|X = k, Z = z] - E[IF(y; v, F)|X = r, Z = z] \zeta(z) dz$$

The simplest regression-based estimator assumes:

$$E[IF(y; v, F)|X = x, Z = z] = \alpha + z\gamma + x\beta$$

Appendix B. Comparison of EU-SILC and national counts of foreign-born populations

Figure B1: Foreign-born proportions in EU-SILC compared to national counts, population aged 16+ (EU-SILC) and 15+ (Eurostat), 2018 (percentage points)



Reading Note: Compared to national reference values, the Belgian EU-SILC sample underestimates the population share of EU-born immigrants by 1.2 percentage points. It underestimates the share of non-EU-born immigrants by 0.8 percentage points.

Note: The figure shows the population share of foreign-born persons aged 16+ in the EU-SILC or 15+ in the national reference statistics taken from Eurostat. National counts are not available for Serbia. Iceland and Slovakia are not covered in the 2018 EU-SILC. * In the EU-SILC, Estonia, Latvia, Slovenia and Malta do not reveal information on country of birth. Their values therefore refer to the sum of EU and non-EU-born immigrants. ** Germany also distinguishes neither EU from non-EU-born immigrants but it further doesn't break down its foreign-born population by age groups in the statistics provided to Eurostat. The German value therefore compares the foreign-born population aged 16+ in the EU-SILC to the total foreign-born population in Eurostat data.

Source: Authors' computation, EU-SILC cross section 2018 (UDB 2018 – version 1 of September 2019) and Eurostat table [migr_pop3ctb] from which we calculate population shares.

Appendix C. Inequality and polarization levels, 2018

Table C1: Gini coefficients by country, from lowest to highest, 2018

Country	Gini	Country	Gini	Country	Gini
CZ	.24	DK	.27	EL	.32
NO	.25	PL	.28	PT	.32
BE	.25	FR	.28	ES	.33
FI	.26	HU	.28	IT	.33
SE	.27	IE	.29	LU	.33
AT	.27	HR	.30	UK	.34
NL	.27	CH	.30	LT	.37

Source: Authors' computation, EU-SILC cross section 2018 (UDB 2018 – version 1 September 2019 release)

Table C2: Foster-Wolfson polarization coefficients by country, from lowest to highest, 2018

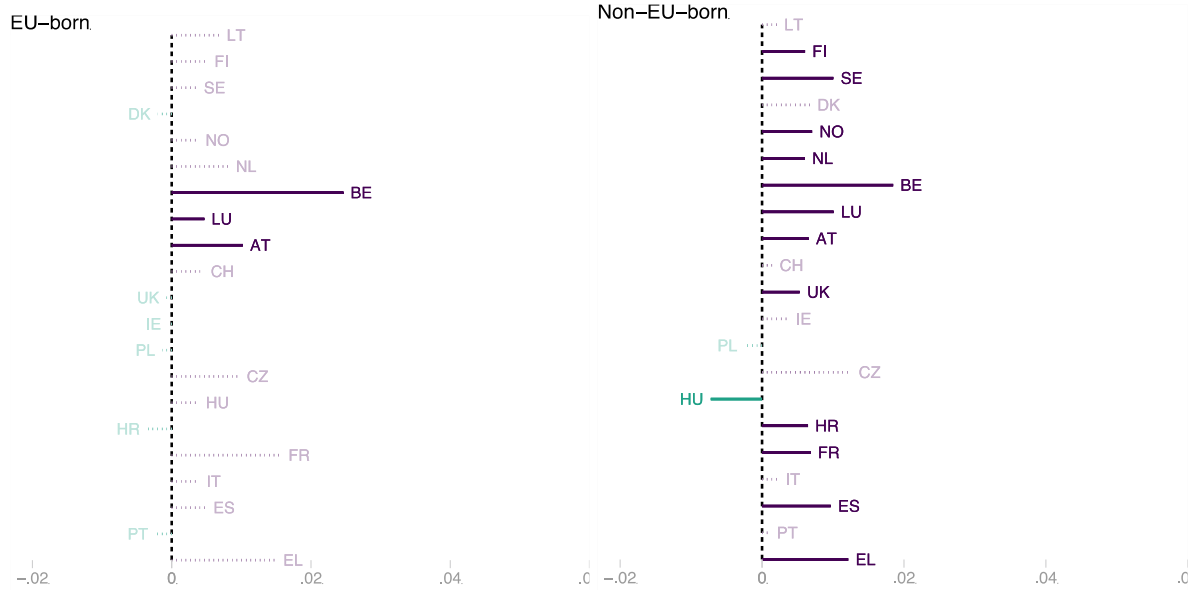
Country	Foster-Wolfson index	Country	Foster-Wolfson index	Country	Foster-Wolfson index
NO	.45	NL	.51	EL	.62
CZ	.46	FR	.53	IT	.64
BE	.48	PL	.53	PT	.64
FI	.49	HU	.54	ES	.66
SE	.50	IE	.56	LU	.67
DK	.51	CH	.57	UK	.68
AT	.51	HR	.58	LT	.76

Source: Authors' computation, EU-SILC cross section 2018 (UDB 2018 – version 1 September 2019 release)

Appendix D. 2013 and 2008 effects on inequality and polarization

Figure D1: Unconditional and conditional effects of EU and non-EU-born households on the Gini coefficient by country, 2013

Panel a. Unconditional effects:



Panel b. Conditional effects:

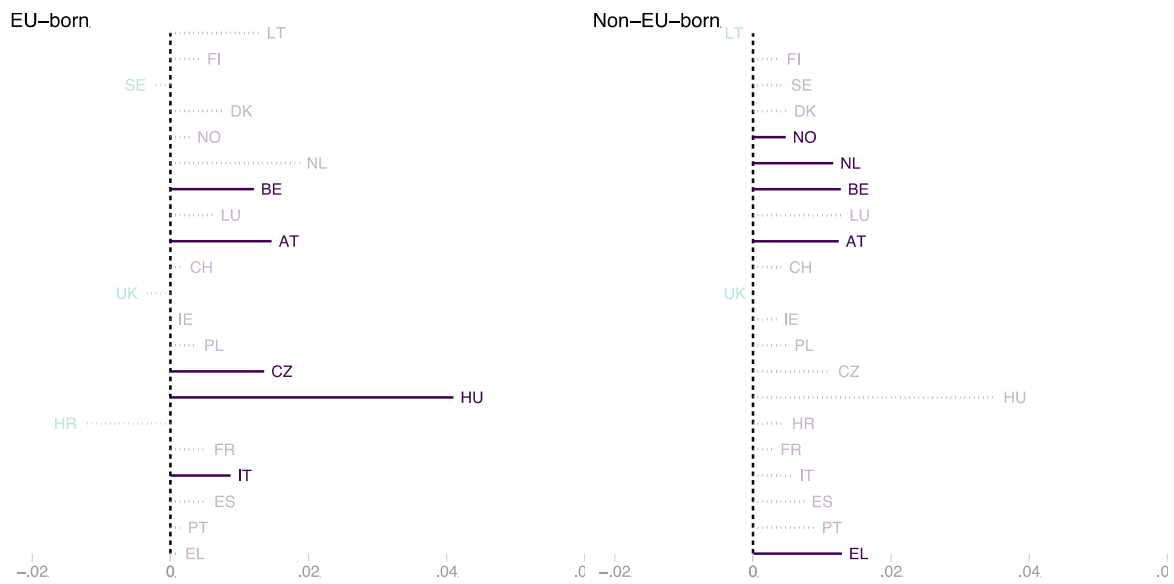
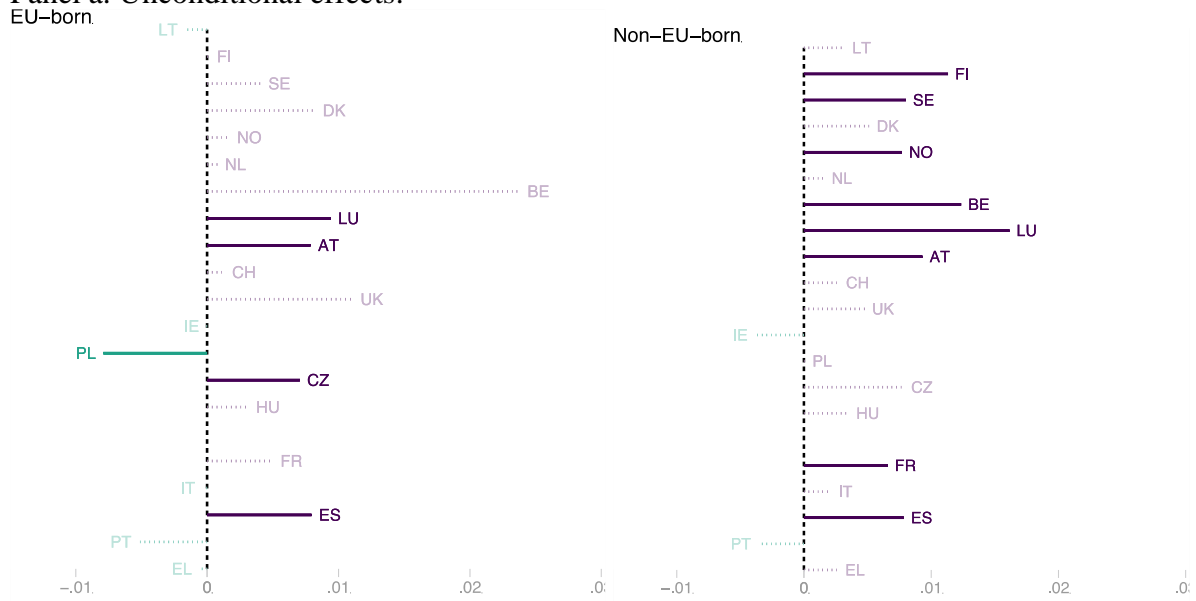


Figure D2: Unconditional and conditional effects of EU and non-EU-born households on the Gini coefficient by country, 2008

Panel a. Unconditional effects:



Panel b. Conditional effects:

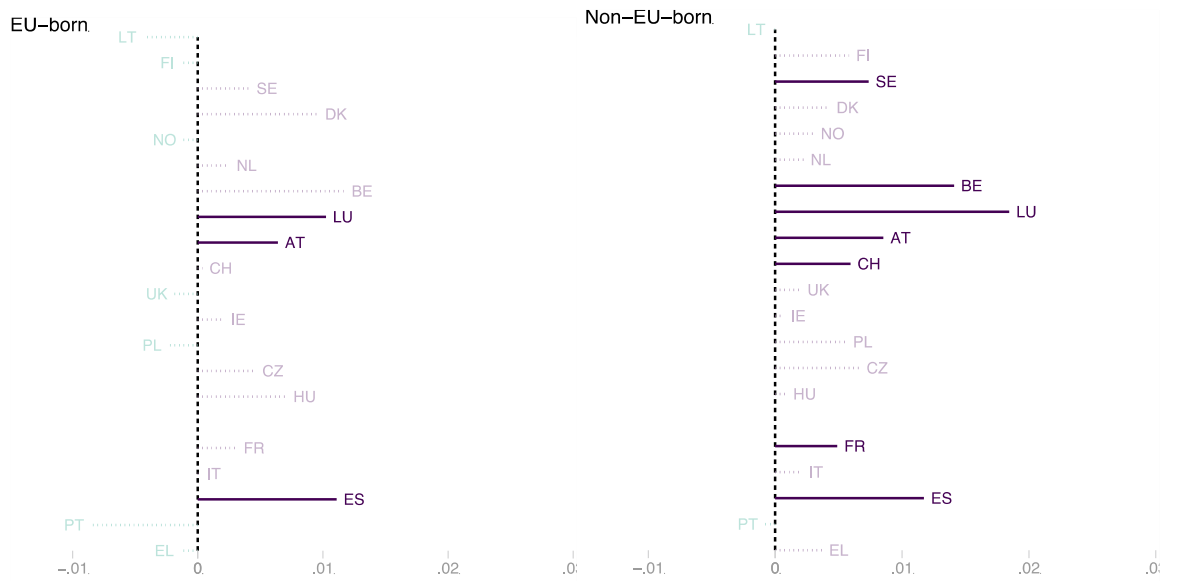
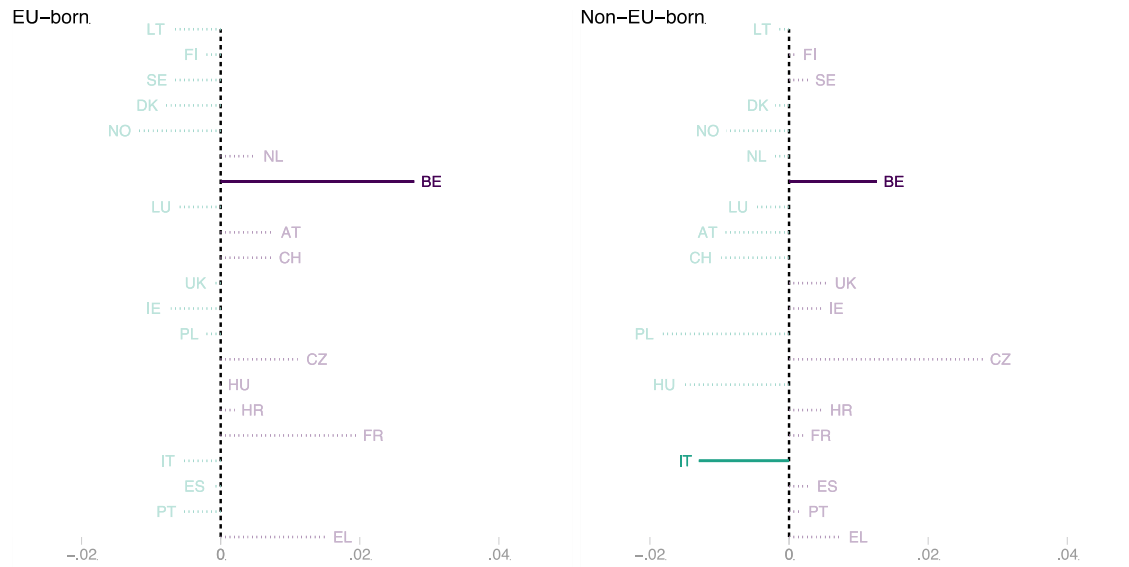


Figure D3: Unconditional and conditional effects of EU and non-EU-born households on the Foster-Wolfson index of polarization by country, 2013

Panel a. Unconditional effects:



Panel b. Conditional effects:

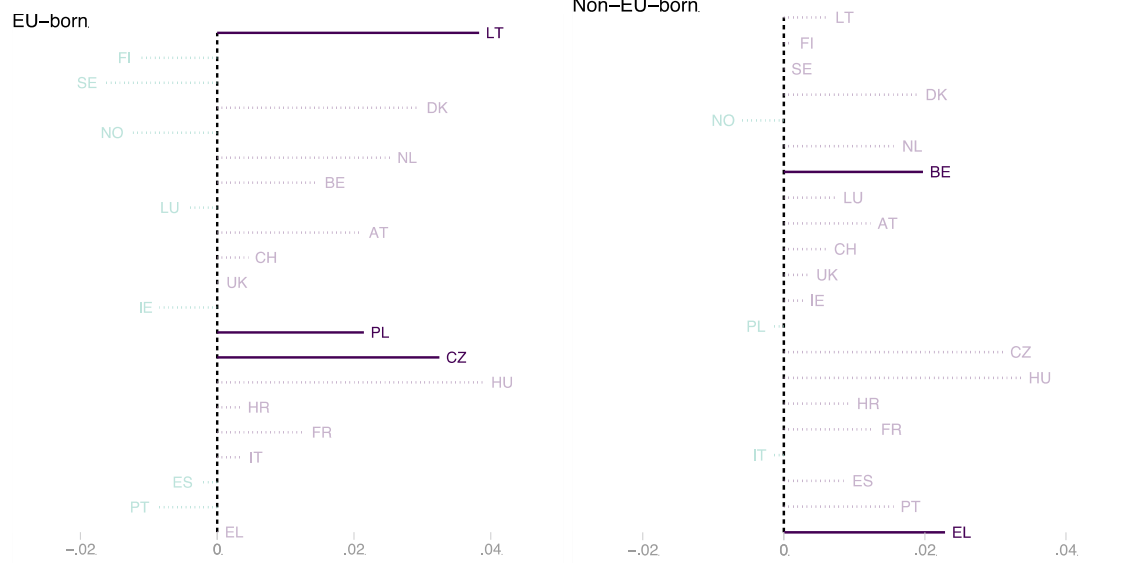
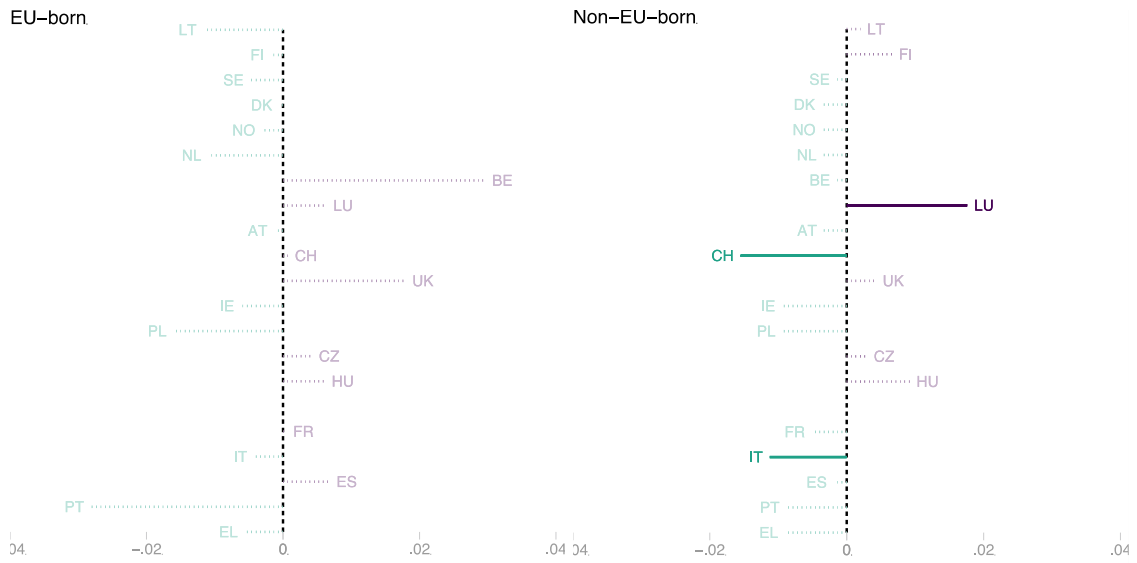
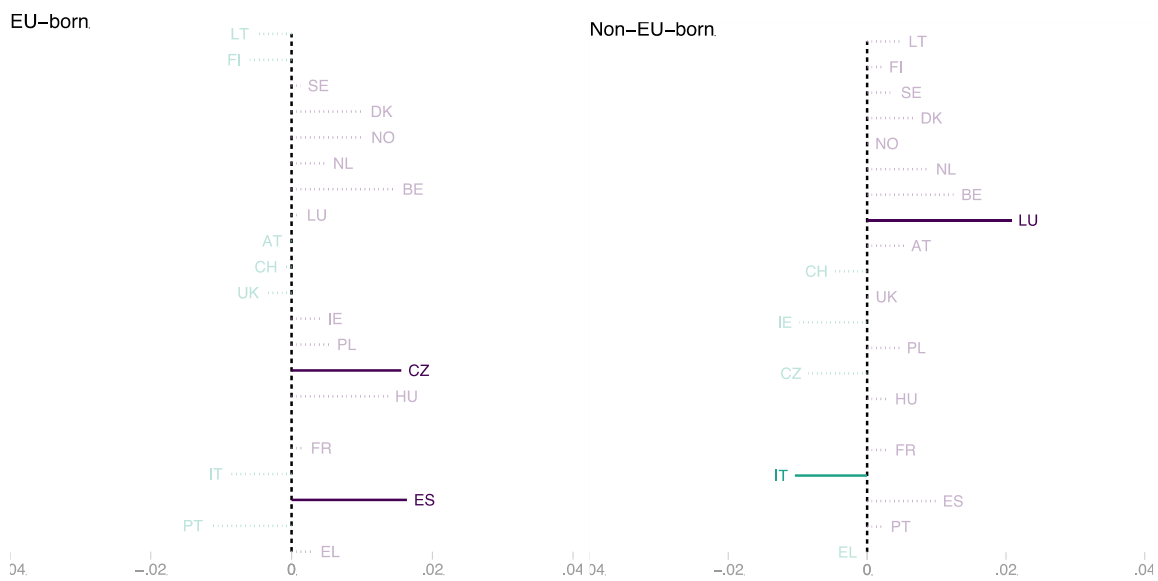


Figure D4: Unconditional and conditional effects of EU and non-EU-born households on the Foster-Wolfson index of polarization by country, 2008

Panel a. Unconditional effects:

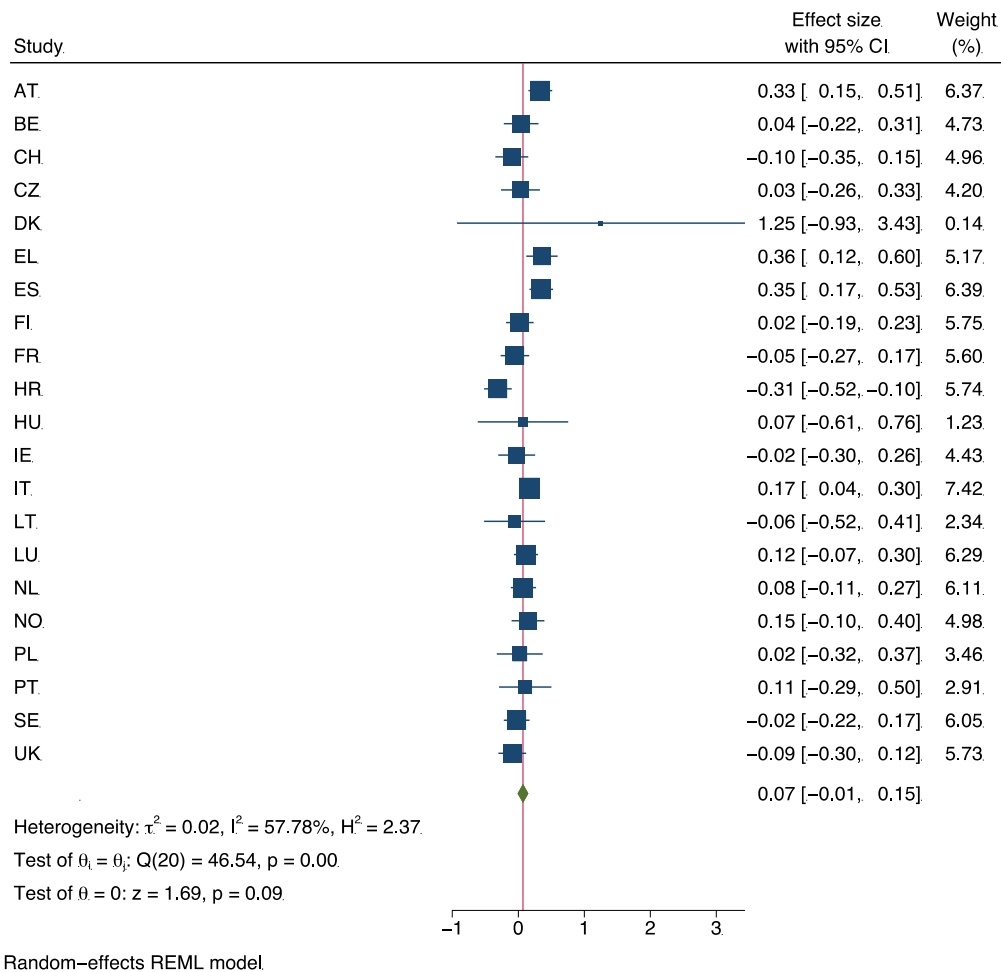


Panel b. Conditional effects:



Appendix E. Combined effects of EU-born immigrants

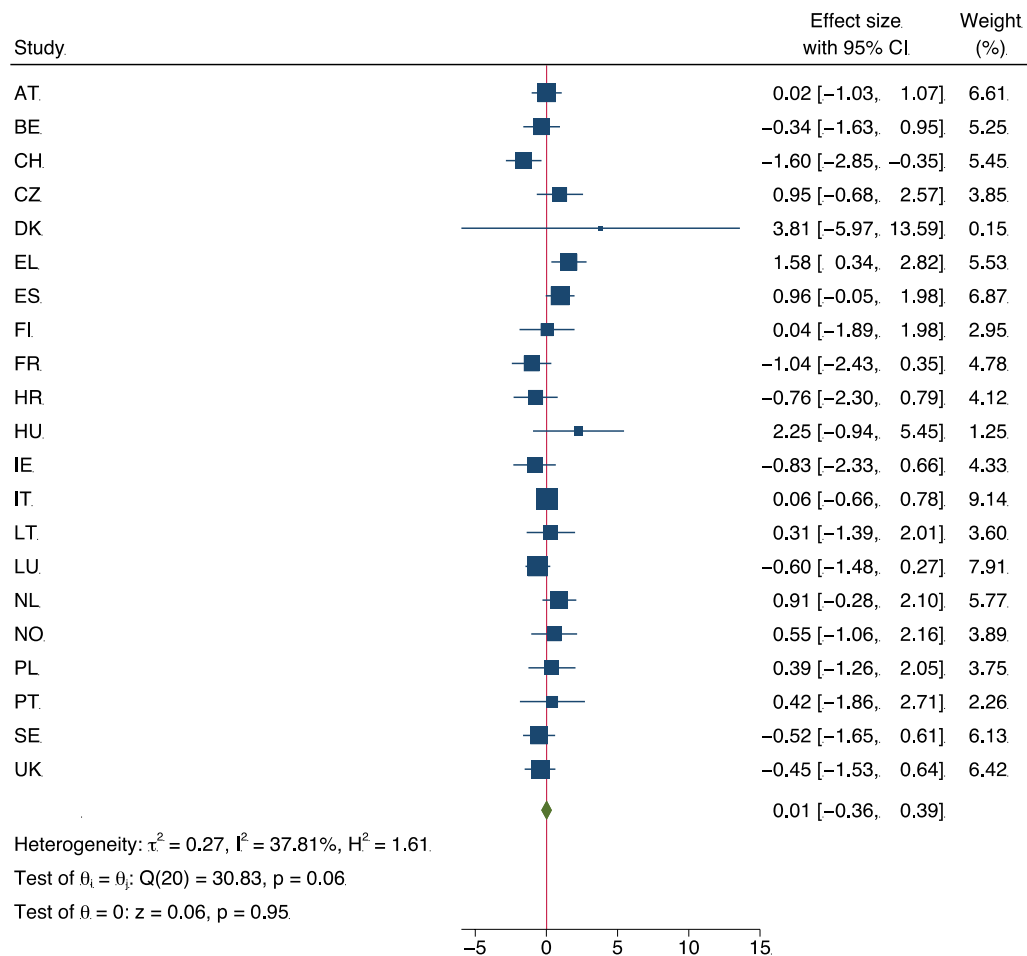
Figure E1: Forestplot of the cross-national variation in the association between immigration and the Gini coefficient, EU-born immigrant households 2018



Reading Note: Each square represents one immigration coefficient estimated in the first part of the paper using RIF regression. For example, the association between EU-immigrants and the Gini coefficient is estimated at 0.33 in Austria with a confidence interval of [0.15, 0.51]. The size of the square is related to the precision of the estimate. The horizontal lines show confidence intervals.

Source: Authors' computation, EU-SILC cross section 2018 (UDB 2018 – version 1 September 2019 release)

Figure E2: Forestplot of the cross-national variation in the association between immigration and the Foster-Wolfson coefficient of bi-polarization, EU-born immigrant households 2018



Random-effects REML model.

Reading Note: Each square represents one immigration coefficient estimated in the first part of the paper using RIF regression. For example, the association between EU-immigrants and the Foster-Wolfson index of bi-polarization is estimated at 0.02 in Austria with a confidence interval of [-1.03, 1.07]. The size of the square is related to the precision of the estimate. The horizontal lines show confidence intervals.

Source: Authors' computation, EU-SILC cross section 2018 (UDB 2018 – version 1 September 2019 release)

Appendix F. Variable definitions

Table F1: Variable definitions for the meta regressions

Variable	Source	Variable definition
Unemployment rate	Eurostat (TPS00203)	Total unemployment rate, percent of population in the labour force, 15-74 years
GDP	Eurostat (nama_10_pc)	Gross domestic product at market prices, euro per capita, in log
Population share of EU-born immigrants	Country-of-birth variable taken from EU-SILC	Population share of EU-born persons aged 16+ of total population aged 16+
Population share of non-EU-born immigrants	Country-of-birth variable taken from EU-SILC	Population share of non-EU-born persons aged 16+ of total population aged 16+
Welfare state classification	Ferrera (1996)	<p>1 – Anglo-Saxon (IE, UK)</p> <p>2 – Scandinavian (DK, FI, IS, NO, SE)</p> <p>3 – Bismarckian (AT, BE, FR, LU, NL, CH)</p> <p>4 – Southern (EL, IT, PT, ES)</p> <p>5 – former USSR (CZ, HR, HU, LT, PL, SK)</p>

CHAPTER 2

IMMIGRATION AND WELL-BEING IN LUXEMBOURG

Rhea Ravenna Sohst¹⁶

2.1 Introduction

Immigration is driving the populations of virtually all affluent countries more diverse. The trend has evoked concerns about social cohesion and the well-being of societies (Putnam, 2007). Yet previous research gives no conclusive answer as to how immigration affects the well-being of receiving societies, suggesting at times positive (Akay et al., 2014 and 2017; Betz and Simpson, 2013) or negative effects (Longhi, 2014; Kuroki, 2018) – and sometimes none at all (O’Connor, 2020).

The differing outcomes in the literature point towards a large degree of heterogeneity across countries which cannot be adequately addressed by international comparisons. Indeed, it seems plausible that the question of how immigration affects the well-being of receiving societies must depend on the concrete circumstances of each country, including the composition of the immigrant population and the historical context. Luxembourg provides an interesting case study to that effect. Among OECD countries, it is an outlier in terms of immigrant shares and economic growth. In fact, immigrants are a major pillar of the country's prosperity. With over 40% of its population holding a foreign nationality and an average annual wage of over 52 000€ in 2011, it ranks among the top on both measures (OECD, 2018a and 2018b). Foreigners in Luxembourg tend to be EU nationals, with a majority coming from the neighbouring three countries, Portugal and Italy, and tend to find jobs easily. The employment rate is in fact higher for foreigners than for natives. The OECD (2017) therefore estimates that immigrants contribute 2% of GDP to the overall budget, the largest share recorded.

In this paper, I investigate the relationship between immigration and the well-being of natives in Luxembourg (measured by self-reported life satisfaction). I use the 2011 wave of the Luxembourgish Socio-Economic Panel, a wave surveying a particularly large sample, combined with Census data to exploit variation in local immigrant shares across the 102 municipalities. To account for the endogeneity of immigrants’ location choices, I propose a

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new version of the classic shift-share instrument in which I predict initial shares by their proximity to iron ore deposits in Luxembourg. The results suggest that immigrants have no impact on the well-being of the Luxembourgish population overall. However, I find that the younger and particularly the college-educated do experience small negative effects, pointing towards potential competition between immigrants and natives with a similar profile.

I begin the paper with a discussion of how we might think about the links between immigration and well-being. I also review previous empirical studies and common empirical strategies to estimate the impact of immigration, notably instrumental variables and the shift-share instrument. In section 3, I present my data and methodology, including the alternative version of the shift-share instrument that I propose. Section 4 covers the results of my analysis, exploring heterogeneous impacts across population sub-groups and compositional effects of the immigrant population. Section 5 concludes.

2.2 Conceptual and empirical framework

2.2.1 Conceptual framework

A key question of the immigration debate concerns the impact of immigration on the welfare of natives. Studies show how immigration impacts employment, education and other objective measures of natives' living conditions. Yet, human welfare is insufficiently captured by these factors alone. As a result, subjective well-being has increasingly gained traction as a more comprehensive measure of utility. Past research shows that well-being is influenced by a multitude of factors in a person's life, including their income, social connections and health. However, contrary to purely objective measures, it also captures a personal experience and perception of reality that is affected by these objective measures but not completely determined by them (Arrondo, Carcaba and Gonzalez, 2020).

To conceptualize the relationship between immigration and subjective well-being, it is thus useful to think along those two lines: the impact of immigrants on factors determining well-being, and their impact on the personal experience of natives. Much attention has been paid to the impact of immigrants on competition for jobs and wages for instance. Immigration can indeed alter the size and composition of the labour force in receiving countries. However, research shows that the effect of immigration on employment and wages is mostly negligible, or at least small, localised and short-lived (Card, 2005). Yet there are other ways in which immigrants can impact the living circumstances of natives. Immigration can increase the demand for housing, pushing up rents (Saiz, 2007). They may also negatively impact the quality

of education in public schools by increasing class sizes and limit learning progress – not least because of their limited proficiency in the language of the receiving country (Brunello and Rocco, 2011; Brunello, Lodigiani and Rocco, 2020).

In addition to impacting determinants of well-being, immigration can have an impact on the personal experiences and perception of reality of natives. According to Becker's theory on discrimination (1957), people generally prefer people of their own race over people of other races because he suggests it provided evolutionary advantages. In the same spirit, Alesina et al. (2001, p. 227) suggest that "human beings are genetically programmed to form in-group, out-group associations and to prefer members of what they perceive as their own group". In the United States, racial fragmentation has indeed been shown to be associated with a higher incidence of riots, lower levels of trust, lower participation in social activities and a higher probability of people to cheat on each other, among others (Denise DiPasquale and Glaeser, 1998; Alesina and La Ferrara, 2000; Glaeser et al., 2000).

In contrast, immigration can improve the well-being of natives for the same reasons it can impair it, namely by generating positive changes in the living circumstances of natives or by confirming beliefs and preferences held by natives about immigrants. Concerning the labour market for example, Peri (2009) and Ottaviano and Peri (2005 and 2006) show that immigrants expand the productivity of receiving societies, even increasing wages and adding to total employment. Buchardi et al. (2020) demonstrate the positive impact of immigration on innovation. Concerning education, Hunt (2017) shows that receiving immigrant pupils at school increases the probability of natives to complete high school in the United States. Studies have further shown that immigrants can increase home values in struggling markets (Myers, 2007), and that their presence in rural places can encourage persons to follow and generate population growth (Vigdor, 2013).

Personal preferences for more immigration are also strong in a subset of the population. According to the European Social Survey (Heath and Richards, 2016), around 10% of respondents support "allowing many more [immigrants] to come and live here." Social identity theory offers one explanation for those positive attitudes towards immigrants. It suggests that natives could approve of immigration if their group identity is strongly linked to notions of fairness, equality, or social justice (Card, Dustmann & Preston, 2005). Recalling the scenes of 2015, in which Syrian asylum seekers arrived in Germany and were greeted by tropes of volunteers and emphatic Germans seems to support that theory (Graham-Harrison et al., 2015).

Given the vast body of research showing evidence for impacts of immigration that could be both increasing and decreasing the well-being of natives, it seems unwise to try to

theoretically detangle and weight these aspects. Instead, a growing number of studies have started to directly assess the link between immigration and natives' well-being.

2.2.2 Existing empirical evidence

While most studies focus on the impact of immigration on objective factors (discussed above), more attention has been brought in the past decade on the specific relationship between immigration and well-being.

Well-being has increasingly gained recognition as a measure that captures the overall welfare of individuals. It refers to how people experience and evaluate their lives (National Research Council, 2013) and goes beyond standard measures of economic production or living standards by including both material and immaterial factors influencing our quality of life. That life satisfaction is connected to a wide range of real-life outcomes has been shown in numerous studies, including its connection to unemployment, age, income and wealth, and marital status (Clark, 2003; Frey and Stutzer, 2002; D'Ambrosio, Jäntti and Lepinteur, 2019; Clark and Oswald, 1994). Yet in addition, it captures aspects that are difficult to observe and quantify otherwise. As such, subjective well-being has at times been more accurate at predicting future behaviour of societies than more traditional indicators like economic growth (OECD, 2013).

The evidence on the association between immigration and life satisfaction has grown substantially in past years. In the United States, Kuroki (2018) finds a negative association between immigration and well-being across counties. Increasing the share of non-Whites by 10 percentage points is associated with a small, 0.006 points reduction in life satisfaction for White men, given a four-point scale. The effect is driven by the presence of Blacks, and stronger for older White populations than the young. Kuroki's findings appear to be in accordance with the arguments brought earlier by Alesina et al. (2001) that underline the importance of ethnic cleavages in the United States. Yet, similar results have also been found in the United Kingdom. Longhi (2014) reveals that White British natives are less satisfied with their lives when they live in diverse areas. However, the same is not true for non-White British natives, for whom there is no association between life satisfaction and residential diversity. Besides ethnic dividing lines, Ivlevs and Veliziotis (2017) suggest that the results are differentiated by socio-demographic groups. They study the effect of immigration on life satisfaction following the eastern EU enlargement. Residents that were older, unemployed and low-income experienced a dip in life satisfaction following immigrant inflows whereas the younger, employed and educated experienced a rise in their life satisfaction levels. In contrast to these findings,

Papageorgiou (2018) finds no significant impact at all on natives in the United Kingdom. Outside of the United Kingdom, two prominent studies by Akay et al. (2014 and 2017) find a robust, positive effect of immigration on natives' wellbeing in Germany. Their results suggest that the positive effect of ethnic diversity is stronger for immigrant groups that are culturally and economically closer to Germany. Yet, in contrast to Longhi (2014), they show that natives experience lower well-being in areas that are ethnically homogenous.

well-being is relatively lower when they live in ethnically homogeneous areas. Lastly, two internationally comparative studies assess the effect of immigrant shares on national life satisfaction. Betz & Simpson (2013) study 26 European countries between 2002 and 2010 and find an overall positive impact on the well-being of natives. However, their results are very small in magnitude and in practical application since only large immigrant flows would affect native well-being significantly. O'Connor (2020) also studies European countries but finds no effect on the well-being of natives.

Table 1. Previous research on the impact of immigration on native well-being

Author	Effect Direction	Region
Betz & Simpson (2013)	positive	Europe
Longhi (2014)	negative	Britain
Akay et al. (2014, 2017)	positive	Germany
Ivlevs & Veliziotis (2017)	positive for young, high-income negative for older, low-income	England & Wales
Kuroki (2018)	negative	United States
Papageorgiou (2018)	neutral	United Kingdom
O'Connor (2020)	neutral	Europe

Source: Author's own elaboration

The differing outcomes in the literature point towards a large degree of heterogeneity across countries which cannot be adequately addressed by international comparisons. Indeed, it seems plausible that the question of how immigration affects the well-being of receiving societies

must depend on the concrete circumstances of each country, including the composition of the immigrant population and the structure of the economy. Luxembourg, with its particularly large immigrant population, provides a useful case study to identify potential effects. Except for an unpublished master thesis by Loera-Vargas (2015), no study has yet assessed the evidence in Luxembourg.

In addition, methodological differences may explain why results vary across studies. Identification strategies can be particularly sensitive when assessing any effect of immigration since immigration is methodologically prone to the pitfalls of endogeneity. In the following section, I discuss the difficulties associated with estimating causal effects of immigration and present advances and solutions that have been recently suggested.

2.2.3 Common empirical strategies

Identifying the impact of immigration is tricky because of various confounding factors. Most critically, the allocation of immigrant populations across different areas is not a random process. If the decision of immigrants to locate in certain places is related to the life satisfaction of natives (either directly or through correlated but unobserved reasons) determining whether immigrants move to places with already greater life satisfaction or whether immigrants improve the life satisfaction of the local population is difficult. At the same time, natives that are unhappy could move out of areas that experience large immigration inflows, which would erroneously suggest a positive correlation between immigration and life satisfaction. Lastly, we can't exclude the possibility that immigration and life satisfaction are jointly determined by an omitted, unobserved third factor, such as a strong labor market that would attract immigrants and at the same time increase the life satisfaction of natives.

To address those problems of endogeneity, including reverse causality and omitted variables bias, research involving the subject of immigration frequently relies on instrumental variables to estimate the effects of immigration consistently. For studies that rely on spatial variation of immigrant inflows for identification, several instruments have been proposed in the past¹⁷:

¹⁷ In other studies, the goal is not to instrument the location choices of immigrants but rather their propensity to migrate or to send remittances. In those cases, other instruments have been used, including for example migration networks, policy experiments such as visa lotteries, natural shocks and weather events (see McKenzie and Sasin (2007) for an overview).

- Immigration push factors. Instead of relying on observed immigration, counterfactual inflows can be constructed based on economic and political conditions in sending countries. The counterfactual inflows are independent of characteristics in the receiving country (O'Connor, 2020; Cho, 2019).
- Geographical instruments based on distances to a border, entry point or consulate. Proximities to these points can point towards higher shares of immigrants in the receiving country, or emigration intensity in countries of origin. Yet, proximity is arguably unrelated to productivity or employment outcomes at the destination (Peri, 2012; McKenzie et al. 2010; Schnapp, 2015).
- Synthetic instruments. When external instruments are unavailable, synthetic instruments can be constructed as functions of the model's data. Synthetic instruments have no straightforward interpretation on their own but can still technically achieve identification (Lewbel, 2012; O'Connor, 2020).
- Past settlement. The shift-share or Bartik instrument relies on the observation that immigrants tend to settle in origin-specific enclaves. It predicts local immigrant shares by weighting historical shares with national growth rates from each country of origin. It has been argued that identification is thus generated from quasi-random variation in the aggregate shock (Card, 2001).

The shift-share instrument is easily the most widely used instrument in immigration research (for a list of studies using it, see Jaeger, Ruist and Stuhler, 2018). It is applicable in a wide range of contexts, draws on data that are relatively easy to obtain compared to other instruments and tends to be high-powered. Yet, research in past years has newly assessed the validity of the instrument and detailed the conditions under which it is reliably estimating the effects of immigration. Perhaps the most important innovation has been contributed by Jaeger, Ruist and Stuhler (2018). They show how the classic shift-share instrument might not meet the exclusion restriction when the settlement of immigrants is serially correlated. In such case, the instrument is likely to conflate past and present responses to immigration shocks, and lose its exogeneity argument. To alleviate that problem, Jaeger, Ruist and Stuhler suggest an alternative variant of the shift-share instrument that uses multiple lags of the immigration variable instrumented with multiple lags of the classic shift-share instrument. The current instrument

then captures short-term effects whereas the lagged instrument captures longer-term effects. However, the approach requires substantial changes in the composition of origin countries, so that each instrument can capture distinct variation. The approach is therefore applicable only in particular historical situations.

In another paper, Goldsmith-Pinkham, Sorkin and Swift (2020) also assess the validity of the shift-share instrument. Although the original instrument is composed of two parts, (1) local shares and (2) national growth rates, they find that identification must come from either shares *or* growth rates. The immigrant enclave argument typically relies on an identifying assumption in terms of initial shares. The instrument is then numerically equivalent to the initial shares, with national growth rates serving only as weights without counteracting endogeneity issues. To justify an instrument, authors thus need to justify the exogeneity of initial shares to provide credible identification. This is even more the case when few origin groups account for much of the variation, as is often the case in practice. Lastly, two papers by Borusyak, Hull and Jaravel (2021) and Adao, Kolesar and Modales (2019) investigate the validity of shift-share designs. They suggest a framework based on identifying variation in the shocks – thus contrasting Goldsmith-Pinkham, Sorkin and Swift (2020) who rely on exogenous shares – and illustrate how shift-share regressions can be correlated across regions due to the presence of unobserved sectoral shifters affecting the outcome. Taken together, the recent advances are promising because they suggest several conditions under which the shift-share instrument can be valid. Yet they underline the need to be upfront about which identifying strategy is to be used and how the instrument assumptions can be fulfilled.

2.3 Data and methodology

2.3.1 The Luxembourgish Socio-Economic Panel (PSELL)

The empirical analysis of this paper is based on data from the 2011 wave of the Luxembourgish Socio-Economic Panel (PSELL). The 2011 iteration of the survey covers the largest cross-sectional sample of Luxembourgish residents to date, surveying more than 15 000 individuals and collecting a rich set of socio-economic variables at the individual and household level. Only in 2011, the PSELL further included a question about life satisfaction – the outcome I am interested in for this study: Overall, how satisfied are you with the life you are living right now? [translated by the author from French] (STATEC, 2017). The response is measured on a 1-10 scale where 10 indicates the highest level of life satisfaction [very satisfied] and 1 the lowest [not at all satisfied]. On average, respondents in the raw sample indicate 7.74 as their degree of

life satisfaction, with a standard deviation of 1.79. The question belongs to the group of evaluative well-being measures.¹⁸ Such questions on life satisfaction have been extensively used in past years and studied methodologically to show that they can provide valid and meaningful information (Kapteyn et al., 2015; OECD, 2018; Fischer, 2009; Diener, Oishi and Tay, 2018; Krueger and Schkade, 2008).

The main explanatory variable in the analysis is the local population share of immigrants. Information on immigrant shares are taken from the 2011 and 1991 Luxembourgish censuses. I exploit variation in the share of immigrants at the municipality level, the smallest administrative unit in Luxembourg.¹⁹ Immigrants are defined by their citizenship, i.e. holding other than a Luxembourgish citizenship. The reason I use citizenship to define immigrants, and not their country of birth, is because administrative data are only available by citizenship. Conversely, natives are defined as residents who hold Luxembourgish citizenship.

2.3.2 Descriptives

With just over 600 000 inhabitants, Luxembourg is one of the smallest countries in Europe yet one with the largest share of immigrants. Almost half of its population are immigrants and its economy is fuelled by foreign workers. In the first quarter of 2021, foreigners represented 73% of total employment (Statec, 2021). The participation rate among foreign-born was 77% versus 66% among native-born in 2019 (OECD, 2021). Immigrants tend to be attracted by Luxembourg's high wages, living standards and growing number of white-collar jobs. A typical immigrant is therefore well-educated, coming from another European country and migrating for employment purposes. In addition to immigrants living and working in Luxembourg, many more workers commute every day from France, Belgium and Germany across the border. Yet, the immigrant population is also growing more diverse. In recent years, Luxembourg started accepting growing shares of humanitarian immigrants and allowed more workers to bring their families.

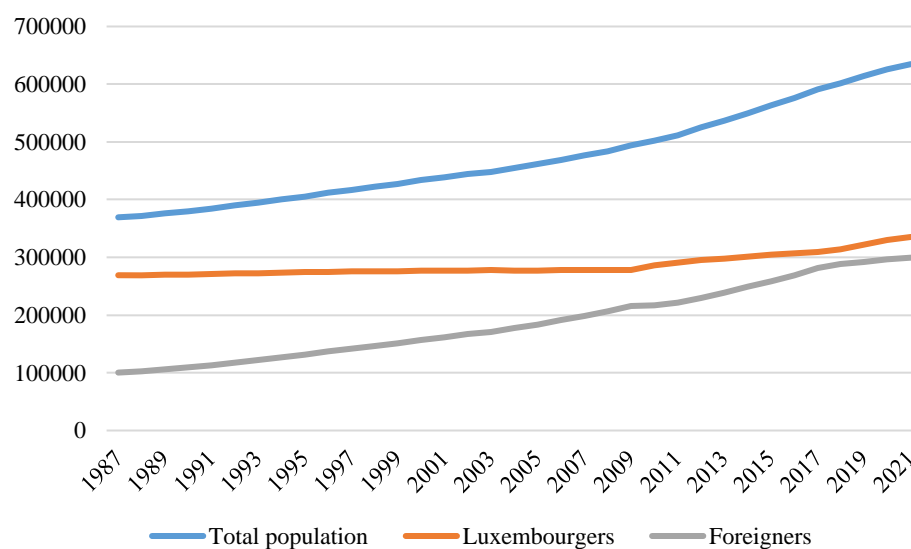
Between 1991 and 2011 – the period that is the focus of my empirical analysis in this study – both the size of the immigrant population and its composition changed. Net migration

¹⁸ Evaluative well-being is commonly contrasted with experiential well-being. The key difference is that questions on life satisfaction such as used in PSELL are thought to provoke a comprehensive reflection on one's life and thereby go beyond the respondent's momentary emotional state. In contrast, questions on experiential well-being aim to capture the fluctuation of affections in a more transient manner.

¹⁹ Note that there has been an administrative reorganization in Luxembourg concerning the municipalities. The reforms involved a reduction of the total number of municipalities and consequently the merging of smaller municipalities. In my analysis, I use municipality borders as they exist in 2018 because administrative data are available only for this configuration. I adapted the 2011 PSELL data according to the administrative changes that were made between 2011 and 2018.

remained relatively stable throughout the 1990s at around 10% of the population but then increased in the 2000s, doubling its share to reach 21% in 2011. The overall population share of immigrants grew from 29% to 43% at the same time (Figure 1). The composition of the immigrant population also changed, continuing trends that had started in the after-war period. Most of the newcomers arrived from countries of the European Union, seeing their share among foreigners increase from 27% to 37%. The Portuguese population, who has been the single largest immigrant group since the 1970s, continued to grow considerably, from 10% in 1991 to 16% in 2011. In contrast, 1991-2011 was marked by a slight decline for the Italian population that had historically been the largest immigrant group in Luxembourg. The share of Germans remained stable at around 2.4% while both the shares of Belgians and French grew (by 0.6 and 2.7 percentage points, respectively).

Figure 1. Evolution of Luxembourgish, foreign and total population, 1987-2021

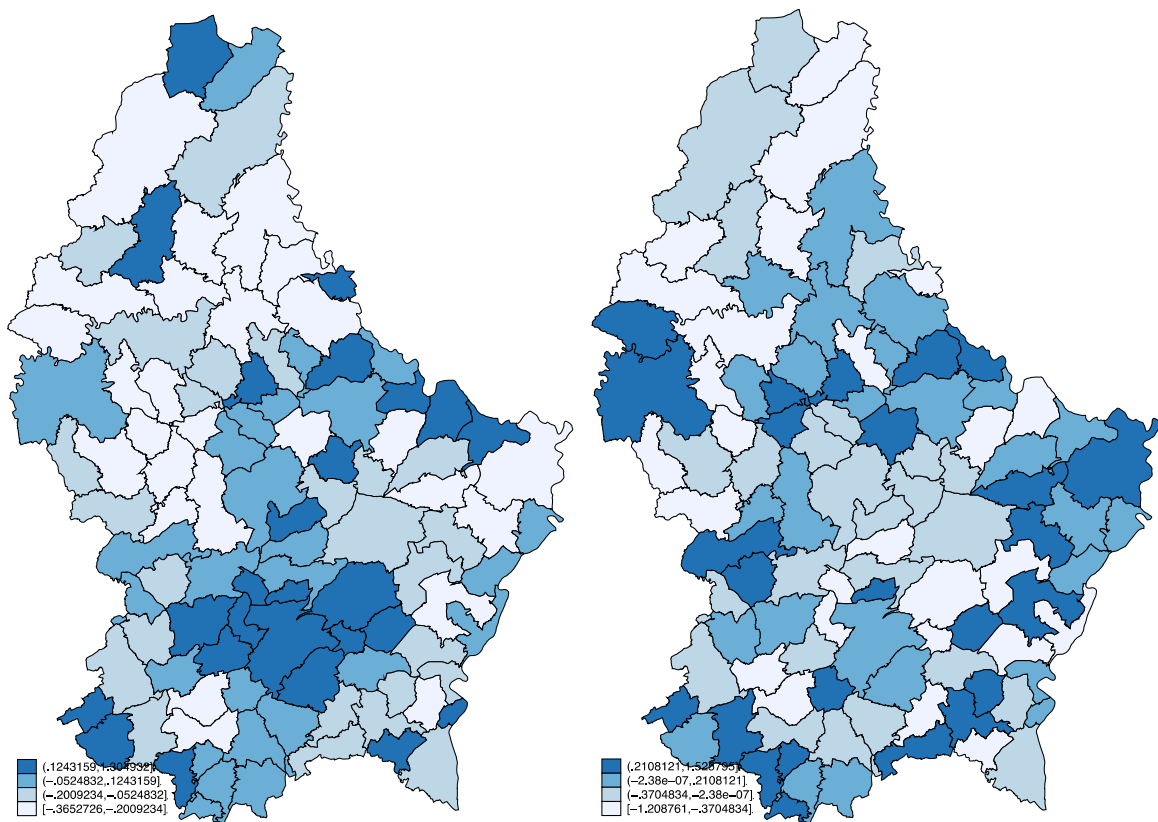


Source: Statec (2021a)

Although the share of foreigners is generally high in Luxembourg, there is substantial variation across municipalities. In 2011, the overall share was 43% on average but ranged from 15% in Goesdorf to 65% in Luxembourg City. Figure 2 shows the deviation from Luxembourg's mean immigrant-to-native ratio based on 2011 census data, the key independent variable used in my empirical analysis. As can be seen from the map, immigrants are concentrated in several locations across the country. The largest concentration is found around the capital city, Luxembourg Ville, and its surrounding municipalities. The South and South-West also have high immigrant ratios. The immigrant ratio in Differdange and Esch-sur-

Alzette (two of the darkest municipalities in the South-West) is over 1, indicating more foreign residents than natives living there. A similar pattern holds for municipalities along the border with Germany in the North-East. Overall, five municipalities have more immigrants than natives as residents (Luxembourg City, Differdange, Esch-sur-Alzette, Strassen and Larochette). In contrast, most of the North (with the exception of Troivierges, the most northern municipality bordering Belgium) reveals comparatively low immigrant ratios.

Figure 2. Deviation from mean immigrant-to-native ratio (left) and natives' life satisfaction (right) across Luxembourg's municipalities, 2011



Note: The maps show the mean deviation from the national mean ratio of natives to foreigners (left) and mean level of life satisfaction (right). Life satisfaction scores are calculated using personal weights. The darker the area, the higher is the share of immigrants or the lower is the average life satisfaction.

Source: Luxembourgish Census (2011) for immigrant shares and PSELL (2011) for life satisfaction

The mean deviation from mean life satisfaction is shown on the right map of Luxembourgish municipalities. Life satisfaction is lowest along the southern border with France where much of the iron deposits are located and along the lower border with Germany. There are also a

number of municipalities in the north of Luxembourg Ville that appear to have particularly low levels of life satisfaction. However, since the PSELL survey is not meant to be representative of the population at these low levels of geography, mean levels of life satisfaction by municipality are likely imprecisely measured and I will examine the relationships at the individual level only. The estimated correlation between local immigrant ratios and life satisfaction of natives is weakly negative at -0.38.

Table 2 presents the summary statistics of natives in my sample living in municipalities with below-median immigrant ratios (left) and above-median immigrant ratios (right). It shows all variables used in my analysis and further displays average immigrant ratios in high and low-immigration municipalities. Natives living in areas with relatively few immigrants report slightly higher levels of life satisfaction than natives living in areas with higher immigrant ratios. There are also a few differences in socio-economic characteristics between the two groups. For example, fewer residents are college-educated in low-immigrant areas (17% versus 25% in high-immigration municipalities). Households tend to be larger and more people live in married relationships. Yet, a slightly higher share of persons in low-immigrant areas are working and fewer are unemployed. The immigrant ratios vary considerably, between an average of 0.4 in low-immigration areas and 1.0 (indicating an equal number of foreigners and natives) in high-immigration areas. That difference is largely driven by immigrants from other European countries who are a lot more numerous in high-immigration municipalities. However, the ratio of Portuguese immigrants is markedly higher in otherwise low-immigration municipalities, 0.16 versus 0.4.

What is largely left out in Table 2 are regional characteristics and macroeconomic conditions that are likely to be heterogeneous too. However, as I will explain in my methodological section below, those local factors are purposefully left out since they might conceal the full impact of immigration. However, I do consider a few local characteristics that might mediate the impact of immigrants on life satisfaction in one part of my analysis. The last panel on the bottom shows these factors. Unemployment is considerably lower in municipalities with few immigrants (5% versus 8%), and rents increased slightly less in those areas. The ethnic diversity index further indicates – somewhat unsurprisingly – that there is a larger number of nationalities found in high-immigration municipalities, or that the size of nationality groups tends to be more equal. Lastly, the table indicates a higher population density in high-immigration municipalities, suggesting a preference for immigrants to settle in urban rather than in rural areas.

Table 2. Summary statistics – individual characteristics of natives living in low (left) and high-immigration (right) municipalities

	Low-immigration municipalities		High-immigration municipalities	
	Mean	SD	Mean	SD
Life satisfaction	7.95	1.67	7.86	1.72
Men (%)	.51	.5	.5	.5
Log annual income	10.47	.59	10.5	.51
Age	48.29	17.26	48.6	18.08
College-educated (%)	.17	.37	.25	.43
Household size	3.06	1.33	2.84	1.38
Number of children	1.5	1.31	1.43	1.36
Public sector employment (%)	.28	.45	.29	.45
<u>Health status (%):</u>				
Very good	.25	.43	.24	.43
Good	.48	.5	.48	.5
Fairly good	.21	.41	.2	.4
Bad	.05	.23	.06	.24
Very bad	.01	.1	.02	.12
<u>Marital status (%):</u>				
Never married	.26	.44	.3	.46
Married	.6	.49	.52	.5
Separated	.01	.1	.01	.11
Widowed	.05	.23	.07	.25
Divorced	.07	.25	.08	.27
Partnership	.02	.12	.02	.15
<u>Activity status (%):</u>				
Working	.5	.5	.48	.5
Inactive	.48	.5	.49	.5
Unemployed	.02	.12	.03	.16
<u>Immigrant to native ratios:</u>				
Ratio of all immigrants to natives	.42	.11	.1	.42
Ratio of EU foreigners	.4	.1	.93	.37
Ratio of non-EU foreigners	.02	.01	.07	.04
Ratio of Portuguese	.16	.08	.4	.18
<u>Other local characteristics:</u>				
ΔRent 2001-11	4.14	.91	4.94	1.15
Unemployment rate (%)	5.4	1.56	8.12	2.49
Ethnic diversity index	.47	.07	.66	.09
Mean income of natives	38 088	4 971	37 125	6 534
Population density	270	248	925	719

Note: The results are computed using personal weights provided in the PSELL.

Source: Own computations based on PSELL (2011), the Luxembourgish Census (2011) and Statec (2021b, 2021c)

2.3.3 Methodology and instruments

My empirical approach relies on estimating the impact of local ratio of immigrants to natives on the personal life satisfaction of natives using the following standard structural equation:

$$(1) \text{ Life satisfaction}_{ij} = \alpha + \beta \text{immigrant-native ratio}_j + \gamma \text{personal characteristics}_i + \varepsilon_{ij}$$

Individual life satisfaction (LS) of person i depends on the ratio of immigrants to natives in the municipality j and a number of personal characteristics including sex, age and income (see Table 2). Although many studies use a first-difference of their outcome variable to differentiate out local fixed-effects, this is not absolutely necessary for the estimation (Lonsky, 2020). Furthermore, local control variables are purposefully not included in a first step since immigration is correlated with a wide range of factors and including them would attenuate the full impact of immigration. I will later re-introduce local-level controls to explore potential “mediators” through which immigration has its effect (see Table 6).

As is commonly noted, specifications such as (1) entail the possibility that both immigrant ratios and life satisfaction are jointly determined by third factors or that life satisfaction influences immigrants’ location choices, leading to problems of omitted variables bias and reverse causality. To address the endogeneity of immigrant ratios, I identified municipality characteristics that are related to the presence of immigrants but much less to life satisfaction. These are the proximity of municipalities to sites of steel production as well as the presence of immigrants prior to 1991. In particular, I propose a version of the classic shift-share instrument but incorporate some of the advances suggested in recent years by instrumenting both the 2011 immigrant ratios and the 1991 ‘initial’ settlement patterns. Instead of relying on observed immigrant stocks in my base period, I predict initial stocks using their proximity to sites of iron mining and manufacturing. By connecting initial stocks to the occurrence of natural resources, I ensure that they are exogenous to my outcome, life satisfaction.

It is difficult to overstate the importance of the steel industry for the economic development of Luxembourg. Before its exploitation, Luxembourg was mainly an agricultural state with few small industries. In 1842, Luxembourg joined the German customs union which triggered a period of economic transformation and growth. Luxembourg intensified relations

with the German states, attracting investments and workers to develop its heavy industry. Large industrial sites were built across the country and especially in the south where important iron ore deposits were found. Former villages like Esch-sur-Alzette and Dudelange experienced a population boom with people moving to work in the mines and furnaces. However, there weren't enough workers in Luxembourg that had either the right skills or willingness to work in the mines and furnaces to support the fast-growing industry. Workers were therefore recruited abroad, particularly in Germany where they had longstanding experience in the sector, and Italy where the south was especially poor. For over 130 years, the steel industry created most of the country's wealth, built the foundations of its infrastructure and solidified centers of manufacturing, commerce and immigration. Its decline only started after the Second World War when the financial industry started to become predominant. Luxembourg still relied on the inflow of foreign labor to support reconstruction efforts after the war and maintain the steel industry's needs. Yet it had become less attractive to Italians, who were previously the most important foreign source of labor. As a result, the Luxembourgish government signed a comprehensive guest worker agreement with Portugal after which it saw a large inflow of Portuguese and Portuguese Cap Verdeans. When the economic crisis hit in 1975, the demand for steel eventually collapsed and prices fell (Gouvernement du Grand-Duché de Luxembourg, 2021).

I use the logarithmic distance between the geographic center of each municipality and the eight major sites of steel production established between 1872 and 1911 as predictors for the size of the local immigrant population separately for each nationality group.²⁰ My premise is that the infrastructure created by the steel boom is driven only by the exogenous occurrence of natural resources and the geopolitical context of border and trade routes but unrelated to the personal well-being of natives today. Yet because immigrants tend to settle in enclaves and because the industrial boom produced physical infrastructure that remains in place until today, immigrants are likely to still cluster around those sites. Given that there are 102 municipalities in Luxembourg and eight sites of steel production, I have a total of 816 municipality-steel site pairs. The list of steel production sites and their addresses can be found in Appendix 1. In addition to the steel sites, I sensitize the predictions of immigrant stocks to the size of the local native population because immigrants in several municipalities make up more than half of the total population. Equation (2) shows how the data were generated to predict local stocks of

²⁰ I use a logarithmic scale because most of the steel sites are located along the southern border of Luxembourg, making the distribution of distances between municipalities and steel sites close to log-normally distributed.

immigrants in 1991. This is obtained from a regression of the stock of immigrants of each nationality on the size of the native population and distances between the municipality and eight steel production sites:

$$(2) \tilde{m}_{nj91} = c_n + \alpha_n \text{Distance}1_j + \beta_n \text{Distance}2_j \dots + \theta_n \text{Distance}8_j + \iota_n \text{Native Population}_j$$

Negative predictions are truncated to zero. In a second step, I combine those predicted stocks with a variant of the shift-share instrument:

$$(3) \tilde{m}_{j11} = \frac{\sum_{n=1}^{80} \left(\tilde{m}_{nj91} + \frac{\tilde{m}_{nj91}}{M_{n91}} * \Delta M_{n91-11} \right)}{N_{j11}}$$

where \tilde{m}_{j11} is the 2011 ratio of immigrants to natives in municipality j that I want to estimate; \tilde{m}_{nj91} are the previously predicted immigrant stocks in 1991; \tilde{m}_{nj91}/M_{n91} is the constructed local share of immigrants holding nationality n among the total immigrant population in Luxembourg holding the same nationality in the base period 1991, and ΔM_{n91-11} is the national inflow of immigrants with nationality n between 1991 and 2011. The nominator is calculated separately for each nationality group and then summed to yield the total stock of immigrants in municipality j in 2011. It combines exogenously predicted initial stocks with inflows constructed using the standard shift-share strategy. The result is divided by N_{j11} , the number of native residents in the same municipality. In the end, the instrument is correlated with real immigrant ratios at 0.74. I also calculated the instrument by dividing the immigrant stocks by the total population, thus yielding the population share of immigrants as is done elsewhere (Saiz and Wachter, 2006; D'Amuri and Peri, 2011; O'Connor, 2020). However, since immigrants make up such large shares in several Luxembourgish municipalities – over 50% – I would risk re-introducing the potentially endogenous location choices of immigrants. I therefore prefer to use the ratio between immigrants and natives instead of population shares.

In addition to using the instrument shown in Equation (3), I also use the eight distances to steel sites alone to instrument current immigrant ratios and I use the classic shift-share (Equation 3) for comparison. This results in a total of four specifications: OLS, the standard shift-share instrument, the modified shift-share, and the distances (see Table 1).

$$(4) \tilde{m}_{j11} = \frac{\sum_{n=1}^{80} \frac{M_{nj91}}{M_{n91}} * M_{n11}}{N_{j11}}$$

Equation (4) shows the classic shift-share instrument based on Lonsky (2020). It simply multiplies the 2011 stock of immigrants with 1991 shares and then divides the results by the 2011 native population. The shares act as weights to the total stock. In contrast, Equation (2) uses the shares only to weight recent inflows, and then adds them to the predicted 1991 stock of immigrants. That is why the correlation between the classic shift-share instrument and 2011 immigrant ratios is markedly higher than in the modified instrument, at 0.88. For all instruments, I use the standard IV diagnostics to assess the relevance (first stage F-stat) and validity (overidentification test) where possible to assess the instruments.

2.4 Results

2.4.1 Benchmark results

I estimate the effect of immigration on natives' life satisfaction using a benchmark OLS estimation and the three different instruments: (1) the baseline OLS estimate, (2) an estimate using the standard shift-share instrument, (3) the shift-share in which initial immigrant stocks are predicted and (4) distances to steel sites. The dependent variable is individual life satisfaction, measured on a scale between 1 and 10. All models use personal weights and control for individual characteristics including age, sex, education, income, health status, marital status, activity status and household size (see Table 2). Standard errors are clustered at the municipality level. The beta-coefficient corresponds to the impact of a 0.1-point increase in the local immigrant-to-native ratio, which ranges from 0.18 to 1.85 across municipalities.

Table 3
Estimated Impact of Immigration on Natives' Life Satisfaction

	1	2	3	4
	OLS	Classic shift-share	Shift-share with predicted initial stocks	Distances to steel sites
Immigrant ratio Second Stage	-0.009 (0.009)	-0.013 (0.013)	-0.005 (0.011)	-0.018 (0.015)
Shift-share instrument First Stage	— —	2.625*** (0.508)	0.423*** (0.133)	—
Distance instruments First Stage	—	—	—	Yes
First stage R2	—	0.76	0.52	0.74
First stage F-stat	—	26.65	10.09	19.64
Observations	6455	6455	6455	6455
# of municipalities (clusters)	102	102	102	102

Note: Author's calculations using the PSELL (2011) and STATEC 1991-2011 register data. The table reports the slope coefficients of the local population share of immigrants on individual life satisfaction of natives (first row) and the first stage regression results of the instruments (rows 2 to 8). Robust standard errors are clustered around the 102 Luxembourgish municipalities and reported in parentheses. *** indicates $p < 0.01$, ** indicated $p < 0.05$, * indicates $p < 0.10$

Column 1 shows the OLS baseline estimate. The immigration coefficient is negative and small in magnitude but statistically insignificant. In models 2 to 4, the ratio of immigrants is instrumented. All instruments show a first-stage F-stat over 10, the commonly used threshold for weak instruments, although the modified shift-share instrument just barely so at $F = 10.09$. Using the Montiel Olea and Pflueger (2013) test of weak instruments, which extends the Stock and Yogo (2005) standard test, I find that the classic shift-share instrument exceeds the critical value at $\tau = 10\%$ and can thus be considered non-weak. The two other instruments exceed the

critical value at $\tau=20\%$.²¹ In addition, all show significant coefficients in the first stage and reasonably high first stage R-squared. This is also true when I use the purely geographic instrument in Model 4. Overall, the immigration coefficient remains relatively stable, small and negative but statistically insignificant across all models. The results from Table 1 suggest that there is no statistically significant relationship between local immigrant ratios and natives' life satisfaction as a whole.

2.4.2 Heterogenous impacts by group

Previous research has shown that the effect of immigration is likely to be heterogeneous across population sub-groups. In particular, both Kuroki (2018) and Ivlevs and Veliziotis (2017) find that older populations are less happy in diverse areas compared to the young. Yet, Kuroki also finds evidence that education increases preferences among White men to live in racially-homogenous White areas.

To explore potential heterogeneity in Luxembourg, I rerun the OLS benchmark model along with two models where immigrant shares are instrumented, using the modified shift-share instrument and the purely geographical instruments. In the analysis, the population is split in distinct groups based on their age, sex and education. In addition, I also run the analysis on public sector employees alone. The idea is that the specific profile of Luxembourg's immigrant population might be felt most acutely on the labour market. Indeed, the inflow of skilled Europeans in recent years has increased the supply of such labour in Luxembourg and could potentially affect natives who are directly competing with them. There are only few positions and sectors in which competition is likely to be less intense, particularly the public sector that requires multi-lingual fluency including of the Luxembourgish language. Since few people speak or learn Luxembourgish, the public sector is one employer where natives compete much less with immigrants. Table 4 shows the results.

²¹ Note that the Montiel Olea and Pflueger (2013) test is made without using personal weights.

Table 4
Estimated Impact of Immigration on Life Satisfaction by Age, Gender and Education sub-populations

IV	1	2	3
	OLS	Shift-share with predicted initial stocks	Distances to steel sites
Over 50 years	-0.002 (0.010)	-0.013 (0.013)	-0.005 (0.011)
Observations	3047	3047	3047
R ²	0.22	0.23	0.23
30-50 years old	-0.025* (0.015)	-0.037 (0.026)	-0.027 (0.017)
Observations	1,976	1,976	1,976
R ²	0.25	0.24	0.25
Under 30 years	-0.024* (0.012)	-0.048 (0.030)	-0.050** (0.024)
Observations	1,216	1,216	1,216
R ²	0.22	0.22	0.22
Men	-0.013 (0.011)	-0.014 (0.014)	-0.021 (0.016)
Observations	3,213	3,213	3,213
R ²	0.24	0.24	0.24
College educated	-0.022*** (0.007)	-0.032** (0.015)	-0.028*** (0.011)
Observations	1,327	1,327	1,327
R ²	0.17	0.17	0.17
Public-sector employee	0.006 (0.008)	0.014 (0.014)	-0.006 (0.010)
Observations	1,848	1,848	1,848
R ²	0.19	0.19	0.19

Note: Author's calculations using the PSELL (2011) and STATEC 1991-2011 register data. The table reports the slope coefficients of the local population share of immigrants on individual life satisfaction of natives over 50 years old (first panel), between 30 and 50 (second panel), under 30 (third panel), females (fourth panel) and the college-educated (fifth

panel). Robust standard errors are clustered around the 102 Luxembourgish municipalities and reported in parentheses. *** indicates $p < 0.01$, ** indicated $p < 0.05$, * indicates $p < 0.10$

In contrast to previous studies, the results suggest no statistically significant – or virtually any – effects for the older population above 50 or for men. However, the results suggest a pattern that is diverting from previous results in that the younger population and especially college-educated Luxembourgers experience a negative impact of immigration on their well-being. The OLS baseline models suggests a negative impact on the 30 to 50-year olds and people under 30. Using the distances instrument, I also find a negative effect on people under 30. Yet in particular, all three models estimate statistically significant, negative effects on the college-educated native population. A 0.1-point increase in local immigrant ratios would be expected to decrease life satisfaction of college-educated natives by between 0.02 and 0.03 points, holding all other personal characteristics constant. This is arguably a small magnitude, given that life satisfaction is measured on a scale from 1 to 10. Yet, the finding gives weight to the hypothesis that immigrants affect a specific demographic in Luxembourg which are the young and educated. Given that Luxembourg's immigrant population tends to be young, European and skilled, Table 4 suggests that immigrants affect natives who are similar to them. The younger generations might stand more directly in competition with immigrants on the labour market, potentially competing for the same jobs. In contrast, the results of the OLS and shift-share model suggest a positive influence of local immigrant shares on natives' life satisfaction who work in the public sector. This is not surprising given their relatively protected position on the labour market and less competition from foreigners. Although the effects are not statistically significant, it is worth noting that public sector employees are indeed the only group suggesting a happiness-increasing effect through immigration.

2.4.3 Composition of the immigrant population

Next to heterogeneous effects on different groups of natives, one could assume that the immigrant composition also plays a role in shaping the overall effect of immigrants on life satisfaction. Kuroki (2018) for instance finds a negative effect of immigrants on the life satisfaction of natives in the United States that is largely driven by the local presence of Blacks. In Luxembourg, a particularly salient group of immigrants are the Portuguese who started arriving in large numbers in the mid 1960s. They replaced in parts the slowing inflow of Italian workers and thus often started working industrial or manual jobs. With over 16%, the Portuguese are the largest single foreign nationality group living in Luxembourg still today.

Yet, the share of Portuguese varies widely across municipalities, from 3% in Ell to almost 50% in Larochette. In contrast, the share of all non-EU immigrants is much smaller and ranges from only 0.3% to 5.7%. Lastly, EU immigrants make up the largest share with up to 60% of the local population in Luxembourg Ville.

To account for the composition of the local immigrant population, I separate the total number of immigrants into those having a nationality from another EU-member country, those with a nationality from outside the EU and those holding Portuguese nationality. As previously, the beta coefficients correspond to the impact of a 0.1-point increase in the immigrant ratios. Following Akay et al. (2017), I also compute an index of ethnic diversity: $ED_j = 1 - \sum_o \left(\frac{m_{nj}}{m_j}\right)^2$ for each municipality. m_{nj} is the number of immigrants holding the nationality n in municipality j and m_j is the total number of immigrants in municipality j . The index goes from 0 to 1 and rises when municipalities host a larger number of immigrant groups and when the number of immigrants in each of those groups is more evenly distributed. Because the models include potentially several endogenous variables, I use only the geographic instruments.

Table 5
Estimated Impact of Ethnic Diversity, EU, non-EU and Portuguese Immigrants on Natives' Life Satisfaction

	1	2	3	4	5	6
	OLS	IV Distances	OLS	IV Distances	OLS	IV Distances
Immigrant ratio			0.004 (0.019)	0.025 (0.034)		
EU ratio	0.040 (0.033)	0.042 (0.093)			0.062 (0.037)	0.071 (0.083)
Non-EU ratio	-0.309 (0.267)	-0.337 (0.754)			-0.336 (0.271)	-0.406 (0.639)
Portuguese ratio	-0.070* (0.035)	-0.080 (0.062)			-0.071** (0.035)	-0.071 (0.072)
Ethnic diversity			-0.050 (0.068)	-0.164 (0.135)	-0.064 (0.066)	-0.088 (0.167)
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes
R2	0.23	0.23	0.23	0.22	0.23	0.23
Observations	6,455		6,455		6,455	

Note: Author's calculations using the PSELL (2011) and STATEC 1991-2011 register data. All models control for individual characteristics. Robust standard errors are clustered around the 102 Luxembourgish municipalities and reported in parentheses. *** indicates $p < 0.01$, ** indicated $p < 0.05$, * indicates $p < 0.10$

The results in columns 1 and 2 suggest a positive effect of EU immigrants on natives' life satisfaction and negative effects for both non-EU and Portuguese immigrants. However, only the OLS model shows a statistically significant effect of the ratio between Portuguese and natives. A 0.1-point increase in the local ratio of Portuguese is thus associated with a 0.07-point decrease in the life satisfaction of natives. Columns 3 and 4 report results for the ethnic diversity index and total immigrant ratios. The coefficients of immigrant ratios remain statistically insignificant but are in line with previous results. The slope coefficients of ethnic diversity are also statistically insignificant. Columns 5 and 6 combine the ethnic diversity index with

detailed immigrant ratios. Results are as before, showing a positive effect of EU ratios and negative effects of both non-EU and Portuguese immigrant ratios. However, only the OLS estimate is statistically significant.

2.4.4 Local mediators

Finally, I want to explore potential local mediators. In particular, I examine whether the local unemployment rate, income levels of the native population, price development of rents and population density are related to life satisfaction. Although immigration might impact rents, native incomes and unemployment, which in turn impact life satisfaction, including these factors in a model allows us to get an idea of the channels through which immigration is influencing life satisfaction. Given the growing attractiveness of Luxembourg in the past years with its booming white-collar jobs and high wages, it could be that the negative effects observed on college-educated Luxembourgers (see Table 2) are mediated by increasing living costs for example. Rents are measured in the change of square-meter prices between 2001 and 2011. Population density is measured by the number of inhabitants per square kilometre. Table 4 shows the analysis on college-educated Luxembourgers, this time including local mediators.

Table 6

Local Mediators of the Impact of Immigration on College-Educated Natives' Life Satisfaction

	1	2	3
	OLS	Shift-share with predicted initial stocks	Distances to steel sites only
Immigrant ratio	-0.032* (0.018)	-0.030 (0.051)	-0.029 (0.019)
Local Unemployment	-0.026 (0.045)	-0.027 (0.045)	-0.027 (0.044)
ΔRent	0.077 (0.067)	0.074 (0.084)	0.074 (0.067)
Mean local income of natives	0.017 (0.0104)	0.016 (0.0168)	0.016 (0.0104)

Population density	-0.020 (0.196)	-0.033 (0.277)	-0.033 (0.191)
R2	0.18	0.18	0.18

Note: Author's calculations using the PSELL (2011) and STATEC 1991-2011 register data. Mean incomes and population density are divided by 1000 for better readability of the slope coefficients. All models control for individual characteristics. Robust standard errors are clustered around the 102 Luxembourgish municipalities and reported in parentheses. *** indicates $p < 0.01$, ** indicated $p < 0.05$, * indicates $p < 0.10$

Even when including local mediators, the effect of immigrants on the life satisfaction of natives remains negative and significant in the OLS baseline model. However, both models instrumenting immigrant ratios become insignificant compared to the results from Table 4 without mediators. Still, effect sizes remain very similar. The coefficients of the mediators are consistent across models and as would be expected, with unemployment and density being associated with decreasing life satisfaction while income and valuation of real estate is associated with increasing life satisfaction. Overall, R-squared is relatively low in all models, showing that only a small amount of the variation is explained by the independent variables. It is thus likely that none of those channels represent a major mediator for the impact of immigrants on the life satisfaction of college-educated Luxembourgers.

2.5 Summary and conclusion

By most accounts, immigrants have been vastly beneficial to Luxembourg's economy, filling a growing demand for white-collar workers and contributing to public finances. Many countries would indeed envy Luxembourg for the immigrant population it is able to attract: New arrivals tend to be young, educated and already in employment. Furthermore, the vast majority of Luxembourg's immigrants come from within Europe, many even from its neighbouring countries France, Belgium and Luxembourg and thus share a common language and cultural ties. It would therefore be reasonable to expect a positive association between immigration and the life satisfaction of Luxembourgish natives. Yet, the results of my analysis suggest a more complicated relationship.

In this paper, I exploit a particularly large wave of the Luxembourgish Socio-Economic Panel to study the relationship between immigration and natives' well-being across 102 Luxembourgish municipalities. To counteract endogeneity in my empirical approach, I propose a version of the classic shift-share instrument in which I predict initial immigrant stocks

through their proximity to sites of steel manufacturing. I show that the discovery of iron ore deposits in the 19th century has laid the foundation of immigrant settlements in Luxembourg and that they can be used to instrument for current immigrant ratios. The geographic instrument, both when used alone or in combination with the shift-share instrument, produces a consistent picture.

The results of my analysis suggest no impact of immigration on the life satisfaction of natives overall. However, Luxembourgish younger Luxembourgish and especially those who are college-educated do experience statistically significant negative effects. For a 0.1-point increase in the local ratio of immigrants, my results suggest a decrease of 0.02 to 0.3 points in the life satisfaction of working age and college educated Luxembourgish. Admittedly, these magnitudes are not large. Yet, they do point towards an issue that appears to be relevant politically and strategically for Luxembourg. One possibility is that the characteristics of its immigrants create particular competition with similar natives. Since immigrants tend to be well-paid professionals, younger and educated Luxembourgish might feel stronger pressures. This hypothesis is supported by that fact that the effect of immigrants disappears when I look at only public sector employees, who are much less likely to compete with immigrants due to Luxembourgish language skill requirements. The finding stands in contrast to previous research (Akay et al., 2014; Howley et al., 2018; Kuroki, 2018; Papageorgiou, 2018) that shows how the life satisfaction of older populations is particularly related to immigration. Yet, none of these studies focus on Luxembourg which has arguably a vastly different experience of immigration compared to those countries, concerning both the size and profile of immigrant inflows.

To disentangle the compositional effects of the Luxembourgish immigrant population on natives' life satisfaction, I estimate the impact separately for EU, non-EU and Portuguese immigrants. While the results suggest a positive impact of EU immigrants and negative impacts for both non-EU and Portuguese, only the Portuguese appear to be statistically relevant. Furthermore, I follow Akay et al. (2017) and O'Connor (2020) and calculate a municipal index of ethnic diversity. The index however appears to be unrelated to natives' life satisfaction in Luxembourg. When exploring potential local mediators in the relationship between immigration and the life satisfaction of college-educated natives, I find that none have an impact on the immigration coefficient which remains negative and consistent in size.

The results do not warrant much disquiet because of their small effect sizes. Yet, researchers and policymakers should take note that – despite the seemingly overwhelming benefit for the country overall – immigration is at its best unrelated to the well-being of natives.

At its worst, it reduces their life satisfaction. With half of the population being immigrants, it is crucial that any reason for tensions be addressed.

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Appendix

Appendix 1. List of sites of steel production

City	Name	Established
Differdange	Hauts-Fourneaux de Differdange	1896
Luxembourg	Usine de Dommeldange	1907
Esch-sur-Alzette	Hauts-Fourneaux de Beval	1911
Schifflange	Usine Esch-Schifflange	1911
Pétange	Hauts Fourneaux de Rodange	1872
Luxembourg	Aciéries et Ateliers de Luxembourg-Hollerich	1898
Steinfort	Hauts Fourneaux et Aciéries de Steinfort	1911
Dudelange	Hauts Fourneaux et Forges de Dudelange	1887

CHAPTER 3

THE FUTURE OF MIGRATION TO EUROPE: A SYSTEMATIC REVIEW OF THE LITERATURE ON MIGRATION SCENARIOS AND FORECASTS

Rhea Ravenna Sohst, Jasper Tjaden, Helga de Valk, Susanne Melde²²

3.1 Introduction

The aim of this systematic review is to take stock of the state of the literature on international migration scenarios and forecasts and evaluate their development in a comparative manner. The review provides a comprehensive overview and guidance for academics, policymakers and others interested in international migration scenarios and forecasts. The first part focuses on qualitative migration scenarios and the second part on quantitative migration forecasts. The report begins with terminological clarifications, a short description of the methodology for the literature search (more details in Appendix I), and a comparative overview of migration scenarios and forecasts. The main parts (5 and 7) of the report detail and analyse the results of the systematic literature review. Part 5 presents the results of the review of migration scenario studies, including a typology of migration scenarios and the various methodological approaches used in the studies. Part 7 presents the results for migration forecasts. The results include a discussion of available data sources, the strengths and weaknesses of available methods, and a review of the uncertainty related to forecasts.

3.2 Definitions

Two broad approaches can be distinguished in assessing future migration: scenarios and forecasts. Both approaches can be used to make inferences about the future size and structure of migration to Europe. However, there are stark differences between these approaches that are often not well understood. Various terms describing the two approaches are often used interchangeably, adding to the lack of clarity. This section starts by setting clear definitions of

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the terms “scenario” and “forecast,” which will be compared and contrasted throughout the report.

Scenarios are qualitative narratives about the future of migration that emphasize possible structural changes and their consequences for migration. A variety of qualitative and quantitative evidence are used to develop migration scenarios. However, scenarios hold no absolute claim to becoming reality. Instead, they can be understood as thought experiments of the type “What if...?” The aim of migration scenarios is to create alternate visions of the future that consider the multitude of factors that influence migration and their interactions (Vezzoli, Bonfiglio and de Haas, 2017). Each scenario can be interpreted as one plausible vision of the future. Originating in the US Armed Forces, scenario-planning became known to the wider public through Royal Dutch Shell’s use of it prior to the 1973 oil shock. Due to these origins, scenarios draw on a practitioner-driven, strategic and discursive methodology. The elaboration of scenarios, which often involve multiple steps, consisting of surveys and workshops with a group of diverse participants, is an integral part of the approach. Scenario-planning can be situated within the field of strategic foresight, of which it is one of multiple possible methods (Wilkinson, 2017).

Forecasts, in this report, are used to describe all projections or predictions that produce a quantitative estimate of future migration. As such, “forecast” in this report is an umbrella term that spans different methods, including demographic projections, emigration survey analyses, econometric models, expert judgements and any combination thereof. While population projections are typically conditional on assumptions about mortality, fertility and migration rates – and therefore technically not meant to be predictions – they are still frequently interpreted as that (Bijak, 2011).²³ In contrast, *predictions* are explicitly designed to estimate future migration, for example, in anticipation of political changes such as European Union enlargement (which happens in phases). In most cases, forecasts follow a more data-driven, quantitative approach to making inferences compared to scenarios.²⁴ A typical output is the expected future stock of immigrants in a given country or the expected flow of migrants from one country to another. While forecasts were originally deterministic, much attention has been

²³ Projections, as opposed to predictions, are “computations of future changes in population numbers, given certain assumptions about future trends in the rates of fertility, mortality, and migration” (Population Reference Bureau, 2001). Population projections are, thus, conditional on assumptions about the future development of migration. They are often prepared using variants of these assumptions – conventionally, a baseline, a high variant and a low variant.

²⁴ One stream of migration forecasts (described in greater detail in later sections) works without data inputs. This is the case with population projections with an underlying simplistic assumption such as “zero/constant migration”, and with Bayesian migration forecasts that rely on inputs from expert surveys.

paid more recently to introducing measures of uncertainty (Bijak, 2011; Azose and Raftery, 2015; and Disney et al., 2015).

Table 2. Scenario versus forecast approaches in migration studies

Attribute	Migration scenarios	Migration forecasts
Best usage	Long-term strategic planning with uncertainties	Short-term operational planning
Approach	Qualitative narrative	Quantitative estimate
Accuracy of prediction	Low (because scenarios do not attempt to predict the future)	Low to middle
Type of migration	All types	Bound by data limitations (e.g. seasonal or irregular migrants are not captured in most data sources)
Time horizon	Approximately 10–20 years (A time horizon is often connected to key dates such as 2030.)	Population projections: up to 100 years Political forecasts (e.g. European Union enlargement): up to 20 years Specific flows (e.g. asylum applicants): up to one year
Typical output	Storyline about the future state of migration and which developments led to that situation	Net migration in a given year and country
Producers	Practitioners from international organizations, the European Union or national governments, and academics, including demographers	Individual demographers and economists, and national statistical offices

Methodology	Often rely on a participatory, iterative process, but still a relatively less methodological foundation, since scenarios are typically practitioner-driven	Methodologically diverse, the most frequently used tools being: Macro-demographic approaches, such as the cohort-component model; Explanatory econometric models; Bayesian models incorporating expert opinion; Time-series extrapolations.
Uncertainty	Integral part of scenarios, but with no quantification of uncertainty	Possibility to incorporate measures of uncertainty, but most are still deterministic
Main disadvantage	Unwieldy to communicate because of its narrative structure, may reflect bias of participants, highly abstract	Rely on structural continuity and give false impression of precision, reflect data limitations
Main advantage	Sensitize decision-makers towards plausible long-term futures	Aim at an accurate prediction of the future, assuming stable trends

Note: The categories in this table are meant to give an overview of the differences between scenarios and forecasts. The diversity of approaches in use today means that the differences are often less clear-cut than presented in this table. For example, some scenarios use quantitative inputs and some recent population projections incorporate qualitative expert knowledge.

Source: Authors' elaboration based on the results of the systematic literature search.

3.3 Methodology

The report presents the results of a systematic literature review of migration scenarios and forecasts conducted between May and August 2019. The author team designed two separate

search strategies to obtain the most comprehensive and least biased overview of the literature in the two fields, migration scenarios and forecasts.²⁵ The search consisted of three steps:

- 1) An extensive search through six websites (Web of Science, JSTOR, Science Direct, the search engines Google and Google Scholar, and the CROSS-MIG database);
- 2) Screening of all bibliographies of the scenario studies in (a) and selected bibliographies of the forecast studies in (a) for more studies;²⁶
- 3) Consultations with a small group of experts, who were asked to review the inventory of studies and complement the list if necessary.

For literature on migration scenarios, six websites (enumerated in (1)) were searched using any of eight tailored search terms (depending on the functioning of the respective sites and the logical operators that they support). A total of 406 results were retrieved and screened and 53 migration scenario studies retained. During the second step of the search, the bibliographies of all 53 studies were screened, adding another 41 potentially relevant studies. Lastly, consultation with a small group of experts resulted in the inclusion of five more studies. The full texts of the total 99 migration scenario studies were evaluated. The most important evaluation criterion during the final selection was the operationalization of the term “scenario.” Given the diversity of meanings attached to the term, 78 studies were dropped because their definitions of “migration scenario” did not coincide with that of the project’s (refer to Part 3).²⁷ (Refer to Appendix I for a detailed description of the search process.)

The search process for literature on migration forecasts was similar. Three websites (search engines Google and Google Scholar, and the digital library Web of Science) were searched using any of five search terms. Of the 254 search engine results matches, 93 were retained based on a screening of their titles, keywords and abstracts. A total of 18 studies were

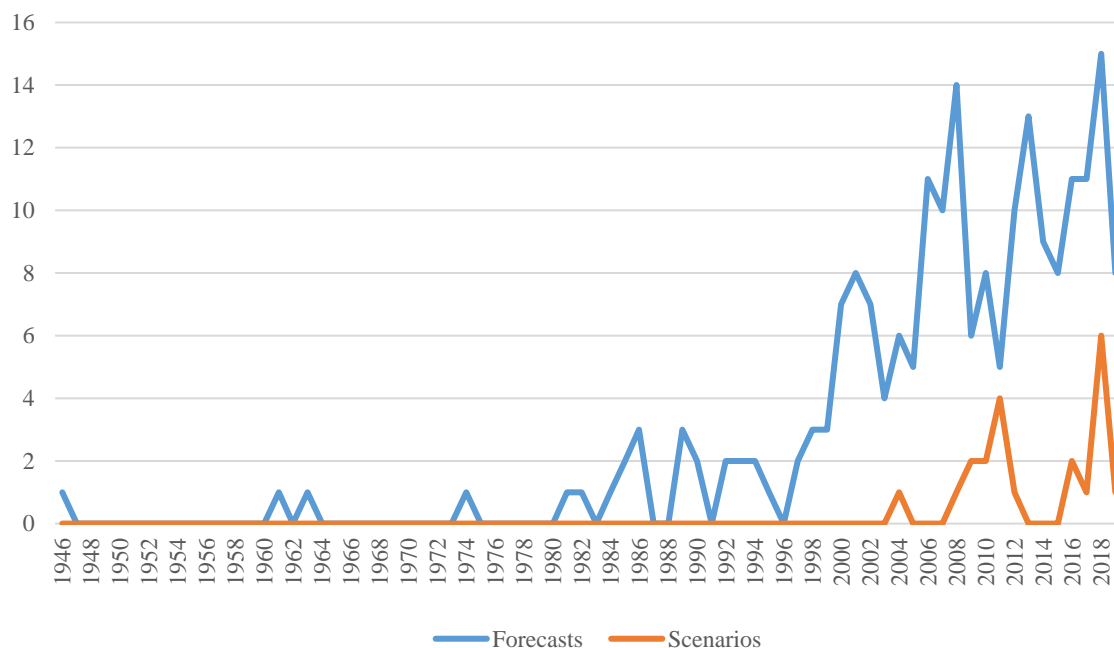
²⁵ While the authors aimed to design the literature search in the least biased possible way, some bias could not be avoided. Importantly, the restriction to English-language publications introduces bias against publications by governments and their bodies, as they are commonly written in their own local languages.

²⁶ Because of the large number of forecast studies retrieved in the first step, 111 in total (see Appendix I), it was not feasible for the author team to review the bibliographies of each study. Instead, a selection of studies for bibliography review was made from the original list of 111. The selection process prioritized the most recent and most widely discussed publications and aimed for a balanced representation of various academic disciplines (i.e. demographic studies, economic studies, etc.).

²⁷ Demographic studies comprise one stream of the literature that commonly uses the term “scenario” but attaches another meaning than the one adopted in this report. In many of these studies, scenarios are considered variants of population change of the type “low/middle/high”. However, because these demographic scenarios do not involve narrative storylines and are therefore dropped from the migration scenario review. If suitable, a demographic study is moved to the migration forecast review.

extracted from the scenario search (see previous paragraph) because they fit better conceptually as migration forecasts than migration scenarios. Selected bibliographies were then screened, which yielded an additional 82 migration forecast studies. In the third step of the search, experts reviewed the list thus far and recommended 15 more studies. Ultimately, 208 migration forecasts were included in the review. (A detailed description of the search process can be found in Appendix I.)

Figure 3. Number of migration forecast and scenario studies retrieved during the literature review, by year of publication



Note: The y-axis represents the number of studies published in a year. Note that the search was completed in August 2019, so that the number for 2019 does not represent the entire calendar year.

Source: Authors' elaboration based on the results of the systematic literature search.

3.4 Results: Migration Scenarios

3.4.1 Why now?

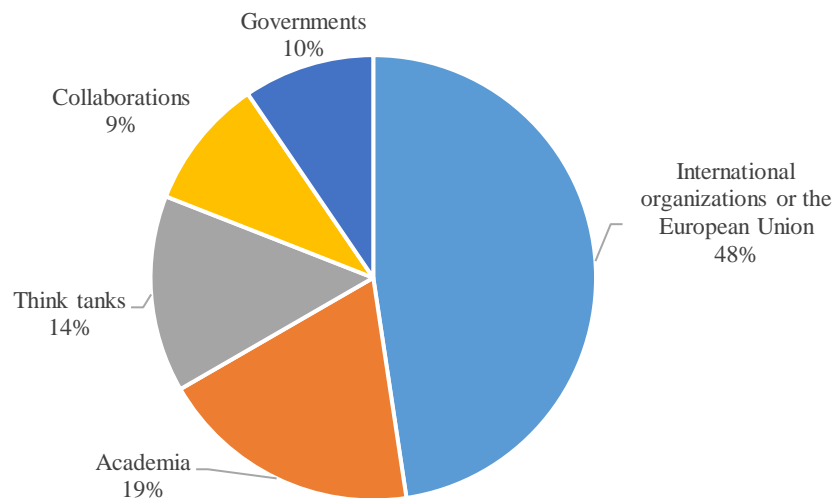
There is clearly a growing interest in being better prepared for the future of migration, with scenarios being a useful tool towards this aim. Developing scenarios for the purpose of migration-planning, however, has a relatively short history. Except for one early study using expert consultations to create scenario-like forecasts (Lachmanová and Drbohlav, 2004), all 21

migration scenario studies in this review were published in 2008 or later. The increasing popularity of migration scenarios coincides with a greater awareness of the factors and processes that potentially drive migration to Europe, such as environmental change and violent conflict. Most importantly, there is currently an understanding that future migration will come in unexpected ways and that preparedness will be essential for the well-being of Europe: “As we move from crisis management to finding long-term structural approaches to migration, a more proactive approach to managing [...] migration is needed” (European Commission, 2019a, p. 1). European leaders have thus repeatedly emphasized the importance of becoming more proactive and “moving away from ad hoc solutions towards sustainable structures” (European Commission, 2019b, p. 2).

3.4.2 Who develops migration scenarios?

As a result of the realization of the need for long-term approaches to managing migration, international organizations, such as the Organisation for Economic Co-operation and Development (OECD) and the European Union, are now among those leading the way in developing migration scenarios. In 2009, the OECD pioneered a type of migration scenario approach that is now the most commonly used and last released an updated report in 2016. Other scenarios have been developed by organizations whose missions are directly linked to migration management, including the European Union’s border protection agency, Frontex (Ariely et al., 2011 and Frontex, 2016), IOM (2017) and the European Asylum Support Office (EASO) (2019). Within academia, the Global Migration Futures (GMF) project, based at the University of Oxford, stands out by having developed a dedicated scenario methodology for migration studies (de Haas, Vargas-Silva and Vezzoli, 2010). The methodology has been frequently used by other migration scenario studies in both academia and professional practice (see, for example: EU Policy Lab, 2018).

Figure 2. Who develops international migration scenarios?

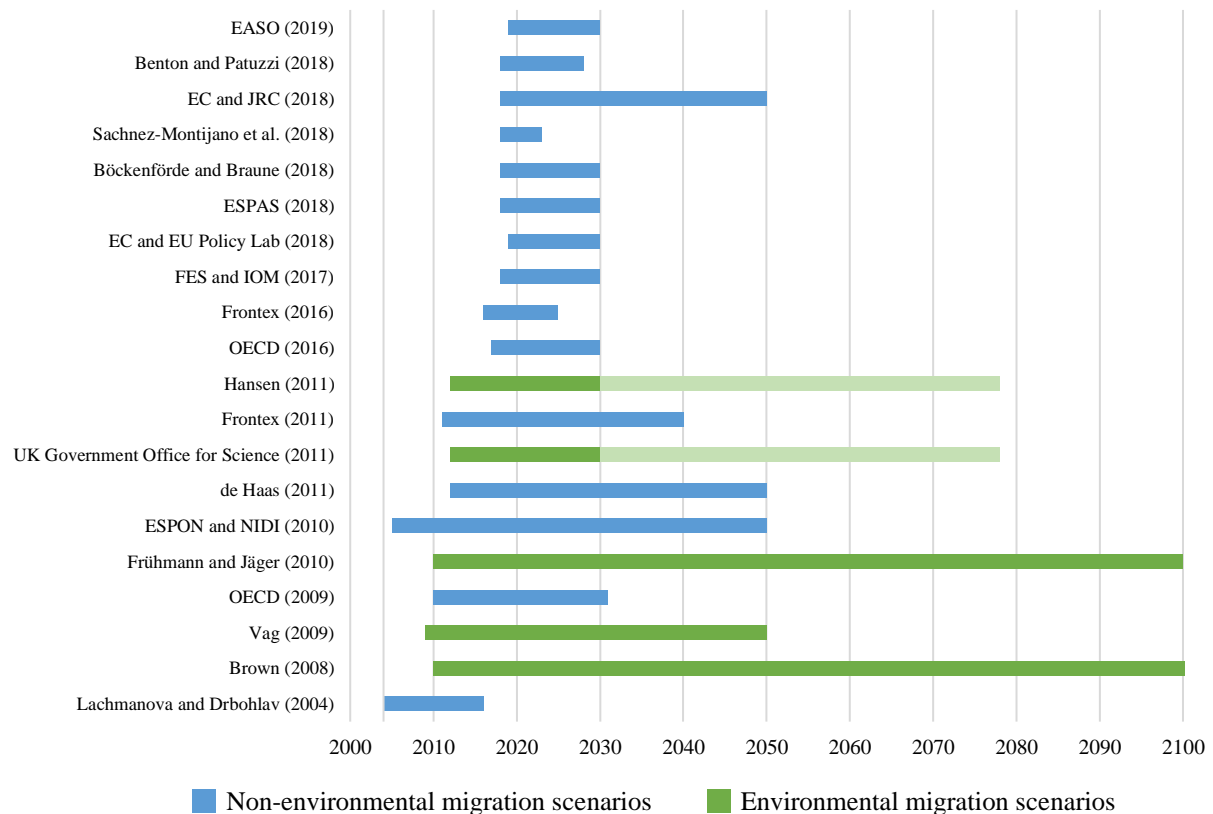


Source: Authors' elaboration based on the results of the systematic literature search.

3.4.3 What are the time horizons of the studies?

Scenario studies build storylines and imagine chains of events leading up to a more or less distant future. A majority (8 out of 18) of the studies in this review use the year 2030 as a time horizon, often in reference to the 2030 Agenda for Sustainable Development. The scenarios therefore have a time frame of approximately 10 to 20 years. However, it is notable that scenarios with a focus on environmental change adopt longer time horizons, up to the year 2100 (Frühmann and Jäger, 2010). This is due to their setups being borrowed from existing scenarios on environmental change, namely, those developed in the Fourth Global Environmental Outlook (GEO), which leads up to the year 2050, and the Special Report on Emissions Scenarios (SRES), which spans to the year 2100. The lone scenario study with a demographic focus (European Spatial Planning Observation Network (ESPON) and the Netherlands Interdisciplinary Demographic Institute (NIDI), 2010) similarly adopts a longer time frame. The chosen time frame thus depends on the thematic literature that a scenario builds on, as well as the level of granularity with which developments are described.

Figure 3. Time horizons of environmental migration scenario studies versus scenarios with other foci



Note: The figure shows the start and end dates of the scenarios in each study. In some cases, the timespan or horizon has to be inferred from the text. The green bars refer to migration scenarios with a major environmental component, the blue bars refer to all other scenarios. Bars with lighter-coloured sections (Hansen, 2011; and UK Government Office for Science (GO-Science), 2011) indicate that the scenarios have two time horizons, 2030 and 2050. Both studies are outputs from the same project (Migration and Global Environmental Change: Future Challenges and Opportunities), but present separate scenarios. One scenario study (Goff, Zarin and Goodman, 2012) is not included in the figure because it indicates no time horizon.

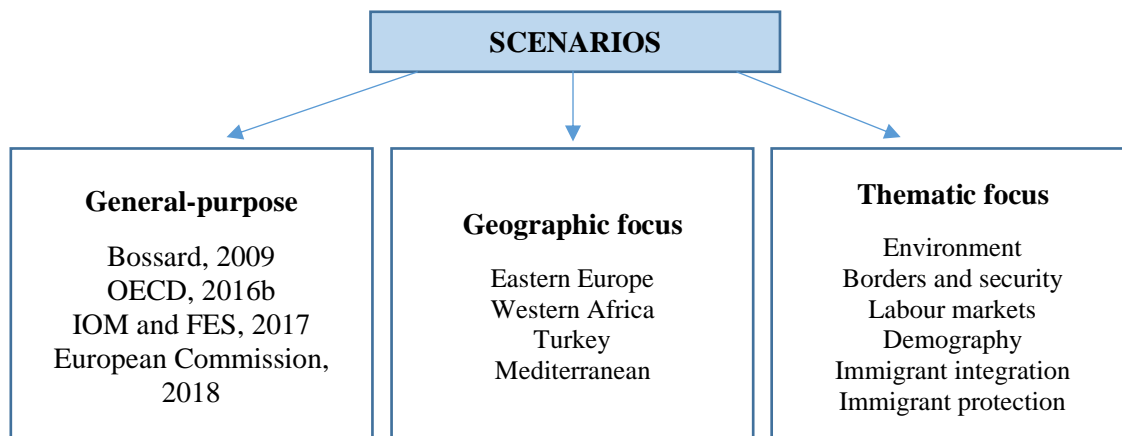
Source: Authors’ elaboration based on the results of the systematic literature search.

3.4.4 What types of migration scenarios exist?

Three types of migration scenarios are distinguished in this review. The first comprise general-purpose scenarios that build comprehensive narratives about the future state of the world. The two OECD scenarios (2009 and 2016), one by IOM and Friedrich-Ebert-Stiftung (FES) (2017) and another by the EU Policy Lab (2018) report fall under this category. The second type focuses on a particular region or country (beyond the common geographic focus, i.e. Europe, of all studies in this report). Lachmanová and Drbohlav (2004) explore European East–West

migration; de Haas (2011) focused on Mediterranean migration; Goff, Zarin and Goodman (2012), on Northern Africa; Böckenförde and Braune (2018), on Western Africa; and Sánchez-Montijano, Kaya and Sökmen (2018), on Turkey. All of these countries and regions are important areas of origin, given their geographic proximity to countries of the European Union and/or their historical ties with certain European Union countries, for example, the relationship formed between Germany and Turkey through their guest worker agreement and those between European powers and their former colonies in Western Africa. A third group of scenarios revolves around a thematic focus. Four studies (Vag, 2009; Frühmann and Jäger, 2010; United Kingdom Government Office for Science (GO-Science, 2011; and Goff, Zarin and Goodman, 2012) focus on the connection between future migration and the environment. Also, four studies explore borders and security in connection with migration (Vag, 2009; Ariely et al., 2011; Frontex, 2016; and Goff, Zarin and Goodman, 2012). One study concentrates on humanitarian migrants (EASO, 2019), another on the structural changes in European labour markets and their impact on immigrant integration (MPI, 2018), and yet another on demographic developments (ESPON and NIDI, 2010).

Figure 4. Types of migration scenarios



Note: The categories are not mutually exclusive. For example, Goff, Zarin and Goodman (2012) present scenarios on climate-induced migration from Northern Africa to Europe and highlights their implications for security, thus combining two thematic foci. All scenarios are linked to the European Union since this was part of the inclusion conditions of our systematic search. The geographic focus therefore refers to a focus beyond that of the European Union.

Source: Authors' elaboration based on the results of the systematic literature search.

3.4.5 Migration drivers in scenarios and forecasts

In imagining the future of migration, scenario creators must think about what drives people to migrate today, and how these drivers could change in the future. Much policy interest and research has focused on this question (see, for example, (Natale, Migali and Münz, 2018) for a comprehensive overview), and various academic disciplines and methodological approaches have produced alternative ways of thinking about the underlying reasons or motivations for migration. In narrative scenarios, migration drivers have a broad and dynamic meaning. Also, in contrast to quantitative models used in migration forecasts, scenarios do not require measuring and quantifying drivers of migration. This is particularly important when considering structural drivers of migration like environmental and climate change and global power balances, which can be challenging to measure. Furthermore, scenarios emphasize the context in which migration happens and explore how changes in this context and interactions between individual drivers influence migration patterns. A certain migration driver can increase migration flows in one situation, but very possibly decrease flows in another. For example, migration networks are generally thought to reduce migration costs by serving as a safety net for newly arrived migrants through financial, housing and/or employment assistance. Alternatively, in difficult economic times, migrants may “send (mis)information back home to influence others’ decision[s] to migrate, [...or] deliberately reporting lower earnings to relatives back home to provide disincentives for others to migrate” (Carlson, Jakli and Linos, 2018, p. 548). Scenarios therefore emphasize the effects of interactions between migration-relevant variables, feedback mechanisms and the importance of context to understand why people migrate.

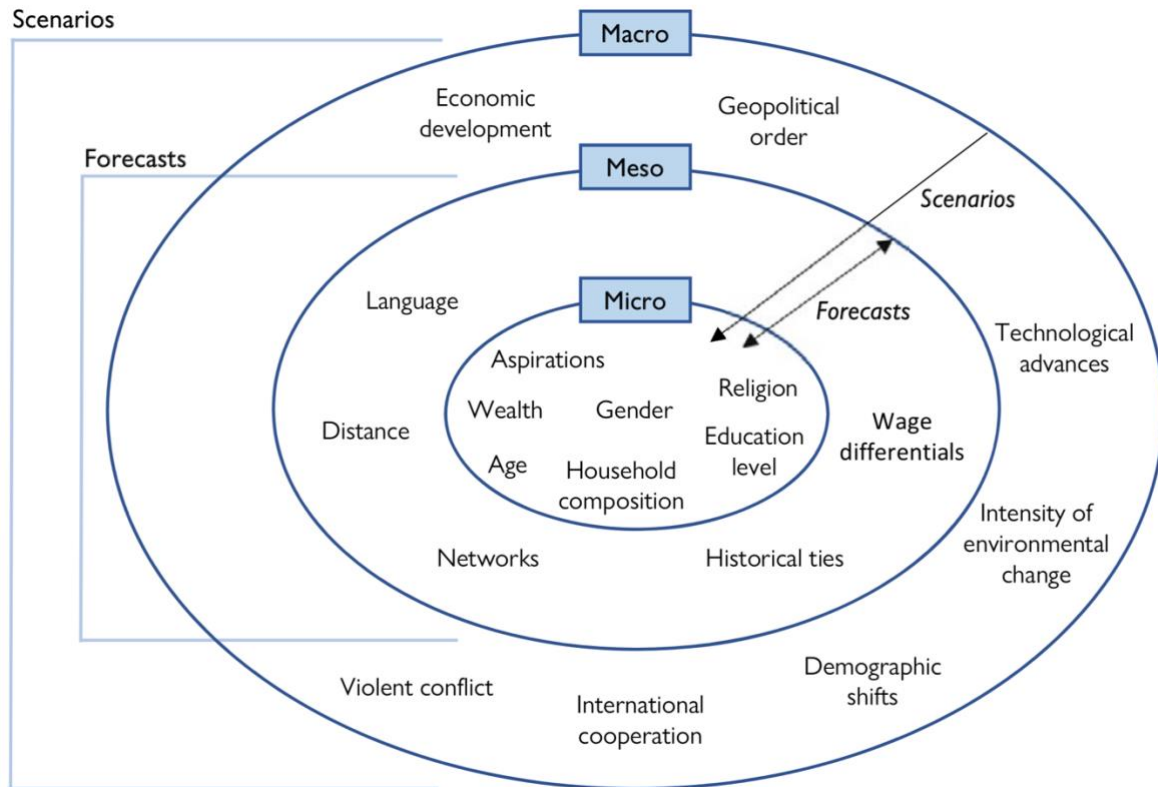
Figure 5 contrasts migration drivers in scenario studies with those in econometric models. (The fundamentals of econometric forecasts will be discussed in greater detail later. However, it is helpful to have a basic understanding of them early on, to clarify the distinct features of the scenario approach.) Econometric forecasts produce quantitative estimates of the relationships between observed migration and the variables that are believed to cause it (income differentials between countries of origin and destination, the presence of migrant networks, etc.). These variables (or drivers) need to be measurable and quantifiable to be included in the model. The previously mentioned report by the Joint Research Centre (JRC) of the European Commission provides a typical example of how econometric models interpret migration drivers: “The positive sign of GDP indicates that improving economic conditions in middle-income countries of origin are associated with increasing emigration from [those countries].”

(Natale, Migali and Münz, 2018). Scenario studies also consider economic performance an important factor in explaining migration. However, instead of defining hard and fast rules, they show how relationships between variables are country-, time- and context-dependent. As Figure 5 illustrates, scenario and forecast studies often identify the same migration drivers but operationalize and interpret them differently, sometimes in conflicting ways.

Figure 5 illustrates different levels of migration drivers using examples from the reviewed studies. The micro level refers to an individual's personal characteristics (e.g. age and education level) and direct social setting (e.g. family situation). The meso level pertains to comparative characteristics or linkages between pairs of countries or regions, for example, wage differentials, shared languages and migration networks. (Note that community networks (as opposed to personal networks that operate at the micro level) are aggregate social relationships of members of a particular community (Bonfiglio, 2011).²⁸) Finally, the macro level refers to structural factors that shape global developments, such as social, economic, cultural, technological and environmental changes.

²⁸ Bonfiglio (2011, p.7) notes that the distinction between personal and community networks (she refers to them as “migrant network” and “migration network”, respectively) is often ignored, which causes substantial conceptual confusion. Having a personal network means personally knowing someone in the destination country. A community network comprises other migrants at destination with whom one shares important characteristics, such as ethnicity, religion or place of origin, although they may not know each other personally. Quantitative approaches have traditionally studied community networks, whereas qualitative studies tend to study personal networks.

Figure 5. Selected migration drivers in scenarios and forecasts at the micro, meso and macro levels



Note: This visualization does not show all possible migration drivers or determinants.

Source: Authors' elaboration based on the results of the systematic literature search.

Figure 5 shows that scenarios and forecasts differ fundamentally in two ways. First, they differ in the level they focus on and the breadth of inclusion of contextual factors. Scenarios tend to focus first on the macro context and from there deduce implications for the future of migration (Bossard, 2009; OECD, 2016; and EU Policy Lab, 2018). The line of reasoning thus proceeds from the macro to the micro in mapping out a plausible future. In contrast, forecasts concentrate on drivers at the micro and meso levels and the quantification of their individual impact on migration patterns. The reasoning is thus confined at the micro and meso levels.

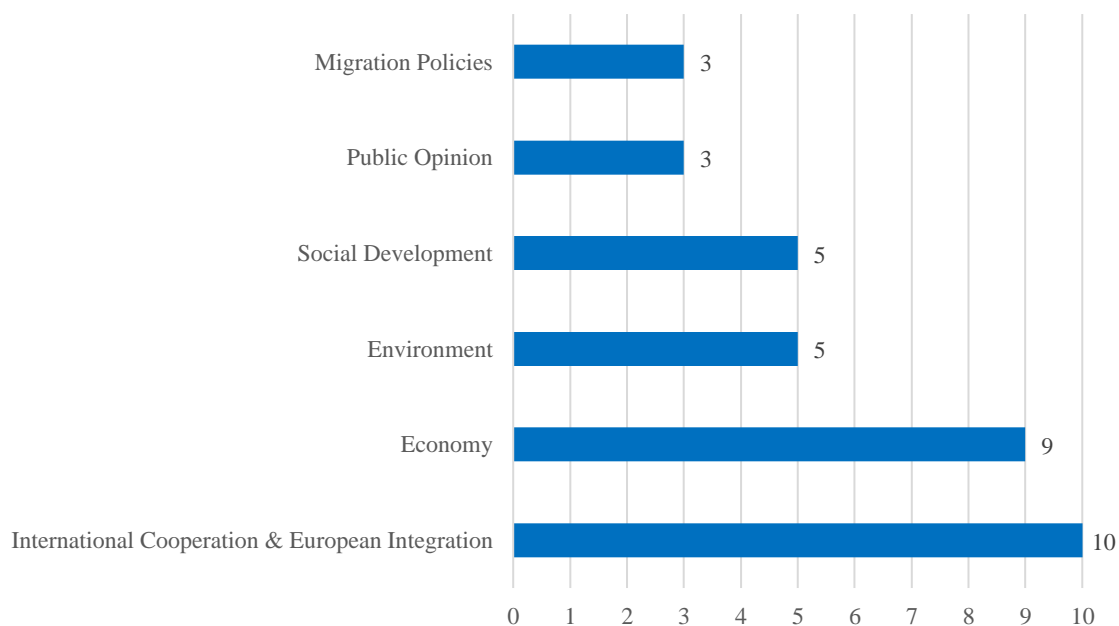
3.4.6 Along which dimensions are migration scenarios structured?

Since most scenario studies approach the future of migration from a macro perspective, the individual-level drivers and intermediate-level factors that influence migration need to be structured around those lines. One common approach consists of selecting two dimensions represented by intersecting axes that create four quadrants, with each corresponding to one

scenario (hence a total of four scenarios). The two variables are not independent, as in econometric models, but should rather be thought of as critical macro-developments that facilitate the comparison of the different scenarios relative to each other and to the two dimensions (de Haas, 2011; and IOM and FES, 2017). In some cases, the dimensions are selected based on their perceived level of uncertainty (EU Policy Lab, 2018). This applies to studies that adopt the GMF approach developed by de Haas, Vargas-Silva and Vezzoli (2010). Accordingly, if a dimension has a very high level of uncertainty, but at the same time is very important in predicting the future of migration, then structuring narratives according to different versions of that dimension will result in the most useful scenarios. Lastly, it should be noted that each of the dimensions can be looked at from the perspective of either the country of origin or the country of destination. For example, “economic growth” can be used in one narrative to refer to that in the European Union, and in another to describe the economic situation in a country of origin.

Of the 20 migration scenario studies included in the review, 13 clearly describe dimensions along which scenarios are developed. There is large variation in the elaboration of the storylines; Figure 6 shows which dimensions feature most prominently in the scenarios.

Figure 6. Overview of dimensions



Source: Authors’ elaboration based on the results of the systematic literature search.

Note: A storyline may consist of different aspects that correspond or belong to different dimensions. For example, the aspects “multilateral and inclusive governance” (EU Policy

Lab, 2018) are attributed to the dimensions “international cooperation and European Union integration” and “social development.”

International cooperation and European Union integration

Of the 21 migration scenario studies in this review, 10 consider the degree of international cooperation and European integration as one of the most decisive macro-developments determining the future of migration. In the scenario storylines, this dimension describes the degree to which countries cooperate on a range of policy areas – from the environment to trade and human rights. While more cooperation does not necessarily lead to less migration, it is thought to produce a smoother, more ordered migration process. There are also gradients to international cooperation. For example, cooperation between several heterogeneous countries is potentially more challenging to attain than cooperation between two similar countries. In turn, cooperation between member States of the European Union could be relatively more feasible than large, multilateral agreements, which can be considered the most demanding and uncertain form of international cooperation (OECD, 2016a). While the dimension “international cooperation and European Union integration” potentially refers to cooperation in any part of the world, most scenarios put particular emphasis on the state of European integration. (In cases where the scenarios focus on a particular geographic region – for instance, Turkey, the Mediterranean or Western Africa – international cooperation is naturally interpreted as the degree of cooperation between the European Union and that region.) In the Frontex-funded study by Ariely et al. (2011), for example, one scenario describes the gradual breaking apart of the Schengen zone and the reinstatement of the European Union’s internal borders. Yet national border security and immigration agencies lack human and financial resources, which leaves their borders porous and eventually results in increasing levels of irregular migration. In contrast, one OECD (2009) scenario imagines a situation in which open-border policies have been expanded from covering only European countries to include all OECD countries, thus increasing movement of people within the OECD community.

Economic development

Nine studies feature economic development as one of the most defining issues driving future migration. Given the continuing influence of economic theory, particularly the neoclassical

school of thought,²⁹ on migration studies and the recurring evidence from econometric studies, income differentials are considered one of the major drivers of migration. However, the studies adopt very different perspectives on the causes and consequences of economic growth. In one scenario, for example, imagined deteriorating economic conditions in Western Africa would lead to more poverty and social unrest. As a result, an increasing number of young people would try to move to Europe (Böckenförde and Braun, 2018). In another scenario, European Union member States struggle to find migrants willing to move to move there because other regions – particularly, Asia – have become more economically attractive destinations (EASO, 2019). The “economic development” dimension can be interpreted from the storylines as either economic development in a particular region, whether Europe or elsewhere, or economic convergence between Europe and other regions. As the aforementioned examples have shown, scenarios can also contradict each other – and they frequently do. This is not a flaw, but a logical consequence of the scenario approach, which aims to explore a wide range of possible futures.

Environment

While only one study (Natale, Migali and Münz, 2018) has a dedicated dimension for the environment, it nevertheless occupies a prominent place in 5 of the 21 scenarios. Since the environment is considered to be closely connected to economic growth, the two are often combined and discussed as one dimension (i.e. the economy–environment dimension), for example, in ESPON and NIDI (2010, p. vi): “At one end of the economy–environment dimension, we envisage a situation where sustainable growth has been achieved through technical and social innovation. At the other end of the economy–environment dimension, we envisage a situation where the environmental challenges have not been met, and growth, as traditionally measured, has fallen.” (ESPON and NIDI, 2010, p. vi). Six scenario studies published between 2008 and 2012 explored this link between migration and environmental change (Brown, 2008; Vag, 2009; Frühmann and Jäger, 2010; ESPON and NIDI, 2010; and GO-Science, 2011; and Goff, Zarin and Goodman, 2012). Besides their shared thematic focus, these studies (namely, SRES, of the Intergovernmental Panel on Climate Change (IPCC); and GEO, of the United Nations Environment Programme (UNEP)) have in common the fact that

²⁹ Neoclassical migration theory treats migration as a means to restore a distorted equilibrium. On the macroeconomic level, this implies migration flows between two countries that are characterized by a surplus in labour and capital respectively. On an individual level, migration would be the result of a cost–benefit analysis. (For more information, see, for example, Bijak (2011) or Howe and Jackson (2005).)

they draw on existing scenarios taken from the field of environmental change. Both the SRES and GEO environmental scenarios provide comprehensive narratives about the future state of the world that go far beyond environmental variables. In addition, they consider a range of structural factors affecting future migration, such as degree of international cooperation, cultural shift, population growth and technological advancement (IPCC, 2000; and UNEP, 2007). These environmental scenarios are therefore easily adoptable for migration scenario-building.

The connection between the environment and migration is discussed in various and sometimes conflicting ways, which highlights the difficulty of identifying all potential impacts of environmental change on migration. For example, GO-Science (2011, p. 9) notes the scenario wherein “environmental change is equally likely to make migration less possible as more probable.” In contrast, Goff, Zarin and Goodman (2012) conclude that climate change is likely to lead to the forced migration of millions of Northern Africans.

Social development

The dimension “social development” describes domestic factors related to social peace, cohesion and capacity for immigrant integration. As with the environment, the impact of social development on migration is not straightforward and can be assessed from the perspective of either the country of origin or the destination country. In the scenario presented in EU Policy Lab (2018), for example, inclusive governance in European countries is discussed in connection with its potential impact on immigrant integration outcomes. Similarly, the OECD (2009) notes that a “failure to integrate effectively could lead to problems of political stability and social cohesion” (Bossard, 2009, p. 210). On the other hand, de Haas (2011) and Sánchez-Montijano, Kaya and Sökmen (2018) explore the impact that social development in countries of origin has on migration. De Haas (2011) argues that democratic reforms and, in particular, economic growth in Southern Mediterranean countries, along with other developments, could lead to lower levels of emigration towards Europe. In addition, social reforms in countries of origin have the potential of not only lowering immigration pressures, but also leading emigrants to return. Sánchez-Montijano, Kaya and Sökmen (2018) hold this view and notes that democratic reforms and political convergence between the European Union and Turkey could prompt highly skilled European Union citizens with Turkish roots or younger Turkish emigrants to return to Turkey.

Public opinion is discussed in 3 of the 21 migration scenario studies as being an important factor shaping future migration. The focus on public opinion is a more recent trend when comparing the scenarios over time, and it appears to be related to the rise of populist parties across Europe. For example, two of the scenarios in EC (2018) imagine a future where populist parties continue to gain political power in Europe, fuelling further anti-immigrant sentiment. In IOM and FES (2017), the public is envisioned to favour skilled, highly selective immigration, but opposes any form of international protection. In de Haas (2011, p. S68), xenophobic politics in Europe and the Maghreb are imagined to further propagate “popular beliefs about fundamental cultural cleavages between the Muslim and secular European cultures.” On the other hand, as IOM and FES (2017) emphasize, public opinion on migration is especially volatile and prone to drastic shifts in either direction. Uncertainty is therefore high, opening up the possibility for vastly different scenarios.

Migration policy

Three studies in this review feature migration policy as a decisive development that will shape future migration. This dimension is a continuum that stretches from very restrictive to fully open immigration policies. To be more specific, the scenarios in these three studies consider migration policies’ degree of selectivity with regard to which migrant groups are targeted and allowed to enter, interaction with technological advances and the level at which they are formulated (mostly either national or international). In one OECD scenario, migration policies become more open and “flows of migration are determined largely by market forces, as migrants respond to variations in labour demand across the world” (OECD, 2016a, p. 262). Migration is thus imagined as becoming a more circular, fluid process with fewer hurdles. In one of the scenarios presented in IOM and FES (2017, p. 49), countries set their own immigration policies, “but implementing them in the prevailing chaos seems irrelevant”. The scenario therefore accounts for imperfect or even impossible implementation. Lastly, NIDI and ESPON (2010) examine migration policy scenarios at the most granular level: among European regions and cities. It is the only scenario study in the review that focuses on internal migration, and not only on international migration.

3.4.7 What methods are used to develop migration scenarios?

With the number of scenario studies growing, there is now a multitude of approaches that have been used to develop migration scenarios. However, the field of migration scenarios is still

characterized by rather dispersed methodological foundations. This can be partly attributed to its origins in the practice-driven areas of military and business (de Haas, Vargas-Silva and Vezzoli, 2010), but also stems from the discursive process that scenario-building often involves. During workshops and interviews, for example, scenario-building teams encounter unforeseen challenges and modify their respective methodologies accordingly. Transparent and detailed documentation of the scenario development process is therefore key for the validity of any proposed scenario.

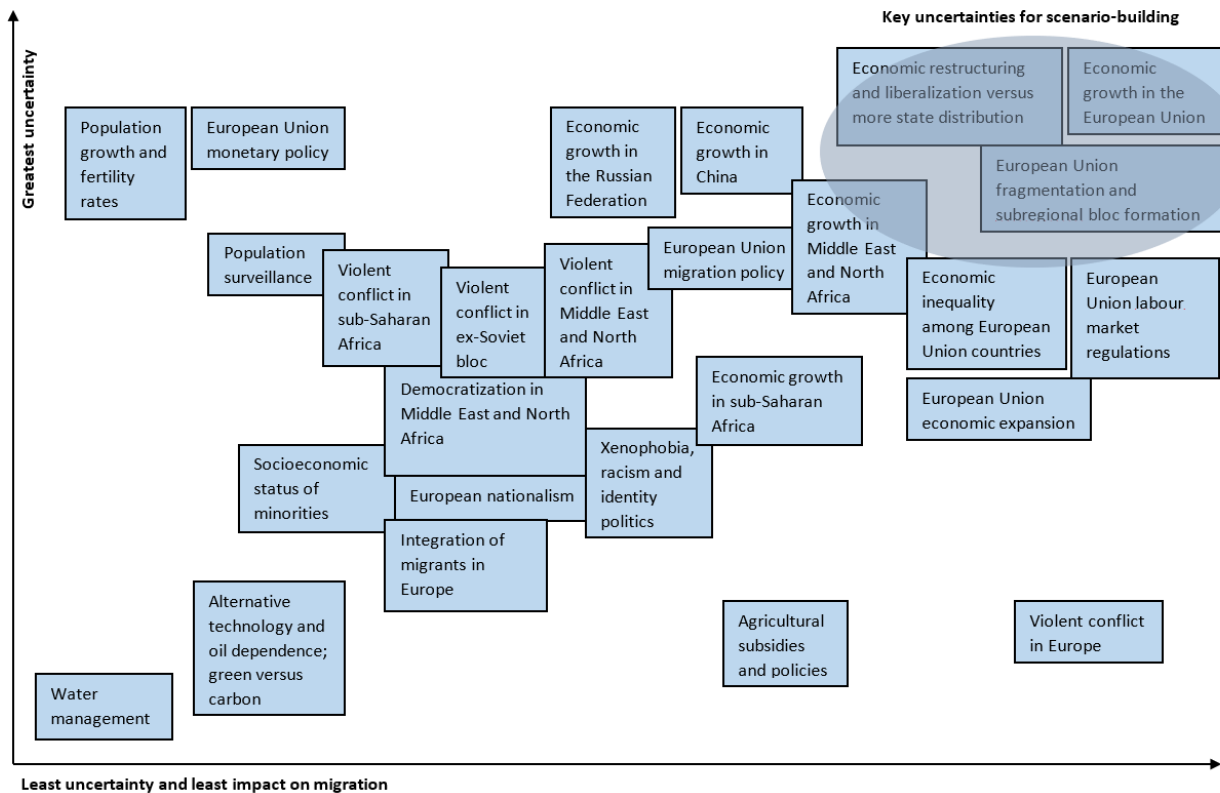
Participatory, discursive approaches to migration scenarios

Almost half of the scenario studies in this review involved external participants in the scenario creation process, such as migration scholars or policymakers. While different methodological approaches are available that involve the inclusion of external participants (such as the Delphi survey (see section 5.7.4)), one recent and comprehensive methodological guide for participatory scenario creation was developed by the Global GMF project.³⁰ It involves multiple steps that alternate between desk research and participatory elements (e.g. workshops, online surveys and interviews). After each event that involves external participants, the new input is collated and organized by the authors. The scenario-building process is communicative and flexible, requiring the methodology to evolve with the scenario team (both the authors and external participants). Another important characteristic of the GMF methodology is its focus on factors that are difficult to project into the future, such as geopolitical shifts or technological advances,³¹ and whose potential impact on migration can be profound despite their lack of predictability. It would therefore be especially fruitful for scenario creators to focus on factors that combine a high level of uncertainty with a high-potential impact on migration. The focus on dimensions that are subject to a high level of uncertainty emphasizes the competitive advantage of scenarios over forecasts, for which it is difficult to capture contextual changes and first-time events.

³⁰ More information is available from the Migration Institute website: www.migrationinstitute.org/completed-projects/gmf.

³¹ The question of how to deal with uncertainty naturally surrounds almost all forecast and scenario studies and is not unique to the GMF approach.

Figure 7. Intermediate output from a scenario-building workshop: selecting factors by how uncertain and how impactful they are



Source: Adapted from IMI (2011, p. 1).

Note: The red circle indicates the location (on the continuum) of factors that are at the same time the most uncertain and potentially having the greatest impact on migration, such as those that are the focus of the GMF scenario methodology. The illustration is adapted from the IMI policy brief dated 8 July 2011, which documented the intermediary outputs of the scenario-building process. Stakeholders identified an initial list of factors with varying uncertainty for Europe in a workshop and the organizing team later refined and structured them.

IOM and FES (2017) and the EU Policy Lab (2018) provide two good examples of transparent and well-documented migration scenario-building processes. Both follow an iterative process that involves a large range of stakeholders and focus on uncertainty rather than certainty. In IOM and FES (2017), for example, 50 professionals from different fields were brought together to imagine plausible futures for migration. The process involved a scoping workshop wherein overarching principles were identified, interviews, two scenario-building workshops and one webinar. In the study by the EU Policy Lab (2018, pp. 20–21), “relative uncertainties for migration by 2030” are clearly listed and separately analysed for European Union and non-European Union countries.

There was large variation overall in the number of participants that the study authors brought together for the workshops, surveys and interviews. For the 21 migration scenario studies, 11 did not involve the direct participation of experts, policymakers or other external stakeholders.³² The remaining 10 studies had participant numbers ranging from 15, as in Lachmanová and Drbohlav (2004), to 350, as in the case of the large-scale mixed-methods study by GO-Science (2011). However, even when the exact numbers remain unclear, it can be estimated from the descriptions that most of the studies that involved external participants (6 out of 10) had between 20 and 80. The composition of study participants, and even information such as names, occupations and affiliations, is fully revealed in 4 of the 21 studies, with another 2 studies providing the names and affiliations for a subgroup of the participants (i.e. the names of the Advisory Committee members and highlighted contributors in the case of the 2018 JRC study, and the names of the Steering Group members in the 2009 OECD report). Two studies opted to keep participants anonymous and instead offered statistical information on their backgrounds (namely, Lachmanová and Drbohlav, 2004; and ESPON and NIDI, 2010). Two other studies provided very little information on their participants' backgrounds (Ariely et al., 2011; and EASO, 2019).

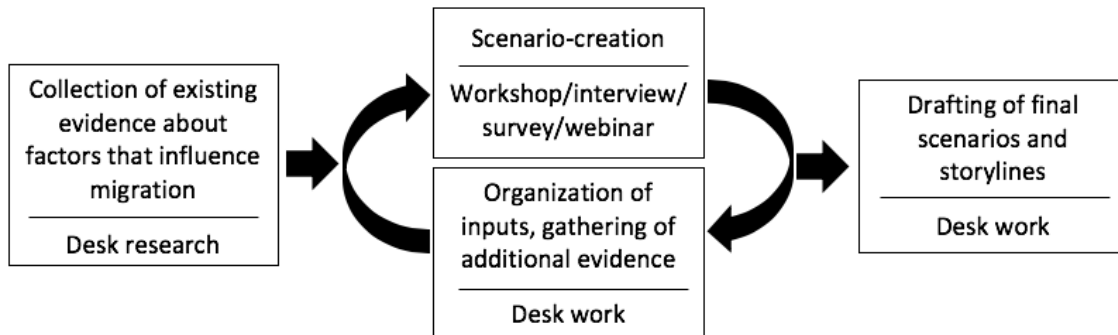
One point repeatedly noted in the scenario studies is the substantial educational impact and mind-broadening effect of the scenario-building process on the research teams and participants. The challenge for scenario studies is how to extend these benefits to non-participants of the process – individuals and institutions alike. This is particularly difficult since the output of scenario studies are often lengthy storylines that require careful reading. Adequate presentation and visualization will therefore be important characteristics of scenarios that aim to make an impact.

Lastly, the participatory and iterative process underlying migration scenario creation requires a great amount of resources – organizational capacity, participants from a range of backgrounds, time spent organizing and attending multiple days of meetings and discussion, and more. It took the IOM–FES joint team one and a half years to complete the process (from May 2016 to October 2017). It is evident that only few organizations have the capability for such an undertaking, and that they are most likely to be larger public or international institutions, such as bodies or agencies of the European Union or the United Nations. This fact

³² Three studies that did not involve participants (Brown, 2008; Vag, 2009; and Frühmann and Jäger, 2010) used existing scenarios (i.e. the GEO and SRES environmental scenarios created by UNEP and IPCC) that were themselves created through participatory processes. (Refer to UNEP (2007) and IPCC (2000) for more information.)

is mirrored in the studies reviewed here: Among those that used a participatory approach, all but one were produced or funded by such institutions.

Figure 8. Typical participatory scenario creation process



Source: Authors' elaboration based on the results of the systematic literature search.

Note: The process illustrated in the diagram typically underlay the scenarios featured in 10 out of the 21 migration scenario studies.

Adapting existing scenarios

An alternative and more accessible approach for smaller institutions and universities involves adapting existing scenarios instead of developing scenarios from scratch. For example, Brown (2008), Vag (2009) and Frühmann and Jäger (2010), which explore the linkage between environmental change and migration, draw on the GEO and SRES scenarios developed by UNEP and IPCC, respectively, through extensive participatory processes. Because the two sets of scenarios focus on macro-contextual factors, it is relatively straightforward to incorporate migration into the scenarios. The GEO scenarios, for example, describe macro-developments such as the future state of international cooperation, long-term demographic developments, changes in the labour market structures and shifts in value systems (UNEP, 2007). All these factors are highly relevant, not only to the future of the environment, but also to that of migration. Therefore, the scenarios can be used either as they are (i.e. not in specific relation to migration) or examined in terms of what they imply for migration. Alternatively, the scenarios can be modified (Brown, 2008) or used as assumptions in computations (ESPON and NIDI, 2010).

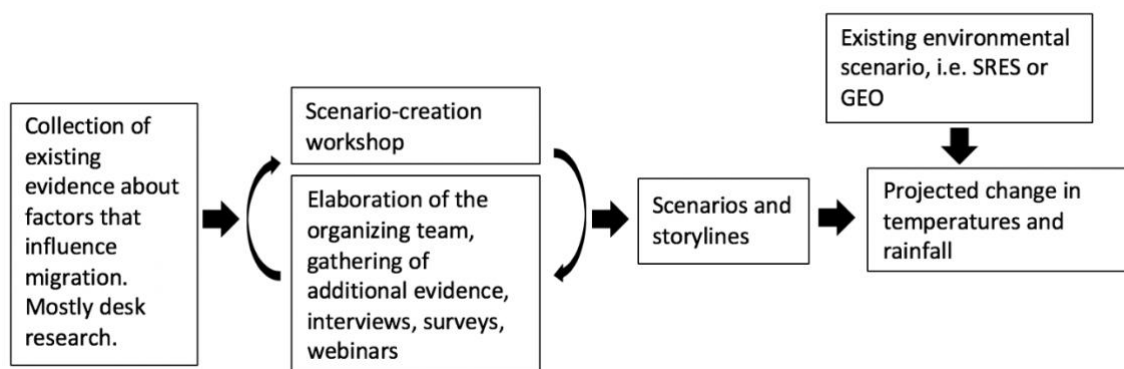
Large-scale mixed studies

The studies from two projects stand out as providing particularly comprehensive assessments of future migration that combines the scenario approach with other forms of qualitative and

quantitative evidence: (a) ESPON and NIDI (2010) (“Demographic and Migratory Flows Affecting European Regions and Cities”) and (b) GO-Science (2011) (“Migration and Global Environmental Change”). GO-Science has commissioned a total of 70 background studies and engaged with 350 experts from 30 countries worldwide to gather all types of available evidence. Some of these background papers explored migration drivers in detail (e.g. “Drivers of Migration in Drylands”), summarized the state of the science for various disciplines (e.g. “Frequency, Location and Severity of Extreme Events”) or conducted case studies for specific regions (e.g. “New Urban Spaces in India”). Population projections, and forecasts of temperature and rainfall changes, among others, were used as direct inputs for the scenarios. Conversely, the four scenarios featured in the UK Government Office for Science (2011) report were used to guide the assumptions made for different projections. Similarly, ESPON and NIDI (2010) provides conventional demographic projections of the European population up to the year 2050. Then, in a second step, it applies a scenario framework to the individual components of their projections – namely, mortality, fertility, migration and labour force participation.

The two projects show that scenarios and forecasts need not be competing forms of foresight. With their respective advantages and shortfalls, it appears that a combination of both would provide a more complete picture of possible futures. Moreover, a forecast is usually more restrictive, given its numerous assumptions. In contrast, a migration scenario utilizes a broader and more permissive approach and can therefore serve as an umbrella framework for several individual forecasts.

Figure 9. Combining migration scenarios with scenarios from other fields, to be used as inputs for quantitative projections



Source: Authors' elaboration. The visualization is based on the approach used to develop the scenario in Go-Science (2011).

Note: SRES and GEO are environmental scenarios produced by UNEP and IPCC.

The Delphi method

The Delphi method, although used in only one study in this review, is well-known and therefore worthy of a brief account.³³ In a nutshell, the Delphi method is an expert-led, interactive research method used to derive estimates of the future. Experts are asked to anonymously answer questionnaires in two or more rounds. Between each round, the experts receive feedback on each other's responses. They can then revise their responses and resubmit the questionnaire, usually leading to a convergence of responses (Helmer, 1967). In Lachmanová and Drbohlav (2004), 15 migration experts from Czechia participated in a two-round Delphi survey. They were asked about future levels of East–West migration and what policy objective the European Union should pursue. Although the Delphi method is designed to reduce individual bias, its results are still always a reflection of the participants' world views, knowledge and imaginative capacity. There is thus a risk of producing overly conforming or conservative assessments of the future. In Lachmanová and Drbohlav (2004, p. 142), for example, the experts were quick to agree that “[t]here will be more or less the same volumes, structures, directions and determinants of migration as it was during the last 2 or 3 years”. The Delphi method can be used on its own, as here by Lachmanová and Drbohlav, or as an input for scenarios and forecasts.

Other approaches

A notable approach that cannot be grouped together with the approaches already discussed was used in Frontex (2016). While the process generally resembled the interactive and iterative GMF methodology, Frontex employed computer software to aid the scenario generation process. After identifying key factors and possible developments for each of these factors, a software program was used to compute all possible combinations of future developments and then select the most plausible ones. The seven scenarios identified in this manner should thus

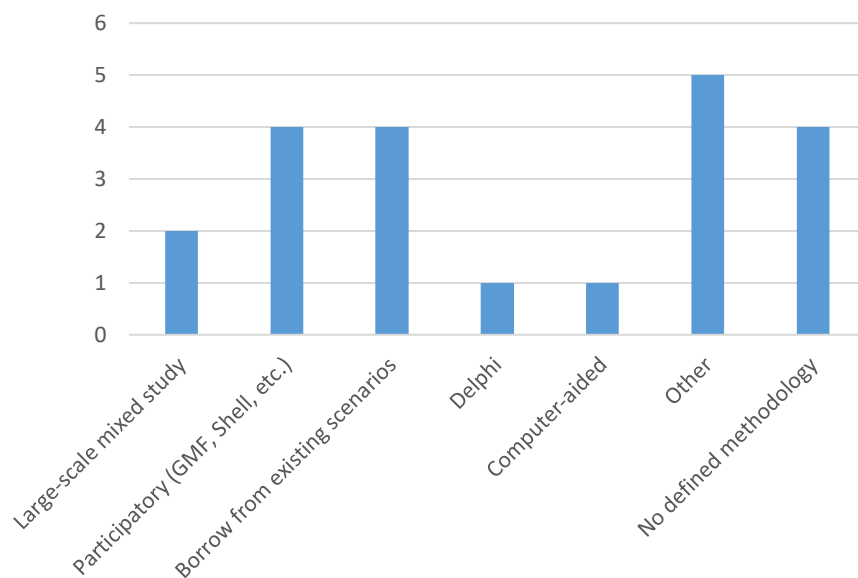
³³ A Delphi study may be classified as either a scenario or a forecast, depending on the specific design of the survey. For example, a Delphi study that asks experts solely about a (quantitative) point estimate of future migration, without creating a narrative storyline that accompanies it, is more similar to a forecast than a scenario, at least for the purpose of this report. A few more Delphi studies are therefore included in the forecast section of this report and will not be discussed at this point.

display the whole range of “windows of possibilities” (Frontex, 2016, p. 44). The process is meant to be less biased, but it nonetheless needs review and validation by experts.

EASO (2019) also employed a methodology that was distinct from the GMF approach and others described thus far. In contrast to the other approaches, there was no ranking of influencing factors according to impact or degree of uncertainty; each of the 12 factors was given equal weight instead. The EASO scenario development involved six consecutive steps that used a combination of workshops, expert interviews and one online survey. The process began with an identification of influencing factors, each of which was itself projected into the future. However, the most salient feature of the study is its focus on migration actors, as their perspectives and deeply rooted assumptions take centre stage in the scenario creation process. Causal layered analysis, an academically recognized and theorized method, was adapted for actor analysis. In the end, the scenarios were developed by combining an analysis of the influencing factors with an analysis of the shaping actors.

Lastly, it should be noted that some studies do not at all specify the methodological foundations of their scenarios (e.g. Hansen, 2011; ESPAS, 2018; MPI, 2018; and Sánchez-Montijano, Kaya and Sökmen, 2018). This is problematic because scenarios are necessarily dependent on personal assumptions and uncertainties. Without a transparent process and documentation thereof, the soundness of scenarios cannot be judged, undermining their usefulness. For example, Hansen (2011, p. 5) states that “the EU will almost certainly survive the next 30–50 years”. This might have seemed like a plausible assumption at the time of that report’s writing. However, since then the European Union has undergone dramatic political turbulence and has notably seen the United Kingdom voting to leave the union. A better methodological foundation would have been helpful in challenging this assumption.

Figure 10. Methodological approaches of the scenario studies in the literature review



Source: Authors' elaboration based on the results of the systematic literature search.

3.5 Interim conclusion: Migration scenarios

Migration scenarios are a relatively new approach to help prepare organizations and governments for future migration. Regardless, in only 10 years, major European and international actors, such as the European Commission, the OECD, national governments and academic institutions, have all undertaken migration scenario exercises.³⁴ The increasing popularity of scenarios points toward a reckoning by policymakers that future migration is not likely to follow linear trends. From a historical perspective, it is in fact highly improbable that migration patterns of the past will be reproduced in the future. Technological advances, environmental change and shifting global power relations are all going to change the patterns of migration as we know them today. However, uncertainty is high and a multitude of different futures is plausible. The strength of migration scenarios is that they can put these uncertainties and discontinuities at the centre of attention and thereby facilitate long-term, high-level strategic decision-making.

Reviewing 21 scenarios studies produced since 2004, the systematic literature review reveals that two global developments are believed to be most influential in setting the course for future migration: (a) the degree to which countries cooperate on an international level, reaching multilateral agreements and defining common goals, and (b) the degree to which

³⁴ It is important to note here that the literature search was conducted exclusively in English, which creates a bias towards non-English publications, especially those prepared by national governments and their agencies.

economic development reduces inequalities across geographic regions. The interaction between these two macro-developments and other factors will not only determine the size of future migration flows. It will also shape the mix of origin countries, the skills composition of future migration, social peace and public opinion.

Furthermore, the review has produced the following takeaways for potential scenario creators:

- a) A key challenge for scenario creators will be to share the substantial educational benefits with stakeholders and institutions that did not participate in the scenario creation process. This will require innovative approaches to communicating the narrative storyline of each scenario.
- b) The increasing availability of scenarios means that not every new study would need to build its own from scratch. Borrowing and adapting existing scenarios can be a fruitful, time- and money-saving alternative.
- c) When study authors do decide to develop a completely new scenario, transparency about the process and its participants is crucial to the validity of the scenario and potential policy recommendations that can be drawn from it. This is particularly important since scenarios are prone to reflecting the personal biases of its creators.
- d) Migration scenarios often overlap with other thematic areas such as regional studies, demography and environmental sciences. The scenario format should ideally communicate with these strands of the literature to feed into the evidence base.
- e) Lastly, the large-scale mixed studies in this review show that migration scenarios can be powerfully combined with other methodological approaches, particularly, quantitative forecasts.

In giving governments and other institutions the tools to prepare themselves better for the uncertainties that the future of migration holds, this systematic literature review has taken stock of existing efforts and evaluated them along the most important dimensions. This literature review is ultimately a reference and guide for future scenario creation projects.

3.6 Results: Migration forecasts

As previously described, migration forecasts, as opposed to migration scenarios, are quantitative assessments of future migration trends. This report evaluates both forecasts and projections.³⁵ Compared to migration scenarios, the literature on migration forecasts is more

³⁵ For an explanation of the difference between forecasts and projections, refer back to 2. Definitions.

mature, meaning, there is a larger number of publications representing a greater degree of diversity, including in the adjacent literature contributing to methodological development. Broadly speaking, two streams of literature can be distinguished in the production of migration forecasts: demographic and economic forecasts. While demographers focus on migration mostly in the context of population projections, economists focus more frequently on the size and impact of future migration flows on labour markets and welfare.

3.6.1 Who produces forecasts?

Immigration has been largely neglected in demographic projections for the past decades and took off in the economic literature only in the 1990s, with the discussions surrounding European Union enlargement (Booth, 2006). However, considering that natural population growth, that is, growth resulting from more births than deaths, is slowing or even reversing in majority of OECD countries (OECD, 2019), both researchers and policymakers are shifting their attention towards migration.

Forecasts have become increasingly sophisticated and their development and application are clearly driven by experts, mostly from academia. This is reflected in the preponderance of the reviewed forecast studies (around two thirds of 208) produced by academia. At any rate, the numbers reported here must be interpreted with caution because the search design excludes any publication not written in English³⁶ (which is why most publications by national statistical offices are not reflected in the review). In contrast, the lingua franca of the academic world has been English for some time now, so that academic articles are more likely to be included in the review. With 40 forecast publications, international organizations are the second largest producer of forecasts. These includes international bodies such as Eurostat and the United Nations Population Division, the World Bank and the OECD. Think tanks and national governments come in last, with 17 and 16 studies, respectively. As noted previously, national governments are underrepresented due, in part, to the study's research design and to the fact that governments frequently turn to academia to translate and apply international research findings to local contexts. Among the think tanks and research institutes, the International Institute for Applied Systems Analysis (IIASA), the Center for Strategic and International Studies (CSIC) and the Migration Policy Institute (MPI) stand out as major producers of migration forecasts.

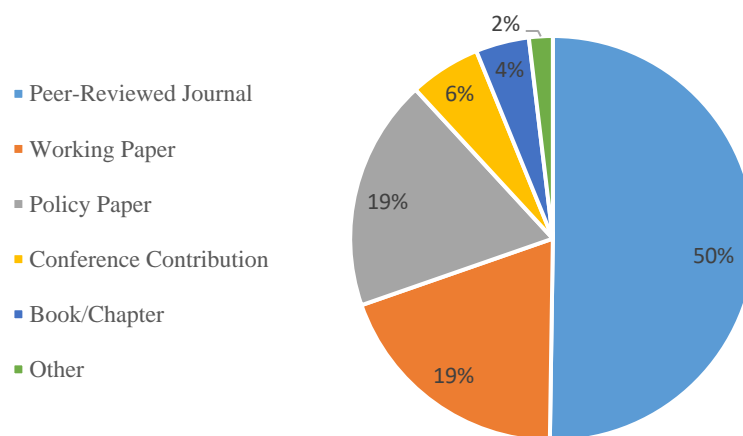
³⁶ Refer to the Appendix I for a detailed description of the literature search design and process.

3.6.2 Where are migration forecasts published?

Mirroring the dominance of academia among forecast developers, 50 per cent of migration forecasts are published in peer-reviewed academic journals. The review shows that there is now a multitude of academic outlets that publish migration forecasts and related theoretical and methodological papers. Among them are prestigious journals like *Demography* (Smith, 1986; Azose and Raftery, 2015; and Wiśniowski et al., 2015), *Nature* (Simini et al., 2012), the *International Migration Review* (Kim and Cohen, 2010; Cappelen, Skjerpen and Tønnessen, 2014; Coleman, 1992; Salt, 1992; and Zolberg, 1989), the *Journal of Forecasting* (de Beer, 1993; Bijak et al., 2019; and Alho, 2008) and the *Journal of the American Statistical Association* (Isserman, Plane, Rogerson and Beaumont, 1985; Rogers, 1986; and Raymer et al., 2013). Furthermore, five books and four book chapters are dedicated to migration forecasts. Among them, two books stand out as providing particularly comprehensive accounts of migration forecasting: Raymer and Willekens's book on *International Migration in Europe: Data, Models and Estimates* (2008) and Bijak's *Forecasting International Migration in Europe: A Bayesian View* (2011). Besides journals and books, policy-driven research is clearly visible in the publication list. National statistical offices have their own dedicated teams that conduct research and frequently publish their findings in working papers and policy reports. However, there is a relatively stubborn gap between academic- and policy-produced forecasts in terms of methodology and level of sophistication. Cappelen, Skjerpen and Tønnessen (2018, p. 948) note that "[as] recently as 2013, most official immigration projections still relied mainly on extending past immigration levels [...]. A lack of formal migration forecasting models is the norm in international, as well as national, population projections." Overall, 20 per cent of the studies are published as policy reports. They address issues of immediate political relevance, such as the potential effects of Scottish independence (Shang, Bijak and Wiśniowski, 2014), and ongoing work of practical relevance for planning, such as labour force projections (Hilgenstock and Kokczan, 2018). In individual cases, policy reports can draw a great amount of public attention and entail far-reaching consequences. The 2000 United Nations report, "Replacement Migration: Is it a Solution to Declining and Ageing Populations?", for example, was widely criticized for proposing seemingly astronomical numbers of international migrants needed to prevent population decline and ageing (United Nations, 2000). In addition, it explored international migration as the sole remedy for ageing populations and shrinking workforces, ignoring crucial policy elements, including workforce participation, productivity and pension reforms (Coleman, 2002).

Overall, it should be noted that categories of academia and policy overlap significantly. Policy reports are often commissioned by international organizations but are prepared by academics at universities. National statistical offices have research teams working on migration forecasts for national governmental bodies that want to know what to expect about the future of migration in their respective countries. Parts of these studies also find their ways to academic conferences or international peer-reviewed journals. With a subject that is so relevant to policy such as future migration, it is no surprise that relevant research quickly finds its way to interested practitioners.

Figure 11. Main outlets for migration forecast studies in the literature review



Source: Authors' elaboration based on the results of the systematic literature search.

Note: The category "Others" includes two PhD dissertations and two online articles. Note also that reports and working papers by national governments are not adequately captured by the search strategy because they are limited to English-language studies.

3.6.3 Which data sources are used?

Quantitative migration forecasts rely on data about past migration and define a set of assumptions on how they can be applied and extrapolated to the future. However, a lack of high-quality data, inconsistencies across countries, and different uses and definitions of key concepts lead to persistent uncertainty and estimation errors in migration forecasting. The challenges are long known and frequently discussed (see, for example: Kelly, 1987; OECD, 2005; Laczko, 2016; and Global Migration Group, 2017). International attempts, such as the 1998 United Nations recommendations for a statistical definition of international migrants and the 2007 European Union regulations on migration statistics, are gradually working to improve the situation (and, in the case of the United Nations recommendations, being revised at the

moment). However, many of the early difficulties continue to pose problems (Nowok, Kupiszewska and Poulain, 2006).

Migration forecasts (and migration data in general) are therefore built on an imperfect base. Even with an ideal model, errors would arise from data inconsistencies. Depending on the specific study purpose and research design, three general data types are available: (a) statistical and administrative data (such as censuses and official registers), (b) survey data (e.g. household surveys and migration surveys), and (c) innovative data sources (mobile phone records, social media information and Internet protocol addresses, among others). Statistical and administrative data are by far the most common source for migration forecasts. More than half of all studies retrieved for this review used administrative data sources. These typically include censuses, population registers and other administrative data collected on an ongoing basis as part of routine operations of ministries or agencies. For example, information on the issuance of various types of visas, people using special travel schemes and border crossings fall under this category. Importantly, each of the sources has its own drawbacks relating to their timeliness, coverage and accuracy compared to “true” migration.³⁷ To project international migration, authors thus need to combine and possibly harmonize different sources. Since this is a tedious and intensive task, many draw on already existing datasets produced by international organizations and agencies like Eurostat (Eurostat), the OECD (OECD, 2019) or the United Nations (UN DESA, 2019). Academia has equally produced datasets on international migration. For example, Willekens (1994) proposes a methodology to build a European database combining different data sources. Raymer et al. (2013) suggest a Bayesian approach to the modelling of European migration.³⁸ Lastly, Abel and Sander (2014) compile data on bilateral flows between 196 countries from 1990 to 2010.

Survey data are another potential source for migration forecasts. The most common are regular household surveys, such as the European Union Labour Force Survey (e.g. Wiśniowski, 2013) or the American Community Survey (e.g. Molloy, 2011). They offer a rich background

³⁷ Visit the Migration Data Portal of IOM’s GMDAC for a comparative evaluation of each of these sources: <https://migrationdataportal.org/themes/migration-data-sources>. Note, however, that the grouping of data sources on the GMDAC website and in this report overlap but are not identical. Disney et al. (2015) present a comprehensive evaluation of available data in the United Kingdom.

³⁸ Bayesian statistics, as opposed to the dominant school of frequentist statistics, understand probability as the degree of belief in an event occurring. Bayesian studies therefore do not need experiments to establish the probability of a given event becoming reality. Instead, it allows researchers to insert prior beliefs into their calculations. For example, Bayesian migration forecasts use personal assessments of migration experts as inputs for their calculations. These personal assessments are later updated with migration data (see, for example: Wiśniowski et al., 2013). Bayesian approaches have gained popularity in migration forecasts because they offer innovative ways to deal with the large amount of uncertainty connected to them, while also making use of different sources of information (i.e. expert opinion and migration data analysis).

on personal characteristics and other potentially migration-relevant covariates such as family composition, income, occupation and aspirations for the future. However, limited sample sizes and high costs are important drawbacks. There are also migration-specific surveys, including surveys asking a population sample about their future migration intentions (Docquier, Peri and Ruysen, 2014; and Tjaden, Auer and Laczko, 2018)³⁹ or the UK International Passenger Survey⁴⁰ (Armstrong and Ven, 2016). However, as with previously discussed survey data, sample sizes are relatively small, costs are high and responses may be biased when inquiring about sensitive information such as reasons for migration. As a consequence, only 12 studies in the review rely exclusively on survey data. On the other hand, most of the 20 studies that use a combination of different data sources employ survey and administrative data together.

More recently, new data sources have been explored to monitor and predict migration using innovative data sources such as social media information or phone records. Eight studies are retrieved in the review, but attention and interest for them is clearly growing. The applications are manifold. For example, Zagheni et al. (2014) collected geo-located Twitter data to track movements within and across countries. Blumenstock (2012) used mobile phone data to measure internal migration in Rwanda. Böhme (2019) analysed online search keywords to predict international migration. The advantage of these types of new data is threefold. First, the data is much more timely than traditional data sources such as censuses, and could even be used to now-cast migration movements (Zagheni et al., 2018).⁴¹ Second, the data is consistent across countries, given their origins in internationally operating companies and not national governments. Third, big data reveal a great level of granularity. They are not limited to movements between countries or administrative units and can show even minor movements during any given period. Short-lasting movements or circular migration are thus more easily captured. However, the new data sources also entail important drawbacks. One concern pertains to the privacy and ethical issues regarding the collection and analysis of many of these innovative data sources, particularly, social media data.⁴² The most important drawback to these, however, is the lack of representativeness. Only a subset of the general global population uses Facebook, Twitter or any social media platform at all, making it difficult to draw general

³⁹ Migration potential surveys were particularly popular before the 2004 European Union enlargement. They have since then been increasingly criticized and less used.

⁴⁰ The UK International Passenger Survey interviews overseas migrants at all ports of entry to the country.

⁴¹ In that context, the European Commission and the IOM launched the Big Data for Migration Alliance in June 2018, which explores how big data can be used to monitor migration trends. (For more information on this initiative, visit <https://ec.europa.eu/jrc/en/news/harnessing-new-data-sources-responsibly-effective-migration-policy>.)

⁴² A range of institutions have proposed ethical guidelines to address issues of consent, anonymity and potential risks, among others (see, for example: Townsend and Wallace, 2017).

statements from the analysis of data gathered therein. Although a number of methods have been proposed to reduce bias (see, for example: Yildiz et al., 2017; and Wang et al., 2015), studies that rely on social media data, phone records, or Internet protocol addresses are still mostly a complement to conventional data sources.

3.6.4 What type of migration is forecasted?

Migrants were being given little attention at the time demographic population projections started to be developed. Net migration (the difference between the number of immigrants and emigrants in one year) was simply considered to be the residual part of population change that could not be explained by births or deaths (Siegel and Hamilton, 1952).⁴³ In 1990, Rogers published his article, “Requiem for the Net Migrant”, in which he sharply criticized the use of net migrants as a “nonexistent category of individuals” (p. 283), as the term hides important information about the relative size of emigration and immigration flows. Much has changed since then and migrants are now widely considered a crucial determinant of demographic change. However, a majority of projections reviewed in our search still does not distinguish between different motives underlying work, family, student and humanitarian migration, despite the fact that migration drivers are shown to have different effects on these groups (see, for example, JRC (2018), for a detailed analysis of migration drivers for each group).⁴⁴ A major obstacle to forecasting migration by group is the insufficiency of available data (discussed previously) and the disregard for short-term and irregular migrants in most data sources. However, few demographic studies have attempted to forecast specific types of migration. An early exception is the 2003 project by the European Commission, “Analysis and Forecasting of International Migration by Major Groups”, in which separate models were proposed for labour and asylum migration. De Beer (2008) similarly emphasizes the usefulness of distinguishing different types of immigration to improve the accuracy of projections. Most recently, Bijak et al. (2019) tested various possible forecasting approaches and concluded that the statistical characteristics of each flow (meaning, the stability of the flow and the length of available time-series data) should determine the most suitable approach. For example, particularly volatile flows like asylum seekers should not be forecasted using the same approach as stable flows

⁴³ Population projections are conventionally based on three components: births, deaths and international migration. In these earlier studies, the numbers of births and deaths were known from official statistics. Births were added and deaths were subtracted from the population in a given base year. In contrast, migration was not observed and instead inferred from the difference between the calculated population size and the observed population size.

⁴⁴ Many studies do make a distinction between international and internal migration, and between in- and out-migration, but this shall not be the focus of this section.

like labour migrants. Furthermore, the respective degrees of uncertainty of each flow and their potential impact on policy should also be considered in forecasts.

In contrast to demographic population projections, econometric models based on explanatory theories of migration more commonly distinguish separate migration flows. While the majority is based on assessments of migration drivers (Natale, Migali and Münz, 2018), innovative approaches have also been developed for specific migrant groups. For example, Smith et al. (2008) use agent-based modelling to produce predictions about climate-induced migration, and Connor (2017) predicts forced migration by analysing online search data from Google.

3.6.5 Migration drivers in forecasts

Causal migration forecasting using econometric models conventionally draw on a number of so-called migration “drivers”, referring to push and pull factors of migration, such as wage differentials, geographic distance, networks and historical ties (e.g. Bauer and Zimmermann, 1999; Brücker and Siliverstovs, 2006; Bossard, 2009; and OECD, 2016b). These are partly adopted from migration theory and partly included in econometric models because of their statistical power.⁴⁵ However, drivers can only be considered in a model if they can be quantified. Fuzzier concepts such as “power relations” or “climate change” cannot be directly included, or at least not without finding a measurable proxy variable.⁴⁶ Furthermore, the data used as inputs for the model are necessarily historical, assuming that past relationships – say, between income differentials and migration flows – can be extrapolated to the future. Eventually, the arguments that can be derived from such analyses follow this format: “An increase of 10% in the income differential between two countries increases the number of migrants between the two countries by 3.1%, on average” (OECD, 2016a, p. 106). Underlying this interpretation is the *ceteris paribus* assumption that all factors not accounted for in the model do not change. However, given the limited number of control variables in econometric models and the overwhelming complexity of the real world, this assumption is difficult to maintain. Disney et al. (2015) evaluated the sensitivity of existing forecasting models and concluded that the typical migration drivers, like unemployment rates and gross national income, are prone to changing their impacts on migration across time and space. Furthermore,

⁴⁵ Models usually aim at including migration drivers that are statistically significant while building an overall parsimonious model. A parsimonious model achieves the desired level of explanation with as few predictors as possible.

⁴⁶ See above for a visualization of migration drivers in scenarios and forecasts.

different types of migration respond differently to the drivers. “For example, migration for family reasons usually follows labour migration, which may be driven not only by the relative economic situation of the sending and receiving countries, but also by the existing networks in the receiving country” (Disney et al., 2015, p. 39). Despite these shortcomings, econometric models and their conceptualization of migration drivers have an intuitive appeal. With their modular structure, they allow users to inspect each driver individually and weigh them against each other. To make best use of them, econometric forecasts should have short time horizons (five years at most) and interpreted with careful attention to changing contexts that might diminish their validity.

3.6.6 Discussion of forecasting methods

Given the growing interest in migration forecasts, combined with an awareness of the shortcomings of each approach, there is now a multitude of available forecasting methods. The methods can be grouped along different criteria, and one recent approach is to distinguish between deterministic and probabilistic methods (see, notably, Bijak, 2011; and Disney et al., 2015). In another recent report, Sardoschau (2020) focuses on different types of quantitative models and forms three mainly three groups (Bayesian, gravity and structural equation models). For the purpose of the review, an intuitive, non-technical introduction will be given to each of the most commonly used methods.

Econometric models

The main difference between econometric models and other methods is its inclusion of covariates, that is, variables that researchers believe to be related to migration, such as income differentials and labour market performance.⁴⁷ Econometric models were originally used to verify economic theories about migration, but have increasingly gained popularity for forecasting as well. Thus, from the theory of migration “push” and “pull” factors were created models that aim to quantify the impact of each of these factors on future migration. For example, econometric models were a popular tool during the successive European Union enlargements in the 2000s to forecast migration to the older European Union member States (Bauer and Zimmermann, 1999; Sinn, 2000; Boeri and Brücker, 2001; and Dustmann et al.,

⁴⁷ There are approaches to migration forecasting that require large amounts of information individual data, like ethno-surveys and event-history analyses. However, these approaches are far less common than econometric models and will not be discussed here. (For more information, see Massey (1987) and Rogers and Castro (1981).)

2003). At any rate, the results of the numerous studies varied widely and proved rather accurate in retrospect (see, for example, Bahna, 2008 for an evaluation).⁴⁸

Despite their popularity, econometric models come with important drawbacks that potentially weaken their forecasting performance. The relationship between migration drivers and observed migration naturally needs to be estimated using historical data before it is applied to a future situation. This potentially introduces bias, especially when the estimation is performed on countries other than the ones targeted by the forecast. In Dustmann et al. (2003), for example, the parameters for future migration from Eastern Europe to the United Kingdom are derived from immigration data from a variety of other, mostly distant, countries such as India, South Africa and Yemen. Naturally, which parameters can be derived is not immediately obvious and the parameters are not directly applicable. Another criticism relates to the limited choice of explanatory variables for which there is often a lack of theoretical substantiation. As a result, most studies use similar sets of explanatory variables that are focused on economic drivers of migration. From a demographic perspective, this ignores major demographic determinants such as population size, population age structure and the dynamic population changes that are produced by migration (Kupiszewski, 2002).⁴⁹

Migration intention surveys

Another approach to estimate future migration flows relies on survey information about migration intentions. Influential studies, such as the 1998 IOM report and the 2004 study by Krieger on the European Union accession of Central and Eastern European countries, typically choose this approach. Although it must be stressed that emigration intentions do not necessarily translate to actual emigration, emigration intention surveys can have advantages under certain conditions. For example, Tjaden, Auer and Laczko (2018) note the relatively high level of comparability of emigration intention data if they are collected in large, standardized surveys, such as the Gallup World Poll.⁵⁰ Furthermore, this type of survey can offer valuable information in the absence of migration flow data, particularly in non-OECD countries.

Nonetheless, emigration intention surveys come with major limitations. The most obvious and most important limitation of studies using this approach is that they are not

⁴⁸ The succeeding paragraph more broadly discusses the accuracy of migration forecasts have been in the past.

⁴⁹ Gravity models used for migration forecasting partially address these criticisms but remain imperfect because they include demographic and geographic variables, such as population size and distance between countries, as time-invariant factors.

⁵⁰ The Gallup World Poll is a company that commercially distributes survey data. It continually surveys 160 countries and asks respondents about various subjects, including migration intentions.

forecasts but only assessments of *potential* migration. The foremost question therefore concerns the relationship between observed intentions and actual behaviour. Whether or not the intention materializes likely depends on a wide range of factors, including the emigration motive. For example, student mobility is more likely to materialize than migration among other groups (van Dalen and Henkens, 2008, p. 15). As a general estimate, Van Dalen and Henkens (2008) estimate that 24 per cent of respondents in the Netherlands who stated an intention to emigrate actually emigrated within two years' time. Tjaden, Auer and Laczko (2018) estimate that roughly 1.3 out of 10 individuals from a European sending country who make emigration plans actually emigrate (to any other country, including outside of Europe). However, as mentioned above, the exact relationship between survey response and behaviour depends on many factors, including the exact wording of questions and the timing of the survey. For example, the questionnaire must make it explicit whether it refers to a hypothetical situation without any legal and practical barriers to migration, or whether the response should account for those restrictions (EIC, 2009). Furthermore, the intended length of stay should be considered, especially in situations where short-term or circular migration is a popular option for potential migrants, such as seasonal workers and students spending some time abroad. Lastly, surveys about migration intentions ignore the demand side of labour migration, that is, the extent to which receiving labour markets are able to absorb potential migrants.

Argument-based forecasts

Argument-based forecasts are believed to be the most commonly used method for migration forecasts in official statistics and are usually treated as a component of population projections (Bijak, 2010). In these forecasts, an argument is basically an assumption about the future development of migration derived from a variety of qualitative and quantitative information but follow no strict rule on how to arrive at the assumption. In most cases, they are produced in three or more variants categorized as “low”, “middle” or “high”. Other frequent assumptions about future migration include:

- a) Zero migration;
- b) Constant migration;
- c) Continuation of historical migration trends;
- d) Convergence to historical or regional averages.

While assumptions might be right in a given context and country, it appears that simplistic assumptions like the ones above mask the uncertainty related to future migration. Most users interpret the “middle” variant often as the most likely projection, which cannot be said, given that the variants are not equipped with probabilities.

Time–series extrapolations

Lastly, an important group of studies applies time–series extrapolations to arrive at future estimates of migration. The autoregressive integrated moving average (ARIMA) model and its many variants are the most frequently used. Importantly, their strong theoretical foundation allows the construction of predictive intervals, which provide a direct visual indication of forecast uncertainty.

A weakness of time–series extrapolation is its sole reliance on past data about migration. As discussed above, data sources for migration are still imperfect and likely to introduce bias into the forecasts. Moreover, even if data were correct, past trends, such as natural crises and political events, are regularly shaken through shocks.

To address this problem, Bijak (2009) proposed an approach that combined expert opinion with probabilistic time–series. In a Bayesian framework, expert judgement can thus be included as a prior distribution of parameters that reflect knowledge about future events, for example, and then be combined with time–series data.⁵¹

3.6.7 How accurate are forecasts?

Migration is notoriously difficult to foresee. History abounds with examples of vastly mistaken forecasts. In 1907, the Austrian researcher Emil Reich predicted that Germany’s population would grow to 150 million in 1980 and reach 200 million by 2000. Given the context then, the predictions seemed plausible. However, in reality, Germany had a population of just 82 million in the year 2000. Another example are the forecasts of migration following the 2004 phase of European Union enlargement. Dustmann et al. (2003) estimated immigration to the United Kingdom would range from 5,000 to 13,000 immigrants per year until 2010. This was vastly underestimated. In 2004, the UK Office for National Statistics estimated that there were

⁵¹ For a comprehensive discussion of probabilistic methods and the combination of expert judgement and time–series data, see: Bijak, 2010; and Raftery and Azose, 2013.

167,000 individuals in the kingdom who were born in a country of the EU-8. In 2010, it estimated that number to be 819,000.⁵²

The reason why migration is so difficult to forecast is the high degree of uncertainty that is attached to all elements of the forecasting process. In particular, one can distinguish three sources of uncertainty: (a) uncertainty about future events influencing migration, (b) uncertainty about the available evidence (i.e. data sources), and (c) uncertainty stemming from the model selected to forecast migration (for a comprehensive discussion of uncertainty in migration forecasts, see, for example: GMDAC, 2016; Disney et al., 2015; and Bijak, 2011). Various studies have addressed the different parts of uncertainty and evaluated the relative forecasting performance of various models (e.g. Alecke, Untiedt and Huber, 2011; Kupiszewski, 2002; and Bijak et al., 2019). However, no individual data source or modelling framework has proven to be clearly outperforming the others.

The degree of uncertainty becomes clear when comparing a recent migration forecast for selected European countries with observed numbers. Bijak and Wiśniowski (2009) applied a probabilistic time-series model and combine it with expert opinion in a Bayesian framework. The chosen forecast model is thus one of the most methodologically advanced approaches currently available. It addresses and quantifies uncertainty, applies a statistical model with relatively few restrictions, and enhances the limited available data with expert knowledge.

Table 2. Comparing immigration forecasts (Bijak and Wiśniowski, 2009) and reported flows (Eurostat, 2019) for selected European countries

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Country	Years forecast	Forecast Year	Median Estimate ⁵³ (000s)	50 per cent Predictive Interval ⁵⁴	Reported Number of Immigrants ⁵⁵ (000s)	Deviation from Median Estimate ⁵⁶ (000s)
Austria	9	2016	151.8	78.4 – 293.6	129.5	-22.3

⁵² Visit the website of the United Kingdom Office for National Statistics for the detailed numbers: www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/internationalmigration/datasets/populationoftheunitedkingdombycountryofbirthandnationality.

⁵³ The median immigration estimate reported here is taken from the study by Bijak and Wisniowksi (2009).

⁵⁴ The predictive intervals reported here are taken from the study by Bijak and Wisniowksi (2009). The authors also calculated 80 and 90 per cent predictive intervals. However, they argue that these intervals become too large “to offer any meaningful information for the forecast users” (Bijak and Wiśniowski, 2009, p. 25), especially over long time horizons.

⁵⁵ The number of immigrants reported here is taken from Eurostat (2019).

⁵⁶ The deviation of the reported number of immigrants from the median estimate is calculated by subtracting column (6) from column (4).

Czechia	9	2016	135.9	52.0 – 348.0	64.1	-71.8
France	10	2015	300	180.0 – 509.0	363.9	63,9
Hungary	10	2016	22.2	12.5 – 38.2	53.6	31,4
Italy	11	2016	369.5	Up to 839	300.8	-68,7
Poland	9	2016	28.3	15.9 – 53.6	208.3	180
Portugal	10	2016	33.9	15.9 – 74.6	29.9	-4

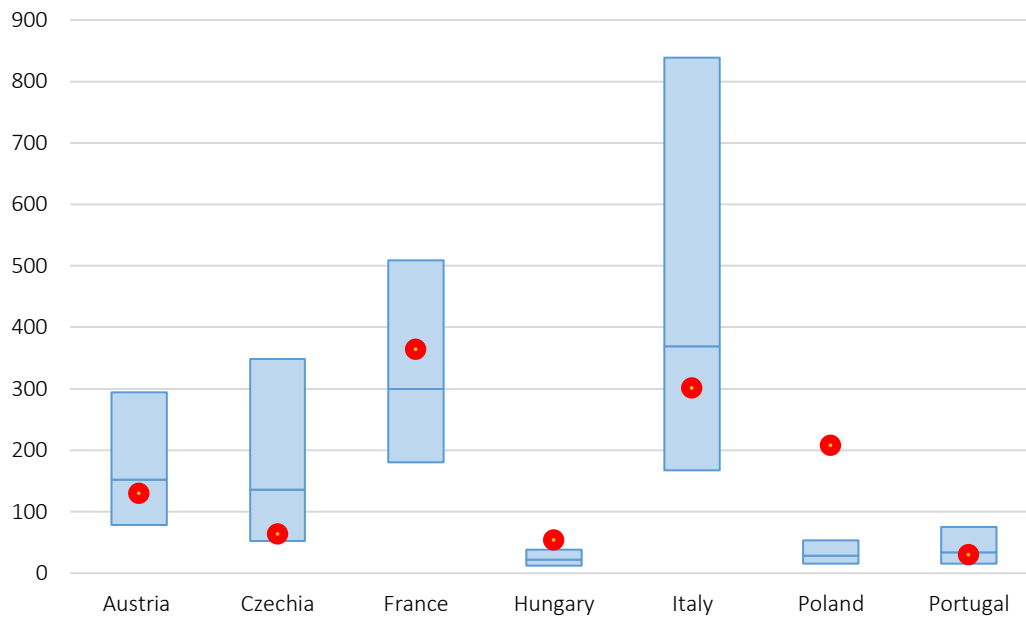
Source: Bijak and Wiśniowski, 2009, pp. 23 – 25 (columns 1 to 5); and Eurostat, 2019 (column 6).

Note: Total yearly immigration numbers are in the thousands. For a detailed description of how the forecasts were produced and which assumptions are involved, see: Bijak and Wiśniowski (2009). The entries marked in bold indicate that the number of immigrants reported by Eurostat lies of outside the 50 per cent predictive interval given by Bijak and Wiśniowski’s forecast.

The table compares predicted and observed numbers of total yearly immigration for selected European countries. The estimates are based on time-series data and cover forecast horizons of 9 to 11 years (see column 2). The fourth column shows the estimated average number of yearly immigration (the median estimate). Furthermore, predictive intervals are provided for the forecast, indicating the range into which 50 per cent of all possible outcomes are expected to fall.⁵⁷ Accordingly, the fifth column shows the lower and upper bounds of the 50 per cent predictive intervals. The observed values in column 5 are the numbers of total yearly immigration in 2016 (except for France for which the prediction year is 2015, see column 3) as retrieved from the official statistics at Eurostat. Lastly, column seven provides the decisive information in the table. It shows the differences between forecast and observed immigration, calculated by subtracting the estimated median value from the observed value. It should be noted however that the difference is not a calculation of forecast errors but rather an illustration of the degree of uncertainty that migration forecasts entail.

⁵⁷ In more technical terms, Bijak and Wiśniowski note (2009, p. 22): “Throughout this section, the predictions are presented in terms of central tendencies, which are medians from the respective predictive distributions. [...] location parameters, such as medians or quantiles, are much more robust statistics than moment-based characteristics, for example, means or standard deviations, the latter being very sensitive to the presence of outlying observations.”

Figure 12. 50 per cent predictive intervals of yearly immigration (in thousands) by Bijak and Wiśniowski (2009) and observed immigration by Eurostat (2019)



Source: Authors’ visualization based on Bijak and Wiśniowski (2009, pp. 23–25), and Eurostat (2019).

Note: The blue boxes represent the 50 per cent predictive intervals of the yearly total immigration estimates produced by Bijak and Wiśniowski (2009) and the blue line marks their median estimate. The red dots represent the observed number of immigrants as reported by Eurostat (2019). The year of the forecast is 2016 for all countries except France, where it is 2015. The lower-bound estimate for Italy refers to the year 2015 and not 2016. See Table 2 for a more detailed description.

Figure 15 is an illustration of the comparison undertaken in Table 2. It shows the 50 per cent predictive intervals including their median estimates of immigration as blue boxes, and the observed number of immigrants as red dots. The figure clearly shows the different degrees of uncertainty attached to the forecasts: Italy stands out as having the largest degree of uncertainty with immigration in 2016 expected to lie anywhere between 167,700 and 839,000 new arrivals.⁵⁸ Regarding the high degree of uncertainty in the forecast for Italy, the authors note: “This is due to two major factors: A long and steady increase of migration observed in the past, and dramatic expectations of the experts resulting in much weight put by them on the explosive nature of the process” (Bijak and Wiśniowski, 2009, p. 24). When comparing the estimated and observed numbers of immigrants, the red dot lies below the median estimate (blue line in the box), thus indicating that the median forecast overestimated inflows by nearly 69,000. In

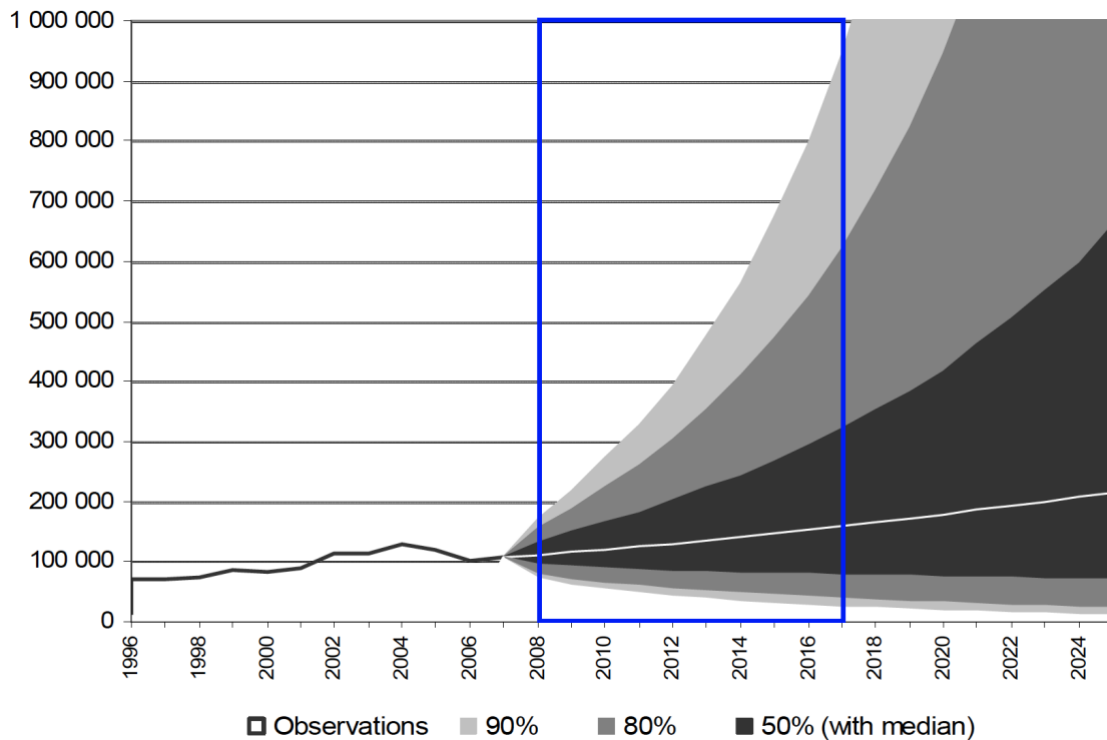
⁵⁸ Note that the lower-bound estimate refers to the year 2015 and not 2016.

contrast, the predictive interval for immigration to Portugal in 2016 is much smaller (ranging from 15,900 to 74,600) and the median estimate also comes much closer to the observed number of immigrants. Poland represents yet another case. The forecast anticipates stable immigration and a relatively small degree of uncertainty indicated by the narrow predictive interval. However, when compared with Eurostat numbers, the median forecast appears to have largely underestimated future immigration. In particular, unexpectedly growing immigration from Ukraine to Poland in recent years increased inflows markedly.⁵⁹ As can be seen from these examples, each forecast produces imprecise results for different reasons – even when using advanced methods that combine time-series analysis with subjective expert assessment, and even with seemingly stable trends.

A few more conclusions can be drawn from the comparison and from the study produced by Bijak and Wiśniowski (2009). One is that forecast uncertainty is rapidly increasing in some countries. This is in line with the intuitive and repeated finding that forecast errors also increase with forecast duration (Bijak et al., 2019; Shaw, 2007; and Alders Neilman and Crujisen, 2007). In Czechia, for example, immigration volumes are estimated to range between 52,000 and 348,000 in 2016 and then increase to between 42,200 and 715,000 in 2025 (Figure 15). Even if the forecasts indicate correct intervals, the extend of the range opens up questions of usefulness for practitioners and policymakers. Second, of the seven estimates, two are outside of the range of the 50-per cent predictive interval. Although the probability of real migration not being lower than the lower interval is only 0.75, two estimates, for Hungary and Poland, fall under this category. Third, the forecast model seems to perform overall better for the Western European countries in the paper than for the Eastern European countries. In their concluding section, Bijak and Wiśniowski (2009, p. 33) therefore note that “given the above conclusion on the [barely predictable] nature of migration, an attempt of its precise prediction in numerical terms is doomed to fail”. Nonetheless, they recognize that predictive intervals can at least help to assess the degree of uncertainty underlying a forecast.

⁵⁹ OECD (2016, p. 290).

Figure 13. Yearly total immigration to Austria as predicted by Bijak and Wisniowski (2009) with predictive intervals, 2008–2025



Source: Bijak and Wiśniowski, 2009, p. iii.

As a result of the inevitable uncertainty contained in migration forecasts, a stream of the literature is working on assessing ex-post forecasting errors, for instance by comparing forecasts with observed migration (de Beer, 1997; Alecke, Untiedt and Huber, 2001; Shaw, 2007; and Bijak et al., 2019). The unanimous conclusion is that errors are ubiquitous and that no approach can be determined to be the best-performing. Each data source, migration stream and country have specific conditions to which the approach should be tailored. For users of forecasts, however, the implications are also important. First, users should understand forecasts as continuous process that needs adjustments and new input to remain relevant. Second, users need to be aware of the assumptions involved in the creation of forecasts and understand the limitations. Lastly, it is recommended that for specific policy areas that require forecasts as inputs, users should not refer to general-interest forecasts of migration. Instead, they are recommended to engage in a more promising, even if longer, process of creating a tailored estimate.

3.7 Conclusions

The aim of this systematic literature review is to take stock of the state of the literature on migration scenarios and forecasts and evaluate their development in a comparative manner. As shown, both scenario and forecast publications have seen important growth since the 1990s. One reason for this is the increasing importance that is certainly attached to the slowing or reversal of natural population growth in most developed countries and immigration becoming a crucial source for future population maintenance. Another reason is the public eye, which has repeatedly fixed its attention on migration in the past decades, be it during the successive European Union enlargement phases or during the more recent arrivals of asylum seekers in Europe.

For the purpose of this report, studies that anticipate future migration were grouped into two groups: scenarios and forecasts. The literature review has demonstrated that both groups contain substantial variety, and that the two groups can overlap. This is, for example, the case with forecasts that use qualitatively developed scenarios as inputs for their calculations. Migration scenarios have been created by a range of actors (academics, national governments, international organizations, and so on) using a range of methods (participatory approaches, Delphi surveys and adaptation of existing scenarios). Migration forecasts have also been produced by different actors but have a relative stronger anchorage among academics, particularly, demographers and economists. Their respective toolboxes are rich and cover, among others, causal forecasts, probabilistic projections and survey-based forecasts.

Importantly, the literature review has shown that each approach has its respective weaknesses and no single method can be said to be the preferred one. Instead, future producers and users of migration forecasts should think carefully about their aims and then choose the most appropriate approach. For example, if the goal is to engage an institution in an open discussion and challenge taken-for-granted assumptions, migration scenarios might be the right tool. In contrast, if the goal is to prepare the operations of a specific government body for the upcoming year, a quantitative forecast using extrapolations could be preferable. The systematic literature review, presented in this report, can be used as a starting point or background for understanding the wealth of work already done on the subject. As such, it can also be a starting point for future users in selecting and interpreting migration forecasts.

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Appendix I. Methodology of the systematic literature review

The studies evaluated in this report were retrieved through a systematic literature search between May and August 2019. The methodology was adapted from *Cochrane's Guidelines for Systematic Reviews of Interventions* (Higgins and Green (eds.), 2011) and was designed to produce a rigorous inventory of relevant studies with minimal selection bias. Relevant literature was identified from three sources: websites, bibliographic searches (of website search results) and expert referrals. In a first step, a keyword search was conducted on four academic websites, namely, Web of Science, JSTOR, Science Direct, and CROSS-MIG, a newly established database for migration research. Furthermore, Google Scholar (Google's specialized search engine for scholarly literature) and Google (Google's general search engine) were searched for relevant entries. Two separate search strategies were developed for each of the thematic areas considered in Table A1.

Figure A1. Search strategies for migration scenarios versus migration forecasts

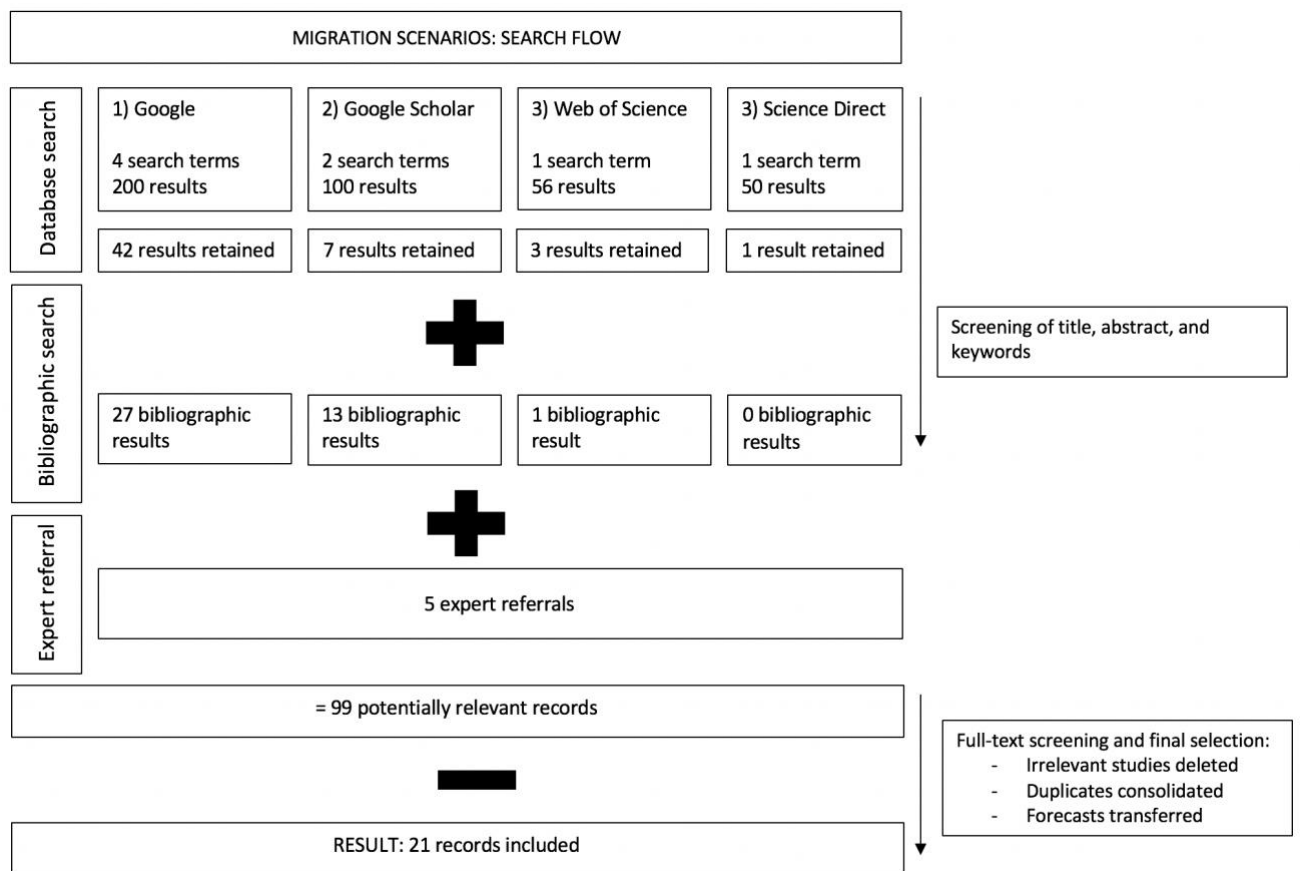
Criterion	Migration scenarios	Migration forecasts
Date of publication	No time restriction	No time restriction
Geographic scope of study	At least partly covers the European Union	No restriction
Language of study	English	English
Type of source	Primary and grey literature	Primary and grey literature
Study design	Narrative scenarios that anticipate future international migration to Europe	Forecasts, projections and other studies that contribute to quantitative migration forecasts
Databases	Web of Science, JSTOR, Science Direct, Google (search engine), Google Scholar, CROSS-MIG (Note: JSTOR and CROSS-MIG did not reveal new records.)	Web of Science, Google, Google Scholar, CROSS-MIG

Initial search trials revealed that Google Scholar provided important additional coverage for the retrieval of scholarly articles after conventional search engines (Gehanno, Darmoni and Rollin, 2013). The general Google search engine proved valuable in retrieving grey literature, in particular, to find forecast studies that are not published in conventional academic outlets, but instead by international organizations or think tanks. While the importance of searching Google to retrieve grey literature has been recognized (Godin et al., 2015), the use of Google comes with challenges that are not encountered when using conventional academic databases. First, the sheer number of search results makes it impossible

to screen them in their entirety. It was therefore decided that for both Google and Google Scholar, the first 50 results (equivalent to the first five pages) would be searched. Second, there is a lack of transparency in the search and ranking algorithms of Google. The best search strategy therefore turned out to be an iterative process that use one-word instead of nested search terms, as used on other databases. Search terms for the migration scenario search included “Europe”, “migration” and “scenario.” For the migration forecast search, they further included “forecast”, “foresight”, “predict”, “anticipate”, “project”, “estimate”, “21st century”, “international”, “flow” and “population.”

After the database searches were completed, a bibliographic search was conducted. Due to the large number of retrieved studies, priority was given to the most recently published studies across a balanced representation of academic disciplines. The full texts of the studies were then reviewed and assessed against the selection criteria. For both the scenario and the forecast searches, only English-language entries were considered. A requirement for the scenario publications was that studies had to have a geographic scope of at least part of the European Union and used qualitative narratives in assessing future migration. For the forecast search, the scope was wider (due to more search terms used), with all studies selected having made quantitative contributions to the study of future migration. Screening revealed that some of the studies retrieved in the scenario search fit methodologically as forecasts and were therefore transferred accordingly. This step was necessary because the term “scenario” was used ambiguously to describe either a qualitative, narrative form of migration scenario or projection variants of demographic studies. After the inventory of studies was compiled, a final review of the scenario studies took place, dropping entries that did not fully meet the selection criteria. Lastly, a small group of leading experts were contacted to review the literature lists and suggest additional studies. Figures A1 and A2 describe the literature selection process step by step.

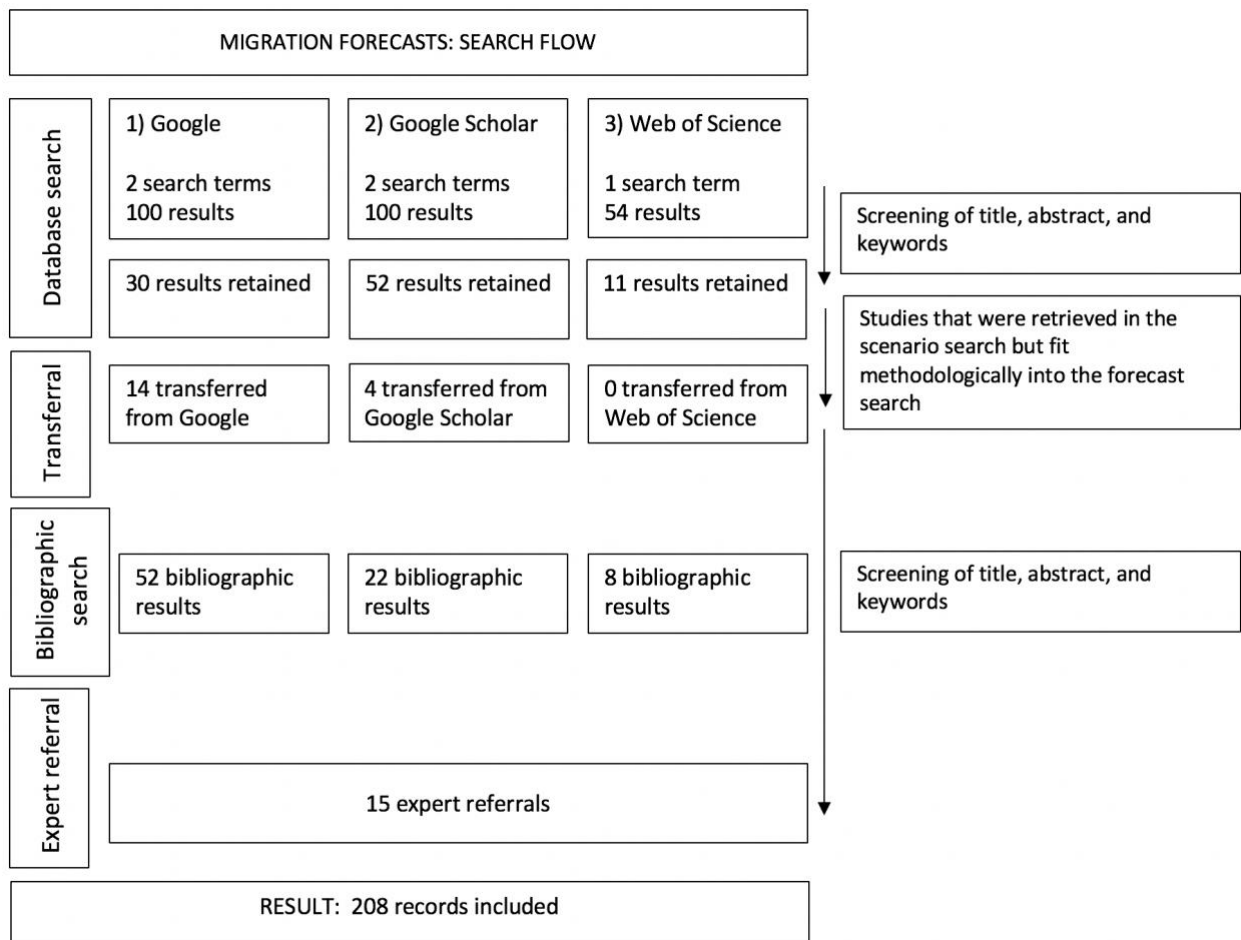
Figure A1. Migration scenario search process



Source: Authors' elaboration.

Note: Two additional online databases, JSTOR and CROSS-MIG, were searched. However, since no additional results were retrieved through them, they were not included in the flow chart. Due to the large number of results on Google and Google Scholar, it was decided that only the first 50 results would be searched. That is why two Google searches yield exactly 100 results.

Figure A2. Migration forecast search process



Source: Authors' elaboration.

Note: Due to the large number of results on Google and Google Scholar, it was decided that only the first 50 results would be searched. That is why two Google searches yield exactly 100 results.

Appendix II. List of reviewed migration scenario studies/publications

Year	Author	Title
2004	Lachmanová and Drbohlav	The probable future development of European East–West migration (the Delphi method revived)
2008	Brown	Migration and climate change (<i>IOM Migration Research Series</i> , no. 31)
2009	Bossard	The future of international migration to OECD countries
2009	Vag	Scenarios of environmental change and migration
2010	European Spatial Planning Observation Network (ESPON) and Netherlands Interdisciplinary Demographic Institute (NIDI)	DEMIFER – Demographic and migratory flows affecting European regions and cities (final report)
2010	Frühmann and Jäger	Linking the earth’s future to migration: Scenarios of environmental change and possible impacts on forced migration
2011	de Haas	Mediterranean migration futures: patterns, drivers and scenarios
2011	Hansen	The European Union’s role in migration up to 2030 and then, 2060
2011	Ariely, Warnes, Bijak and Landesman	Futures of borders: a forward study of European border checks
2011	UK Government Office for Science (GO-Science)	Migration and global environmental change: future challenges and opportunities
2012	Goff, Zarin and Goodman	Climate-induced migration from Northern Africa to Europe: security challenges and opportunities
2016	Frontex	Scenarios for migration, Europe and its external borders
2016	Organisation for Economic Co-operation and Development (OECD)	<i>Perspectives on Global Development 2017: International Migration in a Shifting World</i>

2017	Friedrich-Ebert-Stiftung, IOM and Global Future	<i>Tomorrow's World of Migration and Mobility</i>
2018	Benton and Patuzzi	Jobs in 2028: How will changing labour markets affect immigrant integration in Europe?
2018	Böckenförde and Braune (eds.)	Prospective migration policy – scenario-building on relations between West Africa and Europe
2018	EU Policy Lab (European Commission)	The future of migration in the European Union: future scenarios and tools to stimulate forward-looking discussions
2018	European Political Strategy Centre (EPSC)	The future of migration and integration
2018	Natale, Migali and Münz	Many more to come? Migration from and within Africa
2018	Sánchez-Montijano, Kaya and Sökmen	Highly skilled migration between the EU and Turkey: drivers and scenarios
2019	European Asylum Support Office (EASO)	The future of international protection in EU+ 2030: a scenario study

Appendix III. List of reviewed migration forecast studies/publications

Year	Author	Title
1946	Zipf	The P1 P2/D hypothesis: On the intercity movement of persons
1961	Tarver	Predicting migration
1963	Ter Heide	Migration models and their significance for population forecasts
1974	Wilson and Rees	Population statistics and spatial demographic accounts
1981	Rogers and Castro	Model migration schedules
1982	Plane	An information theoretic approach to the estimation of migration flows
1984	Straubhaar	The accession of Spain and Portugal to the EC from the aspect of the free movement of labour in an enlarged common labour market
1985	Isserman, Plane, Rogerson and Beaumont	Forecasting interstate migration with limited data: a demographic-economic approach
1985	Greenwood	Human migration: theory, models and empirical studies
1986	Smith	Accounting for migration in cohort-component projections of state and local populations
1986	Rogers	Parameterized multistate population dynamics and projections
1986	Harker	The use of expert judgments in predicting interregional migration patterns: an analytic hierarchy approach
1989	Stambol	Migration analysis and regional population projections
1989	Arnold	Revised estimates and projections of international migration, 1980–2000
1989	Zolberg	The next waves: Migration theory for a changing world
1990	Bulatao, Bos, Stephens and Vu	World population projections, 1989–90 edition: short-and long-term estimates

1990	Massey and Zenteno	The dynamics of mass migration
1992	Salt	The future of international labor migration
1992	Coleman	Does Europe need immigrants? Population and work force projections
1993	de Beer	Forecast intervals of net migration: the case of the Netherlands
1993	Lutz	The future of international migration
1994	Willekens	Monitoring international migration flows in Europe: towards a statistical data base
1994	Champion	International migration and demographic change in the developed world
1995	Salt and Singleton	Analysis and forecasting of international migration by major groups
1997	de Beer	The effect of uncertainty on migration on national population forecasts: the case of the Netherlands
1998	Sanderson	Knowledge can improve forecasts: a review of selected socioeconomic population projection models
1998	Lee	Probabilistic approaches to population forecasting
1998	IOM	Migration potential in Central and Eastern Europe
1999	Gorbey, James and Poot	Population forecasting with endogenous migration: an application to trans-Tasman migration
1999	Bauer and Zimmermann	Assessment of possible migration pressure and its labour market impact following EU enlargement to Central and Eastern Europe
1999	Massey	International migration at the dawn of the twenty-first century: the role of the state
2000	van der Gaag, van Imhoff and van Wissen	Internal migration scenarios and regional population projections for the European Union
2000	Fertig and Schmidt	Aggregate-level migration studies as a tool for forecasting future migration streams

2000	Boeri and Bruecker	The impact of Eastern enlargement on employment and labour markets in the EU member states
2000	United Nations Population Division	Replacement migration: Is it a solution to declining and ageing populations?
2000	Arango	Explaining migration: a critical view
2000	Sinn	EU enlargement, migration, and lessons from German unification
2000	Lutz, Saariluoma, Sanderson and Scherbov	New developments in the methodology of expert- and argument-based probabilistic population forecasting
2001	Fertig	The economic impact of EU enlargement: assessing the migration potential
2001	Chamie	World population in the 21st century
2001	European Commission	The economic impact of enlargement
2001	Hille	The impact of EU enlargement on migration movements and economic integration, results and recent studies
2001	Alecke, Untiedt and Huber	What a difference a constant makes: How predictable are international migration flows?
2001	Weise	The impact of EU enlargement on cohesion
2001	Wallace	Migration potential in Slovakia
2001	Papapaganos and Sanfrey	Intention to emigrate in transition countries: the case of Albania
2002	Sweeney and Konty	Population forecasting with nonstationary multiregional growth matrices
2002	Hablicsek and Toth	The role of international migration in maintaining the population size of Hungary between 2000–2050
2002	Disney	Model-based estimates of UK immigration
2002	Jandl	The estimation of illegal migration in Europe
2002	McDonald and Kippen	Projecting future migration levels: Should rates or numbers be used?
2002	King	Towards a new map of European migration

2002	Kupiszewski	How trustworthy are forecasts of international migration between Poland and the European Union?
2003	Bruder	East–West migration in Europe, 2004–2015
2003	Kupiszewski and Kupiszewska	Internal migration component in subnational population projections in member states of the European Union
2003	Dustmann, Casanova, Fertig, Preston and Schmidt	The impact of EU enlargement on migration flows
2003	Alvarez-Plata, Brücker and Siliverstovs	Potential migration from Central and Eastern Europe into the EU-15: an update
2004	Melander and Oelberg	Forced migration: The effects of the magnitude and scope of fighting
2004	Wilson and Bell	Comparative empirical evaluations of internal migration models in subnational population projections
2004	Keilman and Pham	Empirical errors and predicted errors in fertility, mortality and migration forecasts in the European Economic Area
2004	Castles	Why migration policies fail
2004	Lutz and Goldstein	Introduction: How to deal with uncertainty in population forecasting?
2004	Krieger	Migration trends in an enlarged Europe
2005	van Wissen, Gaag, Rees and Stillwell	In search of a modelling strategy for projecting internal migration in European countries: demographic versus economic–geographical approaches
2005	Kancs	Can we use NEG models to predict migration flows? an example of CEE accession countries
2005	Kupiszewski and Kupiszewska	A revision of the traditional multiregional model to better capture international migration: the MULTIPOLES model and its applications
2005	Wilson and Rees	Recent developments in population projection methodology: a review
2005	Willekens	Biographic forecasting: bridging the micro–macro gap in population forecasting

2005	Howe and Jackson	Projecting immigration: a survey of the current state of practice and theory
2006	Alho, Alders, Cruijsen and Nikander	New forecast: population decline postponed in Europe
2006	Bruecker and Siliverstovs	On the estimation and forecasting of international migration: How relevant is heterogeneity across countries?
2006	Erzan, Kuzubaş and Yildiz	Immigration scenarios: Turkey–EU
2006	Bruecker and Siliverstovs	Estimating and forecasting European migration: methods, problems and results
2006	Raymer, Bonaguidi and Valentini	Describing and projecting the age and spatial structures of interregional migration in Italy
2006	Lutz and Scherbov	Future demographic change in Europe: the contribution of migration
2006	Bijak	Forecasting international migration: selected theories, models and methods
2006	Howe	Long-term immigration projection methods: current practice and how to improve it
2006	Massey	Building a comprehensive model of international migration
2006	Lutz	Towards building a comprehensive migration projections framework
2006	Zaiceva	Reconciling the estimates of potential migration into the enlarged European Union
2007	Matysiak and Nowok	Stochastic forecast of the population of Poland, 2005–2050
2007	Bijak, Kupiszewska, Kupiszewski, Saczuk and Kicingier	Population and labour force projections for 27 European countries, 2002–2052: impact of international migration on population ageing
2007	Shaw	Fifty years of United Kingdom national population projections: How accurate have they been?
2007	Wilson	The forecast accuracy of Australian Bureau of Statistics national population projections
2007	Alders, Keilman and Cruijsen	Assumptions for long-term stochastic population forecasts in 18 European countries

2007	Bijwaard	Modeling migration dynamics of immigrants: the case of the Netherlands
2007	Lutz and Scherbov	The contribution of migration to Europe's demographic future: projections for the EU-25 to 2050
2007	Stover and Kirmeyer	DemoProj Version 4: a computer program for making population projections
2007	de Silva	A population projection of Sri Lanka for the millennium, 2001–2101: trends and implications
2007	Skirbekk	Report on methods for demographic projections at multiple levels of aggregation
2008	Kupiszewski	International migration and the future of populations and labour in Europe
2008	Alho	Aggregation across countries in stochastic population forecasts
2008	Bijak, Kicing, Saczuk, Kupiszewska, Kupiszewski and Nowok	Long-term international migration scenarios for Europe, 2002–2052
2008	Cohen, Roig, Reuman and GoGwilt	International migration beyond gravity: a statistical model for use in population projections
2008	Keilman	European demographic forecasts have not become more accurate over the past 25 years
2008	Coleman	The demographic effects of international migration in Europe
2008	Bijak, Kupiszewska and Kupiszewski	Replacement migration revisited: Simulations of the effects of selected population and labor market strategies for the ageing Europe, 2002–2052
2008	Hyndman and Booth	Stochastic population forecasts using functional data models for mortality, fertility and migration
2008	van Wissen	In search of a modelling strategy for projecting internal migration in European countries: demographic versus economic–geographical approaches

2008	Black, Kniveton, Skeldon, Coppard, Murata and Schmidt-Verkerk	Demographics and climate change: future trends and their policy implications for migration
2008	Bijak and Kupiszewski	Population and labour force forecasts for selected European countries: assumptions and results
2008	Raymer and Willekens	International migration in Europe: data, models and estimates
2008	Pijpers	Problematizing the “orderly” aesthetic assumptions of forecasts of East–West migration in the European Union
2008	Smith, Kniveton, Wood and Black	Predictive modelling
2009	Borgy and Chojmicki	Labor migration: macroeconomic and demographic outlook for Europe and neighborhood regions
2009	Bruni	Demographic forecasts, migration and transition theory: a labor market perspective
2009	Ortman and Guarneri	United States population projections: 2000 to 2050
2009	Barrell, Gottschalk, Kirby and Orazgani	Projections of migration inflows under alternative scenarios for the UK and world economies
2009	Bijak and Kupiszewski	Forecasting of immigration flows until 2025 for selected European countries using expert information
2009	Coleman	Migration and its consequences in 21st century Europe
2010	Bijak and Kupiszewski	Bayesian forecasting of immigration to selected European countries by using expert knowledge
2010	Kim and Cohen	Determinants of international migration flows to and from industrialized countries: a panel data approach beyond gravity
2010	Kancs and Kielyte	European integration and labour migration
2010	de Beer, Raymer, van der Erf, and van Wissen	Overcoming the problems of inconsistent international migration data: a new method applied to flows in Europe

2010	Brunborg and Cappelen	Forecasting migration flows from and to Norway using an econometric model
2010	Skarman, Andersson and Ljungberg	Model to forecast the re-immigration of Swedish-born persons
2010	Bijak	Dealing with uncertainty in international migration predictions: from probabilistic forecasting to decision analysis
2010	Anjos and Campos	The role of social networks in the projection of international migration flows: an agent-based approach
2011	Bijak	<i>Forecasting International Migration in Europe: A Bayesian View</i>
2011	Stillwell and Clarke	<i>Population Dynamics and Projection Methods</i>
2011	Shin and Ortman	Language projections: 2010–2020
2011	Molloy, Smith and Wozniak	Internal migration in the United States
2011	Wilson, Charles-Edwards and Bell	Australia's future net overseas migration: a survey of experts
2012	Raftery, Li, Ševčíková, Gerland and Heilig	Bayesian probabilistic population projections for all countries
2012	Okolski (ed.)	<i>European Immigration: Trends, Structures and Policy Implications</i>
2012	Raymer, Abel and Rogers	Does specification matter? Experiments with simple multiregional probabilistic population projections
2012	Cohen	Projection of net migration using a gravity model
2012	Bijak	Migration assumptions in the UK national population projections: methodology review
2012	Simini, González, Maritan and Barabási	A universal model for mobility and migration patterns
2012	Blumenstock	Inferring patterns of internal migration from mobile phone call records: evidence from Rwanda
2012	Zagheni and Weber	You are where you e-mail: using e-mail data to estimate international migration rates

2012	Massey	Towards an integrated model of international migration
2012	Findlay, McCollum and Bijak	A Delphi survey of immigration to the UK to 2060, with particular reference to environmental mobility
2013	Abel, Bijak, Forster, Raymer, Smith and Wong	Integrating uncertainty in time series population forecasts: an illustration using a simple projection model
2013	Raymer, Wiśniowski, Forster, Smith and Bijak	Integrated modelling of European migration
2013	Strielkowski, Šárková and Żornaczuk	EU enlargement and migration: scenarios of Croatian accession
2013	Abel	Estimating global migration flow tables using place of birth data
2013	Keogh	Modelling asylum migration pull-force factors in the EU-15
2013	Calian	Dynamical models for migration projections
2013	Dion	An alternative projection model for interprovincial migration in Canada
2013	Sander, Abel and Riosmena	The future of international migration: developing expert-based assumptions for global population projections
2013	Muenz, R.	Demography and Migration: An Outlook for the 21st Century
2013	Wiśniowski, Bijak, Christiansen, Forster, Keilman, Raymer and Smith	Utilising expert opinion to improve the measurement of international migration in Europe
2013	Abel, Bijak, Findlay, McCollum and Wiśniowski	Forecasting environmental migration to the United Kingdom: an exploration using Bayesian models
2013	State, Weber and Zagheni	Studying international mobility through IP geolocation
2013	Wiśniowski	Bayesian modelling of international migration with labour force survey data
2014	Abel, KC and Sander	Examining the role of international migration in global population projections

2014	Raftery, Alkema and Gerland	Bayesian population projections for the United Nations
2014	Cappelen, Skjerpen and Tønnessen	Forecasting immigration in official population projections using an econometric model
2014	Abel and Sander	Quantifying global international migration flows
2014	Lowell	Managing immigration: a review of some past projections
2014	Wiśniowski, Bijak and Shang	Forecasting Scottish migration in the context of the 2014 constitutional change debate
2014	Zagheni, Garimella, Weber and State	Inferring international and internal migration patterns from Twitter data
2014	European Migration Network	Ad hoc query on forecasting and contingency planning arrangements for international protection applicants
2014	Shang, Bijak and Wiśniowski	Directions of impact of Scottish independence on migration: a survey of experts
2015	Azose and Raftery	Bayesian probabilistic projection of international migration
2015	Fertig and Kahanec	Projections of potential flows to the enlarging EU from Ukraine, Croatia and other eastern neighbours
2015	Garcia, Pindolia, Lopiano and Tatem	Modeling internal migration flows in sub-Saharan Africa using census microdata
2015	Docquier and Machado	Remittance and migration prospects for the 21st century
2015	Colby and Ortman	Projections of the size and composition of the U.S. Population: 2014 to 2060
2015	Wiśniowski, Smith, Bijak, Raymer and Forster	Bayesian population forecasting: extending the Lee-Carter method
2015	Rees, Lomax and Boden	Alternative approaches to forecasting migration: framework and UK illustrations
2015	Disney, Wiśniowski, Forster, Smith and Bijak	Evaluation of existing migration forecasting methods and models
2016	Wiśniowski, Forster, Smith, Bijak and Raymer	Integrated modelling of age and sex patterns of European migration

2016	Hanson and McIntosh	Is the Mediterranean the new Rio Grande? US and EU immigration pressures in the long run
2016	Wilson	Can international migration forecasting be improved? The case of Australia
2016	García-Guerrero	A probabilistic method to forecast the international migration of Mexico by age and sex
2016	Azose, Ševčíková and Raftery	Probabilistic population projections with migration uncertainty
2016	Vandresse	Projection of internal migration based on migration intensity and preferential flows
2016	De Lima	Migration and the EU challenges, opportunities, the role of EIB
2016	Armstrong and van de Ven	The impact of possible migration scenarios after 'Brexit' on the state pension system
2016	IOM's Global Migration Data Analysis Centre	Migration forecasting: beyond the limits of uncertainty
2016	Buettner and Muenz	Comparative analysis of international migration in population projections
2016	Collman, Blake and Bridgeland	Measuring the potential for mass displacement in menacing contexts
2017	KC and Lutz	The human core of the shared socioeconomic pathways: Population scenarios by age, sex and level of education for all countries to 2100
2017	Docquier and Machado	Income disparities, population and migration flows over the 21st century
2017	United Nations Population Division	<i>World Population Prospects: The 2017 Revision</i>
2017	Eurostat	Methodology for the migration assumptions in the 2015-based population projections
2017	Buettner and Muenz	International migration projections: methodology brief
2017	European Asylum Support Office (EASO)	Quantitative assessment of asylum-related migration: a survey of methodology
2017	Campos	Migratory pressures in the long run: international migration projections to 2050

2017	Dao, Maurel and Schaus	Global migration in the 20th and 21st centuries: the unstoppable force of demography
2017	Pew Research Center	Europe's growing Muslim population
2017	OECD	Will migration help increase the educational level of the European labour force by 2030?
2017	Connor	Can Google trends forecast forced migration flows? Perhaps, but under certain conditions
2018	Abel	Non-zero trajectories for long-run net migration assumptions in global population projection models
2018	United Nations Population Division	Projected demographic effects of international migration, 2015–2050
2018	Azose and Raftery	Estimating large correlation matrices for international migration
2018	Raymer and Wiśniowski, A.	Applying and testing a forecasting model for age and sex patterns of immigration and emigration
2018	Etling, Backeberg and Tholen	The political dimension of young people's migration intentions: evidence from the Arab Mediterranean region
2018	Curiel, Pappalardo, Gabrielli and Bishop	Gravity and scaling laws of city-to-city migration
2018	Azose and Raftery	Estimation of emigration, return migration, and transit migration between all pairs of countries
2018	Buettner and Muenz	Modeling alternative projections of international migration
2018	Hilgenstock and Koczan	Storm clouds ahead? Migration and labor force participation rates in Europe
2018	Rigaud	Groundswell: preparing for internal climate migration
2018	Derer	Population growth will make it harder to meet EU climate goals, while stable or declining populations will help cut greenhouse gas emissions in the EU
2018	Vespa	Demographic turning points for the United States: population projections for 2020 to 2060

2018	Willekens	Towards causal forecasting of international migration
2018	Joint Research Centre (European Commission)	Demographic and human capital scenarios for the 21st century: 2018 assessment for 201 countries
2018	OECD	Can we anticipate future migration flows?
2019	Arranz	Predicting migration in Ireland: a gravity model approach
2019	Lutz, Amran, Belanger, Conte, Gailey, Ghio, Grapsa, Jensen, Loichinger, Marois, Muttarak, Potancokova, Sabourin, Stonawski	Demographic scenarios for the EU – migration, population and education
2019	UNHCR	<i>Projected Global Resettlement Needs 2020</i>
2019	The Overpopulation Project	New policy-based population projections for the European Union, with a consideration of the environmental implications
2019	Bijak, Disney, Findlay, Forster, Smith and Wiśniowski	Assessing time series models for forecasting international migration: lessons from the United Kingdom
2019	Scottish Expert Advisory Group on Migration and Population	UK immigration policy after leaving the EU: impacts on Scotland's economy, population and society
2019	Böhme, Gröger and Stöhr	Searching for a better life: Predicting international migration with online search keywords
2019	Willekens	Evidence-based monitoring of international migration flows in Europe

CHAPTER 4

ASK THE EXPERTS?

AN EXPLORATORY DELPHI SURVEY OF IMMIGRATION TO THE EUROPEAN UNION IN 2030

Rhea Ravenna Sohst, Jasper Tjaden, Eduardo Acostamadiedo, Helga de Valk⁶⁰

4.1 Introduction

This study assesses the role of expert input in the field of EU migration policy – an issue that persistently ranks among the top issues of concern for policymakers and citizens across the EU (see recent Eurobarometer results, European Commission, 2020a). Following a rapid increase in migration to the EU amidst the so-called migration ‘crisis’ in 2015-2016 and ongoing pressures of population ageing and decline (Van Nimwegen & Van der Erf, 2010), there is an increasing policy interest in the European Union (EU) to understand future migration and better plan and prepare for the arrival of future immigrants. In 2020, the European Commission thus put forward the New Pact on Migration and Asylum including a ‘Crisis and Preparedness Blueprint’ that proposes the implementation of an EU-wide instrument to forecast migration and facilitate a common response to key migration trends (European Commission, 2020b). Recent years have seen a sharp increase in the number of policy reports and academic studies aiming to provide tools and knowledge about how migration patterns may develop in the future (see Sohst et al., 2020 for an overview) and considerable investment in research on migration scenarios and forecasts through the EU Horizon 2020 program.

Predicting the future, however, is notoriously difficult. A wide range of approaches have been developed to foresee future migration trends, including early warning systems (European Asylum Support Office, 2020; Shellmann and Stewart, 2007), quantitative forecasts based on (causal) modelling of migration flows or time series analyses (Abel et al., 2013; Bijak, 2011; Böhme, Gröger & Stöhr, 2020; Kupiszewski, 2002; Willekens, 2018) as well as foresight

⁶⁰ Ravenna Sohst is with the University of Luxembourg, Jasper Tjaden with the University of Potsdam, Eduardo Acostamadiedo with the International Organization for Migration and Helga de Valk with the Netherlands Interdisciplinary Demographic Institute. This research is associated with the CrossMigration project, funded by the European Union’s Horizon 2020 research and innovation programme under the grant agreement Ares (2017) 5627812-770121. Ravenna Sohst is supported by the Luxembourg National Research Fund (MINLAB DTU 10949242). A previous version of the paper has been published in Acostamadiedo et al. (2021). Email address for correspondence: ravenna.sohst@uni.lu.

or scenario approaches (European Asylum Support Office, 2019; Lomax et al., 2020; Organisation for Economic Co-operation and Development, 2020).⁶¹ One increasingly popular and potentially powerful approach involves the systematic use of expert opinion. Yet, while studies using experts have become more frequent (see Sohst et al., 2020 for a review), the potential of expert advice remains unclear and understudied (Abel et al., 2013; Bijak, 2011; Findlay et al., 2012). At the same time, there have been calls for careful consideration of elicitation protocols as the value of experts has been challenged in other policy fields (Badescu & Chen, 2014; Colson & Cooke, 2018; Morgan, 2014; Tetlock, Mellers & Scoblic, 2017).

We conducted a large-scale Delphi survey with 178 experts to predict immigration to the EU in 2030 distinguishing between four types of immigration (labour, high-skilled, forced and irregular – in addition to total immigration). The Delphi survey is a tool designed to systematically collect information from a group of experts in a way that decreases individual bias and reduces uncertainty about the future (Dalkey & Helmer, 1962; Helmer-Hirschberg, 1967). Our study is distinct in four ways: First, compared to previous studies, we engaged a particularly large pool of experts in the survey. Second, we invited experts to make separate estimations for four different types of immigration (in addition to the total) that allow us to identify separate trends for each group: labour, high-skilled, and asylum migration as well as irregular border crossings. Third, we provided experts with four scenarios for the EU in 2030 and invited them to predict migration flows conditional on these alternative realities. Fourth, we undertook a detailed assessment of the internal consistency (variation, consensus and confidence among experts) of expert predictions. With these adaptations, we aim to increase precision and maximise the potential policy value of expert judgement following initial work in this area that highlighted the high level of disagreement among experts (Abel et al., 2013; Drbohlav, 1997).

The results of our study show that expert surveys can provide valuable, policy-relevant insights into the future development of high-skilled, labour, asylum and irregular immigration. Despite various efforts to increase consensus among experts in our study, however, uncertainty and variation in expert predictions remains high.

⁶¹ There are a number of integrated approaches that combine aspects of different methods (see e.g. United Kingdom Government Office for Science, 2011; ESPON and NIDI, 2010).

4.2 Expert advice and future migration

Policymakers have a range of approaches available to help them anticipate future migration trends. Many include quantitatively analysing migration data using causal models of migration, time series extrapolations or others (see Bijak et al., 2019; Böhme, Gröger & Stöhr 2020; Dao et al., 2018; Tjaden, Auer & Laczko 2019; Willekens, 2018). Yet, the underlying source of forecasting approaches (i.e. past data) is also their main limitation: Migration data are often incomparable across time and countries, unavailable or of insufficient quality (Raymer, 2017). Yet even when data are available and of high quality, the inherent ‘randomness’ of migratory patterns and their susceptibility to hardly predictable factors (so-called ‘black swans’, i.e. natural disasters or violent conflicts) make forecasting migration notoriously difficult (Bijak and Wisniowski, 2010).

Expert-led processes can be seen in many ways as a response to these shortcomings or unavailability of data for purely quantitative approaches (Colson & Cooke, 2018; Drescher & Edwards, 2018; Verdolini et al., 2018). EU policymakers commonly consult with and rely on informal and formal expert councils (European Commission, 2015; European Asylum Support Office, 2019; Organisation for Economic Co-operation and Development, 2015). Underpinning the use of expert judgement by policymakers is the claim that persons observing and analysing migration data over years, designing migration policies or directly working with migrants can provide valuable intuition and knowledge about patterns that are unrecognised by quantitative models (Willekens, 1994: 25). Lastly, experts – especially when consulted in groups – can help resolve conflicting knowledge and enhance awareness about uncertainties, which ideally leads to a situation in which groups perform better than its single best member (Rowe, Wright & Bolger, 1991).

One approach to systematically collect expert input are Delphi surveys. Applied to migration research, they produce estimates of future migration based on surveying experts anonymously in multiple rounds. Each time, the statistically summarised responses from the previous round are returned to the participants, allowing them to revise their assessments in light of the other participants’ answers. The process is intended to lead to a convergence of responses and thus aims to produce ‘the most reliable consensus of opinion’ (Dalkey and Helmer, 1962: 458; Helmer-Hirschberg, 1967). Previous evidence from Delphi surveys shows mixed results. In Drbohlav’s 1997 Delphi survey regarding European East-West migration for example, experts overestimated the overall migration volume from East to West but foresaw the regional differentiation largely correctly. Furthermore, the literature has also shown rather

high levels of uncertainty and disagreement among experts (Drbohlav, 1997; Findlay et al., 2012), calling into question whether the Delphi method generates consensus and valid results.

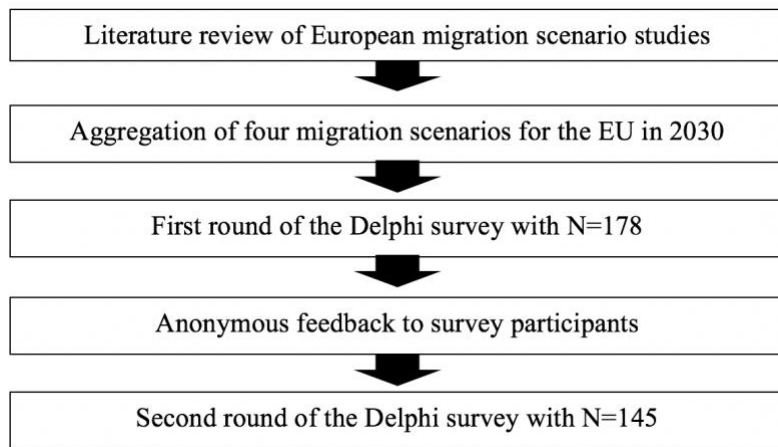
Previous research in other policy areas has highlighted the limitations of approaches involving experts (Kynn, 2008; Morgan, 2014; Sutherland & Burgman, 2015; Tetlock, Mellers & Scoblic, 2017). In this study, we aim to contribute to the debate by investigating the role of experts and the use of Delphi surveys in predicting migration – a subject of top concern among policymakers and a phenomenon whose understanding is still fragmented and therefore hard to predict.

4.3 Methodology

Building on previous research, we designed a two-round Delphi survey with a group of diverse migration experts from across Europe (Table 1). We aimed to address the shortcoming of Delphi surveys – i.e. their limited ability to generate agreement among experts – by drawing on a large pool of experts (N=178) and providing them with four contextual scenarios of the future. Large-scale, high-quality scenario studies have been undertaken in recent years to explore the future of European migration. In our study, we aim to avoid a duplication of developing our own set of migration scenarios from zero and instead build upon these existing scenario studies, analysed by Sohst et al. (2020) in a systematic literature review. Four immigration scenarios, which best represent and summarize the storylines of the selected studies, are thus synthesized and then evaluated in a two-round Delphi survey with a group of diverse migration experts from across Europe (Figure 1).

We further aimed to maximise accuracy in experts' estimates by providing information on past migration flows to the EU over the last decade and asked experts to estimate different types of immigration flows (considering that some flows may be easier to predict than others).

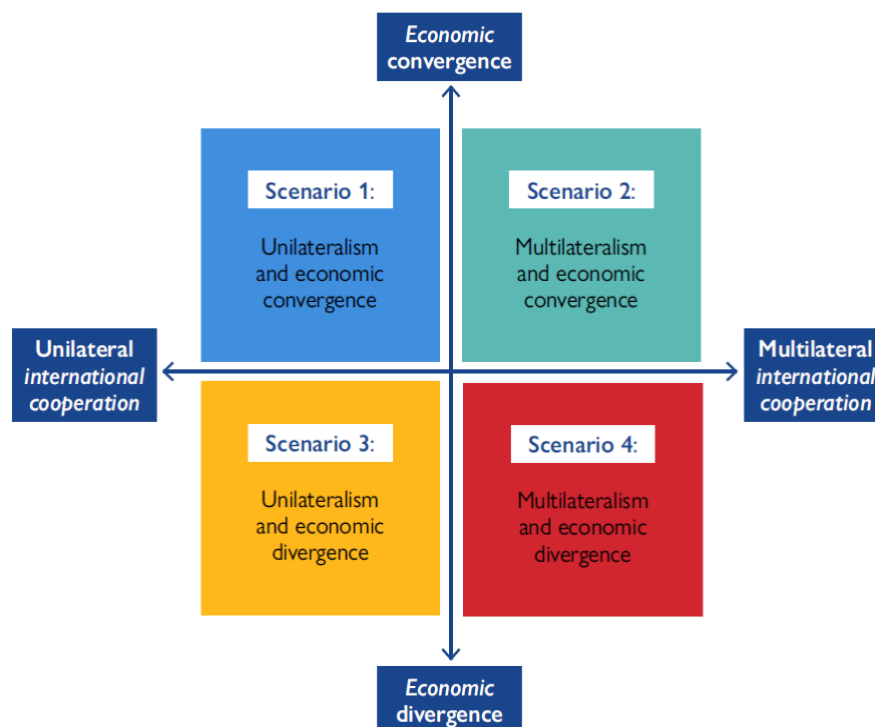
Figure 1: The Delphi process in this study



Source: Authors' own elaboration

The scenarios describe alternative realities for Europe and the world in 2030 and are built around migration drivers perceived to be the most uncertain and most impactful for future migration flows to the EU (Vezzoli et al., 2017). The two main dimensions of the scenario framework are: (a) international cooperation (including European Union integration) and (b) economic convergence between the European Union and migrant-sending regions. Figure 2 shows a visual summary of the four scenarios. The complete survey questionnaire, including a detailed description of the scenarios as they were presented to the survey participants, can be found in Appendix 1.

Figure 4. The four scenarios presented to survey participants



Source: Authors' own elaboration

Following a pilot test (see Appendix 2), our final survey consisted of two rounds. An invitation to participate in the online survey was sent to 1,656 experts in the field of migration studies, in both academia and policy, who were encouraged to further share the survey within their networks.⁶² This implies diversity in expert origin and a certain level of 'self-declared expertise'. The first round of data in the survey were collected between 25 October 2019 and 15 November 2019. Wave 2 of the survey started on 25 November 2019 until the end of 2019.⁶³ Overall, 178 experts participated in wave 1 and 145 participated again in wave 2 (see Table 1 and Acostamadiedo et al. 2020). This implies a response rate of close to 10% in the first wave with some panel attrition (18%) in the second wave. For the analyses of the result, we limit our sample to a subset of participants with at least five years of experience in migration issues and expertise in European migration. All respondents who did not self-identify with these criteria were excluded from the analysis. Implying our analytical sample includes 110 respondents who took part in both rounds and fulfilled the additional selection criteria. In the end, our sample includes both senior experts (34% of experts with 20 or more years of relevant experience) and

⁶² The initial contact list was assembled based on authorship of studies relevant to future migration to Europe (see Sohst et al. 2020) and shared widely through various university networks and research institutes, including IMISCOE, COMPAS and IOM.

⁶³ The data collection was thus terminated before the onset of the Covid-19 pandemic in Europe.

younger members of the migration research and policy community (48% with 5 to 14 years of experience). Two-thirds are migration scholars and one-third policy practitioners. About one quarter of respondents had previous experience with migration forecasts or scenarios, respectively. Lastly, academic backgrounds were diverse among respondents, ranging from sociology (36%) to economics (21%) and law (13%).

Table 1: Delphi survey sample

		First round		Second round		Net sample**	
		Total (N)	Share (%)	Total (N)	Share (%)	Total (N)	Share (%)
Years of experience in the field of migration	0–4	21	11.9	18	12.4	0	0.0
	5–9	45	25.6	37	25.5	34	30.9
	10–14	30	17.1	27	18.6	19	17.3
	15–19	28	15.9	23	15.9	20	18.2
	≥20	52	29.6	40	27.6	37	33.6
Stakeholder	Others	15	8.5	12	8.3	6	5.5
	Practitioner	53	29.9	43	29.7	31	28.2
	Scholar	109	61.6	90	62.1	73	66.4
Academic background*	Political science	59	33.2	48	33.1	38	34.6
	Sociology	52	29.2	45	31.0	40	36.4
	Demography	45	25.3	36	24.8	26	23.6
	Economics	42	23.6	32	22.1	23	20.9
	Law	19	10.7	17	11.7	14	12.7
	Psychology	4	2.3	4	2.8	3	2.7
	Other discipline	46	25.8	37	25.5	27	24.6
Experience in migration research*	Drivers	72	40.5	58	40.0	46	41.8
	Forecasting	41	23.0	33	22.8	28	25.5
	Region-specific	103	57.9	84	57.9	66	60.0
	Scenarios	46	25.8	41	28.3	30	27.3
	Other methods	57	32.0	47	32.4	34	30.9
Regional expertise*	Africa	66	37.1	55	37.9	45	40.9
	Americas	41	23.0	32	22.1	24	21.8
	Asia	47	26.4	36	24.8	26	23.6
	Europe	141	79.2	120	82.8	110	100.0
	Oceania	12	6.7	10	6.9	7	6.4
Total		178		145		110	

Note: Not all respondents answered all questions, so totals may not add up to 178.

* Totals do not add up to 100 per cent because a respondent may belong to more than one category.

** Responses of participants with less than four years of experience and without expertise in European migration were excluded from the analysis.

Source: Authors' own computation based on the Delphi survey

4.3.1 Outcomes measures

Our Delphi survey produces estimates of immigration inflows to the EU in 2030 separately for five categories of immigrants and four scenarios. Experts also estimate the likelihood of each scenario. In addition, we evaluate the Delphi survey based on its internal consistency and the potential impact of expert composition on the immigration estimates. While we cannot evaluate whether the expert predictions are accurate, the assessment can uncover potential biases introduced through the Delphi design.

In our assessment of the consistency, we first explore to what degree estimates vary within and across survey waves and scenarios. Second, we assess the confidence experts have in their own predictions. Survey participants were asked to provide subjective ratings of confidence and assign them a value between 1 and 100. Values were grouped into five categories: 'Very confident' (80–100), 'Confident' (60–79), 'Half-half' (40–59), 'Unsure' (20–39) and 'Very unsure' (1–19). Third, we examine whether the Delphi survey helps experts converge on their predictions – a main motivation for Delphi surveys. We define convergence as the share of experts that change their estimate after the first round of the survey and move closer to the mean estimate of the first round. Between the two rounds, experts were given the anonymised and summarised responses of their peers, which means that changing one's estimate towards the average would indicate consensus. Lastly, we explore the compositional effect of experts on a range of measures including confidence, convergence and flow estimates.

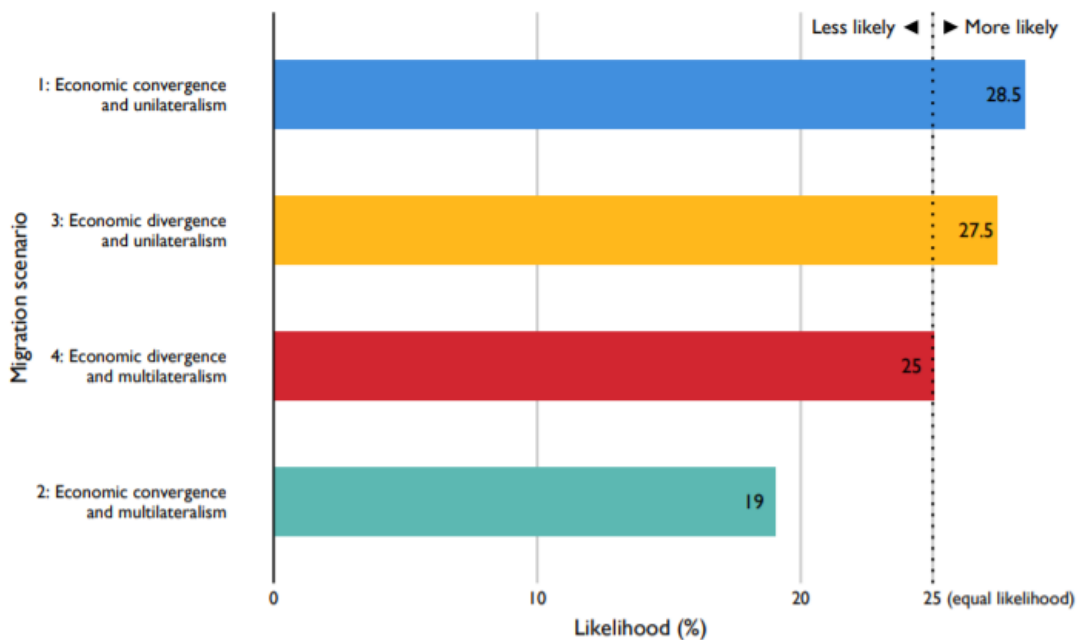
4.4 Results

4.4.1 Likelihood of immigration scenarios

Experts rated the likelihood of four scenarios that were presented to them. Experts' assessment of the likelihood of a scenario may serve as an indirect measure of the relevance of a scenario and can help inform policy priorities. Figure 3 shows the likelihood of the scenarios compared to each other. Scenarios above 25% are rated relatively more likely than the others, scenarios below 25% relatively less likely. Overall, Figure 3 shows that scenarios were rated similarly which is likely to reflect the uncertainty of the subject matter and the abstract nature of the scenarios. Yet, the results also reveal that experts believe states are going to act increasingly unilaterally in the future (scenarios 1 and 3) instead of opting for multilateral cooperation to

tackle migration policy challenges (scenarios 4 and 2). Scenario 1 was considered most likely, foreseeing a future in which wealthy and poor world regions become more equal but political cooperation becomes more fragmented and unilateral. In contrast, the scenario combining both multilateralism and economic convergence (scenario 2) was considered least likely.

Figure 5. Relative likelihood of scenarios according to experts



Reading Note: Experts weighted each scenario against each other and indicate which one they believe to be relatively more (or less) likely than the others by distributing a total of 100 points. A relative likelihood of 25 per cent for all four scenarios means that each is equally likely to materialize. When a scenario is rated more than 25 per cent by the experts, however, experts believe it to be more likely than those rated lower.

Note: The figure is based on the net sample of experts (those who responded to both waves, have at least five years of expertise, and regional expertise in European migration).

Source: Authors' own computation based on the Delphi survey

4.4.2 Expert predictions of immigration inflows to the EU in 2030

Results from our Delphi survey show that – by 2030 – survey respondents expect total immigration to increase by 21-44% compared to the averaged baseline in 2008-17 (Figure 4). High-skilled and labour immigration are expected to grow fastest whereas the number of asylum seekers and irregular border crossings show less clear trends. Overall, experts associate multilateralism (i.e., the degree to which countries cooperate on migration) with higher levels of regular and labour immigration to the EU and, conversely, unilateralism with lower levels. In contrast, humanitarian and irregular migration is expected to increase most in scenarios that

foresee widening economic gaps between the EU and the rest of the world. Figure 4 summarises the results by showing the expected change in immigration inflows for each of the five migrant groups and by scenario.

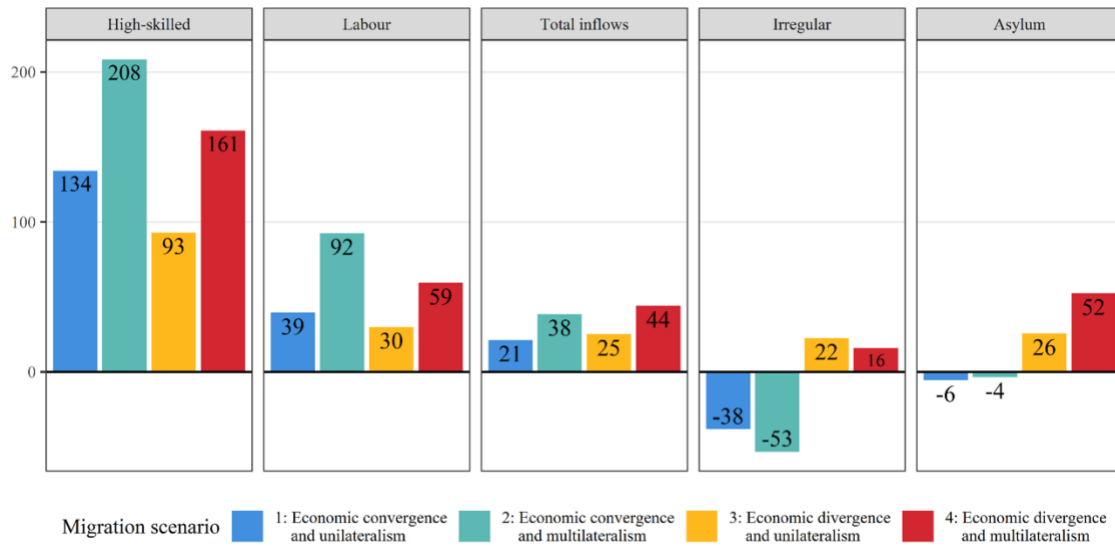
These estimates point towards the weight experts assign to ‘pull’ dimension of European labour markets in attracting high-skilled immigrants. Similar to high-skilled immigration, general labour migration is expected to increase under all scenarios. Growth is expected to range between 30 and 92% compared to the 2009-18 reference period.

Total inflows are expected to increase moderately under all scenarios, to a total volume of 2.4 to 2.8 million in 2030. Scenarios describing a future in which countries cooperate multilaterally (scenarios 2 and 4) are associated with the largest increases – consistent with the result for high-skilled and labour immigrants. In contrast, scenarios in which unilateralism dominates the global political stage (scenarios 1 and 3), legal and labour immigration are expected to decrease. We speculate that this might be connected to the idea that cooperative countries are more likely to create and maintain regular migration channels.

Experts’ judgement regarding future development of irregular border crossings is more sensitive to the particular migration scenario compared to the other types of immigrant inflows. A future that will bring Europe and the world economically closer together is expected to reduce irregular border crossings by up to 53% compared to the 2009-18 average. In contrast, a future that accentuates economic difference might increase them by up to 22%. Yet even the highest estimate corresponds to only 425 thousand expected crossings compared to over 1.7 million recorded by Frontex in 2015.⁶⁴ The differences across scenarios suggest that experts see irregular migration as a function of classic economic ‘push’ and ‘pull’ factors (e.g. poverty and economic opportunity) rather than international cooperation. Experts’ predictions of first-time asylum applications generally mirror the trends observed for irregular border crossings.

⁶⁴ By definition, irregular migration takes place outside of laws or regulations. Statistics, including the numbers cited by Frontex, are therefore an incomplete picture and likely to underestimate the true number of irregular migrants.

Figure 6. Change in immigration to the EU-28 compared to 2009-18, by immigration type and scenario (percentage change)



Note: The sample only includes experts with at least 5 years of experience and expertise in migration to the EU. The figure is based on the net expert sample.

Source: Authors’ own computation based on the Delphi survey; Eurostat 2020; Frontex 2020

In sum, experts believe that regular and labour migration will moderately increase whereas the future of humanitarian and irregular immigration is considered highly uncertain, depending notably on future policy choices, economic scenarios, and their implications for key migration drivers. Nevertheless, in none of the scenarios, experts expect a repeat of the ‘refugee crisis’ of 2015/2016.

4.4.3 Evaluation of expert predictions

The expert predictions presented in the previous section appear useful to inform policy choices since they reveal distinct trends for each of the five predicted immigration flows and scenarios. However, the trends identified above also hide substantial variation across expert predictions that call for closer examination. In particular, we are interested in seeing whether the design features of the Delphi survey fulfil its purpose to increase consensus among experts and decrease the influence of individual expert characteristics. Given that it is impossible (until at least 2030) to assess the accuracy of the predictions, we focus our analysis on the internal consistency of predictions as an indicator of the reliability of experts. Internal consistency is measured as variation (agreement among experts), convergence (consensus building) and subjective confidence of experts in their own predictions (see section 3.1 for details on all outcome variables).

4.4.4 Variation of expert predictions

Overall, our analysis reveals large disagreement among experts (see Appendix 3 which shows the distribution of estimates of total immigration in 2030 separately for the first and second wave of the Delphi survey and for each of the four scenarios). Half of the experts expect (on average across all scenarios) between 2 and 3 million total immigrants to the EU in 2030 – a difference of about 1 million immigrants. To put this figure into perspective, 1 million immigrants approximates half of all immigrant flows to the European Union in 2017. Disagreement remains large despite our attempts to increase precision by providing experts with specific scenarios about the future and information on past immigration flows. However, we do find more agreement among experts in relative terms, i.e. not regarding the absolute number of immigrants to arrive in 2030 but regarding the relative direction of trends based on each scenario. Here we find for example that about two thirds of experts agree that total flows would decrease in scenarios 1 and 3, but increase in scenario 2 (compared to the average estimate of each expert). Overall, we find that disagreement among experts is higher for small migration flows such as irregular border crossings and high-skilled immigration than for larger groups such as total or labour immigration (Appendix 4).

4.4.5 Subjective confidence in predictions

Experts show intermediate levels of confidence in their estimates of future inflows to the European Union. On a scale of 1 to 100, the average level of confidence was 43 for the first wave and 41 for the second. For the second wave, the average level of confidence was similar across different types of inflows: 39 per cent for first-time asylum applications, 40 per cent for irregular border-crossings, 42 per cent for total inflows, 43 per cent for labour inflows and 43 per cent for high-skilled inflows. Even after controlling for expert characteristics, confidence in their own estimates remains in the lower middle, between 40 and 50 per cent (see Appendix 5).

4.4.6 Consensus formation among experts

The Delphi method is specifically designed to increase consensus among participants by informing respondents about the predictions of their peers and letting them re-evaluate their own predictions. In our Delphi survey however, expert views show extremely limited convergence (see Appendix 6). The overall variation in the second wave remained almost

unchanged compared to the first wave, and only 5% of predictions were moved closer toward the group mean of wave 1. On average across all groups of immigrants, only nine percent of experts modified their original estimate after being confronted with the opinions of their peers.

4.4.7 The effect of expert composition

The main difference between a Delphi survey with a group of experts and relying on individual experts as advisors is the assumption that aggregating predictions from a larger pool of experts leads to a more precise, more certain ‘forecast’ that discounts individual biases. Selecting the pool of experts becomes crucial because it is reasonable to expect that individual characteristics drive predictions. The evidence on the role of expert characteristics in Delphi survey predictions is limited, largely due to sample size limitations. Any evidence on the specific types of experts that may tend to provide higher estimates on average, for example, would be useful guidance for policy-makers and researchers who are recruiting experts for advisory boards and Delphi surveys.

In our Delphi survey, we assessed the influence of expert characteristics on a range of outcome measures, including the average immigration estimates, convergence and confidence in predictions. We are also interested in experts who systematically make higher or lower predictions than the average expert (i.e. experts whose predictions are in the bottom or top 25% of the prediction distribution).

The findings highlight that the composition of experts does not appear to have a significant impact on the results (Appendix A7). Neither the gender, the amount of experience, the academic background, nor a particular expertise in forecasting, scenario building or other methodologies to anticipate the future are linked to average predictions of immigration inflows in 2030.

4.5 Comparison of expert predictions and alternative forecasts

We studied expert predictions of four immigration scenarios to the European Union in 2030 based on a large Delphi survey conducted in 2019. Our results show that experts foresee clearly diverging trends for each of the flows. This is an important insight and contribution to migration projections that often focus exclusively on net migration as their outcome (Kupiszewski, 2002). Net migration, i.e. the number of immigrants minus the number of emigrants in a given year, is especially problematic since it is not easily interpretable by policy makers. Our study shows

it is important to include different types of migration in projections, ideally those that match residence permit categories as this is ultimately how immigration policy is shaped.

A limitation of any (including our) Delphi setup is the lack of a possibility to validate the prediction's accuracy – predictions of 2030 inflows can't be compared to "true" values (yet). However, we can compare the trends predicted by experts with the results of other, somewhat similar immigration projection exercises. Eurostat (2019) and the United Nations World Population Prospects (WPP) (2019) for example have published projections of net migration for Europe in 2030. Although net migration (as used in Eurostat and the WPP) is not directly comparable with total migration (as used in our Delphi survey), it still gives an approximative idea of the relative magnitudes of each prediction.⁶⁵ The comparison shows that the expert predictions (between 2.35 and 2.79 immigrants in 2030, depending on the scenario) fall broadly into similar bounds, predicting more immigrants than Eurostat (0.69 to 1.38 million net migrants)⁶⁶ but fewer than WPP (3.35 million net migrants) (Appendix 8). Even if we assume high levels of emigration from Europe (thus lowering the expert predictions), the conclusion is likely to hold.

Additionally we specified three basic forecasts of individual immigration flows: an ARIMA(1,0,1) model, a linear extrapolation and a linear extrapolation with smoothed 'crisis' years 2015-16 (see Appendix 9 for data and calculation details) to compare to our expert predictions. The input for the three models are univariate time-series data of immigration to the EU-28 between 2009 and 2018.⁶⁷ The comparison of mean expert estimates and mean forecasts shows that experts and forecast models produce similar estimates for total and labour flows but diverge substantially in their predictions of high-skilled, humanitarian, and irregular immigration (see Appendix 10). Differences are thus larger for smaller and more volatile immigration flows which produce more uncertainty. When replacing the years 2015-16 with rolling averages in our linear extrapolation, we find that many experts appear to have weighted down those years since they assumed them to be less representative of the overall trend, particularly in the case of irregular border crossings.

Overall, the comparisons with Eurostat, UN WPP and our forecasts underline the large degree of uncertainty regarding the size of future immigration flows, even on a mid-term horizon of ten years and especially for smaller and more volatile migration flows. Yet, it also

⁶⁵ The value of total immigration is always larger than the value of net migration for the same country because net migration is calculated by subtracting emigration from immigration but predicting immigration doesn't account for emigration.

⁶⁶ Eurostat's predictions exclude the United Kingdom.

⁶⁷ Except for the forecast of total immigration which is based on 2008-2017 data.

shows that expert predictions are broadly in line with projections made by Eurostat and the UN's WPP.

4.6 Conclusions

This study assessed the results from an expert survey on future immigration to the European Union. Our study had two aims: First, to present expert predictions of immigration to the EU in 2030 and second, to evaluate the consistency of expert predictions and the influence of expert composition. Departing from the standard Delphi approach, we made several adjustments to maximise the potential value of expert input, namely to provide experts with scenarios of the future and to distinguish five types of immigration flows instead of predicting just total or net flows as is commonly done.

At first sight, experts appear to provide valuable insights for policymakers because they foresee a departure from the patterns observed over the past decade. High-skilled immigration is believed to increase most – between 93 and 208% compared to 2008-18. In contrast, the number of annual asylum applications and irregular border crossings is expected to remain constant or increase only slightly. In none of the four scenarios do estimates of forced and irregular migration exceed levels observed in 2015-16.

However, results regarding the reliability of these expert predictions are humbling and largely in line with the larger literature on the elicitation of expert opinion from other fields (Colson and Cooke 2018; Morgan 2014). Experts tend to have little confidence in their estimates, disagree substantially on the size of international immigration and stick to their original estimates when presented with the responses of their peers. In our diverse group of survey respondents, none of the background characteristics made a substantial difference to these findings.

With a lack of “true” values that we could validate the expert predictions with, we compared them instead to two migration projections from Eurostat and the UN's WPP and found that experts' predictions of total migration were in between those of the WPP and Eurostat. In addition, a comparison with three simple time series extrapolations showed that experts aligned broadly with the forecasts for total and labour immigration – the largest two migration flows – but deviated considerably for high-skilled, asylum and irregular migration – the smaller and more volatile flows.

Despite these valuable insights, some limitations should be noted. First, although we aimed to develop migration scenarios that are commonly used in the scenarios literature and

might therefore be familiar to participants, the scenarios were still complex and left plenty of room for interpretation. To get a better sense on what exactly scenarios entail, it might be better to build them around specific policy choices, like potential cooperation agreements with EU-neighbouring countries for example. Second, given the large number of participants compared to other Delphi surveys, there were no occasions for interaction between the experts. In future surveys, it would be worth exploring if providing qualitative feedback in addition to statistical feedback would increase the odds that experts converge on their views (Rowe & Wright, 2001). Third, the variability in our expert estimates is challenging because we have no way of determining which experts make better predictions – and therefore no way to distinguish noise from information. One possibility to evaluate experts in the future would be to test their knowledge on past migration or probabilistic reasoning for example and then weight their responses based on the results.

Should policymakers ‘ask the experts’ as prompted in the title of this study? It depends. Our survey showed that experts can contribute important new information. This is mainly due to the fact that experts made predictions for specific migration flows and for specific scenarios that are unavailable in official aggregate statistics. However, whether experts are more accurate than alternative approaches to anticipate future migration remains an open question. Despite several efforts to reduce variation and increase consensus among experts, large uncertainty and disagreement remains.

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Data availability statement

The data that support the findings of this study are openly available in Harvard Dataverse at <https://doi.org/10.7910/DVN/RDJGRY>, reference number [UNF:6:imGRmbKaGVyO0WCgAoVdUw==].

Appendix 1. Complete questionnaire for waves 1 and 2 of the Delphi survey, including a detailed description of the scenarios

DELPHI SURVEY OF FUTURE EUROPEAN MIGRATION SCENARIOS IN 2030: PLAUSIBLE, PROBABLE AND RELEVANT?

Welcome to this 30-min Delphi survey about future migration to Europe!

Thank you for taking the time to support this research. In this survey, we will ask you to rate the probability of **four migration scenarios for Europe** and estimate their implications for different flows of immigration. The scenarios are based on a synthesis of scenario and forecasting reports that we have reviewed for this research project.

This survey is not a scenario-building exercise, but an expert-based forecast for four simple migration scenarios. Survey participants are leading experts and researchers in the field of migration, scenarios and forecasting – **just like yourself.**

All experts will be surveyed twice. This is the first round. We will re-contact you later in November when you will have the opportunity to adjust your responses based on the aggregated results.

Before we get started, some important remarks:

1. Please note we ask for your **personal opinion** as an expert, and not as a representative of any institution or employer.

2. There are no “right” or “wrong” answers.

3. We would like to stress that this survey is **absolutely anonymous**. We will not quote individual opinions, nor share your information with third parties.

4. Statistical disclaimer. In this survey, you will find figures of migration inflows to the EU, irregular border crossings, first asylum applications and first residence permits based on the official sources of Eurostat and Frontex. While we are well aware that these figures have certain limitations, like any statistics, we use them **for purely illustrative purposes.**

5. Respondents will get access to the anonymized dataset, early access to the publication and the opportunity to compare their responses with other leading experts.

Yours sincerely,

International Organization for Migration's Global Migration Data Analysis Center

Netherlands Interdisciplinary Demographic Institute

Default Question Block

INTRODUCTION

The scenarios are developed along two axes, taking into account two key future migration drivers.

1. The vertical axis shows **economic convergence** (top) versus **economic divergence** (bottom) between the EU-28 and main sending regions: Africa, Asia and Eastern Europe.
2. The horizontal axis shows **unilateral international cooperation in policy areas affecting migration** (left) versus **multilateral international cooperation in policy areas affecting migration** (right) between the EU-28 and main sending regions: Africa, Asia and Eastern Europe.

The graph reads as follows. The point where the two axes cross corresponds to the world in 2019 in terms of economic convergence/divergence, and multilateralism/unilateralism. The interaction of the two variables and their levels produces four distinct migration scenarios in 2030.

NARRATIVES OF MIGRATION SCENARIOS

Try to imagine the world in 2030, as described below:

Scenario 1: Unilateralism and shifting wealth

Summary: In 2030, protectionism and unilateral international cooperation are on the rise. Asia and Africa have caught up with Europe economically. Wealth within Africa and Asia is heavily concentrated in the richest 5% of society.

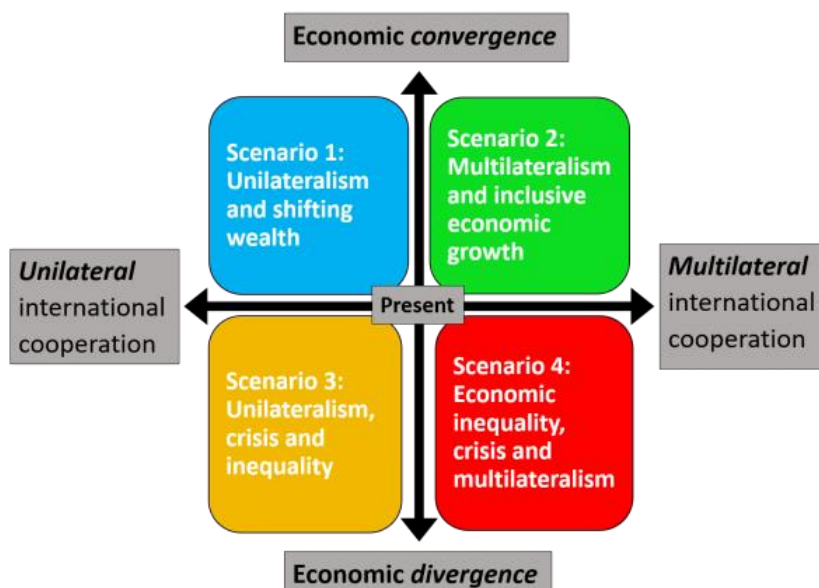
Unilateral international cooperation in policy areas affecting migration

EU cohesion is weakened. While some EU countries seek collaboration, others continue pursuing an agenda of unilateral protectionist policies with little interest in addressing global challenges. China consolidates its global economic dominance. Migration policies are focused on bilateral agreements to regulate labour shortages in the EU. Little is done to address humanitarian migration. Meanwhile, EU limits access to social services for migrants.

Economic convergence between EU and regions of origin

Countries in the EU have not seen any relevant growth since 2025. China, India and Turkey are attractive destinations for migrant workers due to spectacular economic opportunities.

Scenario 2: Multilateralism and inclusive economic growth



Summary: In 2030, global economic growth and strong international cooperation create more inclusive but also more diverse societies in the EU, Africa and Asia.

Multilateral international cooperation in policy areas affecting migration

In Europe, Africa and Asia, governments and civil society rally to implement an ambitious agenda towards multilateralism, openness and environmental protection. EU States address the needs of migrant populations through their general rights-based approach.

Economic convergence between EU and regions of origin

Sustained economic growth rates in the developed world and high and equitable growth in emerging and developing countries have narrowed development gaps between the EU and low-income countries of origin. Labour markets both in the EU and developing countries offer young populations attractive job opportunities.

Scenario 3: Unilateralism, crisis and inequality

Summary: In 2030, international cooperation is at its lowest. There is a large economic gap between the EU and Africa and Asia. Social inequalities are on the rise, causing social unrest.

Unilateral international cooperation in policy areas affecting migration

The EU project is at the brink of falling apart. Protectionist and isolationist policies are the norm as more countries consider leaving the union and abandoning some hard-won global agreements. Very few applicants are granted asylum, and visas are generally difficult to obtain.

Economic divergence between EU and regions of origin

Since Asia and Africa have not seen relevant economic growth in the past decade, there is a wide economic divide between these sending regions and the EU.

Scenario 4: Economic inequality, crisis and multilateralism

Summary: In 2030 an economic crisis in Africa and Asia creates patches of instability. To deal with the economic instability in the sending regions, EU, Africa and Asia engage in multilateral cooperation that allows for some progress in migration management.

Multilateral international cooperation in policy areas affecting migration

The EU has become a more cohesive union. African and Asian countries have deepened their partnerships with one another and the rest of the world. The EU, Asia and Africa engage in bilateral agreements on migration at all skill levels, granting refugee status and encouraging integration. The EU has increased its ability to cooperate with third countries on returns and on delivering humanitarian support outside Europe.

Economic divergence between EU and regions of origin

EU economy is experiencing stable economic growth. Developing economies in Asia and Africa have failed to catch-up due to an economic crisis.

Four assumptions are common to all scenarios:

1. Demand for health and elderly care services will expand in EU.
2. Shrinking labor force in many EU member states due to low fertility rates.
3. Environmental degradation. Increased impact of weather events: floods, droughts, wildfires, landslides.
4. Automation and digitalization will impact labor markets and particularly affect low and medium-qualified workers.

PROBABILITY

What is the probability of each of the scenarios becoming a reality in 2030 measured by a percentage between 0 (very improbable) and 100 (very probable)?

The percentages must add up to 100 across all scenarios.

If all scenarios are equally probable, each should have 25.

0=very improbable 50=half-half 100= very probable

0

50

100

**Scenario 1:
Unilateralism and
shifting wealth
(Economic
convergence and
unilateralism)**

0

**Scenario 2:
Multilateralism
and inclusive
economic**

growth (Economic
convergence and
multilateralism)

0

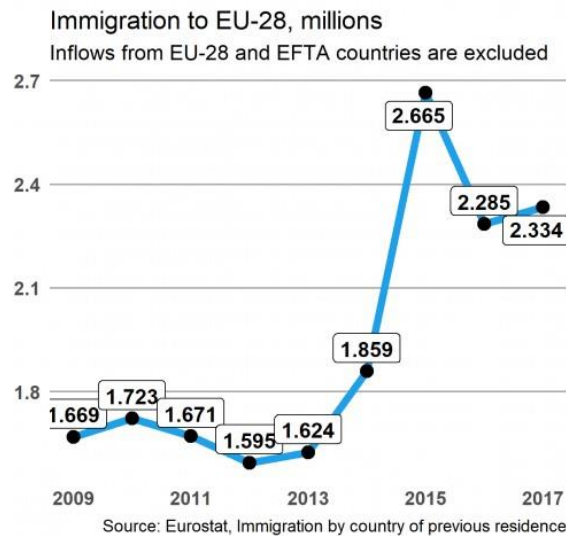
Scenario 3:
Unilateralism,
crisis and
inequality
(Economic
divergence and
unilateralism)

0

Scenario 4:
Economic
inequality, crisis
and multilateralism
(Economic
divergence and
multilateralism)

0

TOTAL INFLOWS



*European Free Trade Association (EFTA): Switzerland, Norway, Liechtenstein and Iceland

In 2017, there was an estimated **total inflow of 2,334,000 immigrants** to the EU-28 from countries outside the EU.

- What would be the **approximate number** in the year 2030 in the EU-28 for each of the scenarios described above?
- How confident are you about your estimation? Please provide a **percentage** based on the scale below:

Confidence level	Per cent scale
Very confident	80-100
Confident	60-79
Half-half	40-59
Unsure	20-39
Very unsure	1-19

Inflows in 2030
(e.g. 2,334,000)

Confidence
(e.g. 96)

Scenario 1: Unilateralism and shifting wealth (Economic convergence and unilateralism in international cooperation)

%

Scenario 2: Multilateralism and inclusive economic growth (Economic convergence and multilateralism in international cooperation)

%

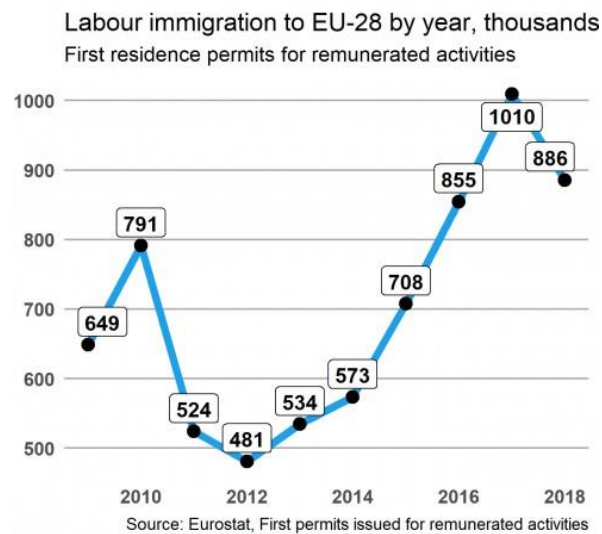
Scenario 3: Unilateralism, crisis and inequality (Economic divergence and unilateralism in international cooperation)

%

Scenario 4: Economic inequality, crisis and multilateralism (Economic divergence and multilateralism in international cooperation)

%

LABOUR IMMIGRATION



In 2018, **886,000 first-time residence permits were issued for migrant workers** in the EU-28.

- What would be the **approximate number** in the year 2030 in the EU-28 for each of the scenarios described above?
- How confident are you about your estimation? Please provide a **percentage** based on the scale below:

Confidence level	Per cent scale
Very confident	80-100
Confident	60-79
Half-half	40-59
Unsure	20-39
Very unsure	1-19

Labour immigration in 2030 (e.g. 886,000) Confidence (e.g. 96) %

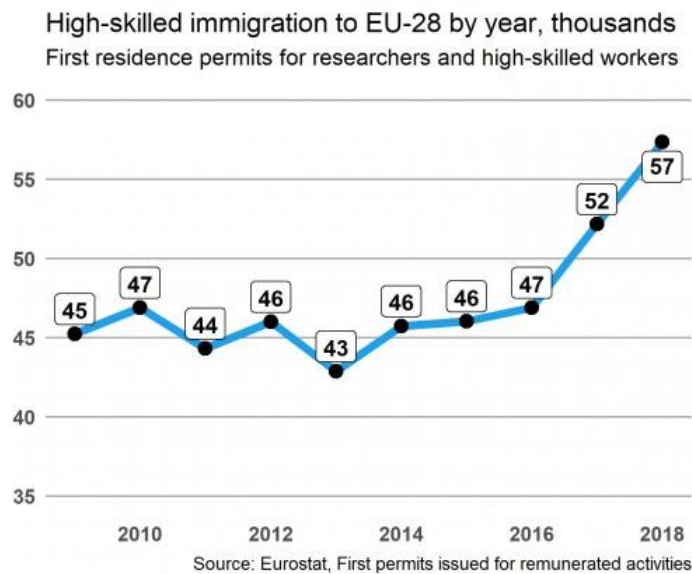
Scenario 1: Unilateralism and shifting wealth (Economic convergence and unilateralism in international cooperation) %

Scenario 2: Multilateralism and inclusive economic growth (Economic convergence and multilateralism in international cooperation) %

Scenario 3: Unilateralism, crisis and inequality (Economic divergence and unilateralism in international cooperation) %

Scenario 4: Economic inequality, crisis and multilateralism (Economic divergence and multilateralism in international cooperation) %

HIGH-SKILLED IMMIGRATION



In 2018, **57,000 first-time residence permits** were issued for highly skilled workers in the EU-28.

- What would be the **approximate number** in the year 2030 in the EU-28 for each of the scenarios described above?
- How confident are you about your estimation? Please provide a **percentage** based on the scale below:

Confidence level	Per cent scale
Very confident	80-100
Confident	60-79
Half-half	40-59
Unsure	20-39
Very unsure	1-19

High skilled immigration
(e.g. 57,000)

Confidence (e.g. 96)

Scenario 1: Unilateralism and shifting wealth (Economic convergence and unilateralism in international cooperation)

%

Scenario 2: Multilateralism and inclusive economic growth (Economic convergence and multilateralism in international cooperation)

%

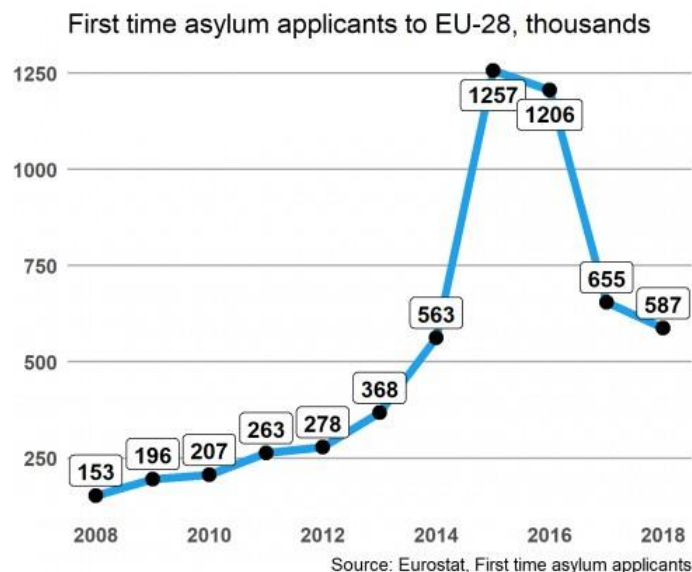
Scenario 3: Unilateralism, crisis and inequality (Economic divergence and unilateralism in international cooperation)

%

Scenario 4: Economic inequality, crisis and multilateralism (Economic divergence and multilateralism in international cooperation)

%

ASYLUM APPLICATIONS



In 2018, **587,000** people lodged an asylum application for the first time in the EU-28.

- What would be the **approximate number** in the year 2030 in the EU-28 for each of the scenarios described above?
- How confident are you about your estimation? Please provide a **percentage** based on the scale below:

Confidence level	Per cent scale
Very confident	80-100
Confident	60-79
Half-half	40-59
Unsure	20-39
Very unsure	1-19

Asylum applications in 2030 (e.g. 587,000) Confidence (e.g. 96)

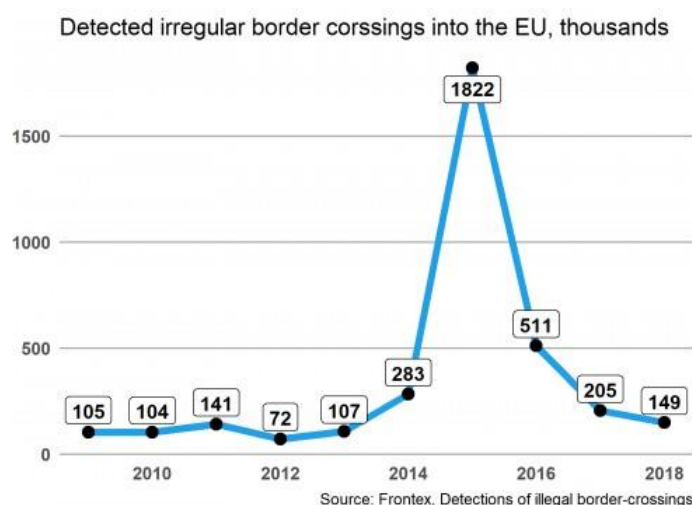
Scenario 1: Unilateralism and shifting wealth (Economic convergence and unilateralism in international cooperation) %

Scenario 2: Multilateralism and inclusive economic growth (Economic convergence and multilateralism in international cooperation) %

Scenario 3: Unilateralism, crisis and inequality (Economic divergence and unilateralism in international cooperation) %

Scenario 4: Economic inequality, crisis and multilateralism (Economic divergence and multilateralism in international cooperation) %

IRREGULAR IMMIGRATION



In 2018, there were **149,000 detected irregular border-crossings** into the EU-28.

- What would be the **approximate number** in the year 2030 in the EU-28 for each of the scenarios described above?
- How confident are you about your estimation? Please provide a **percentage** based on the scale below:

Confidence level	Per cent scale
Very confident	80-100
Confident	60-79
Half-half	40-59
Unsure	20-39
Very unsure	1-19

Irregular border crossings in 2030 (e.g. 149,000) Confidence (e.g. 96)

Scenario 1: Unilateralism and shifting wealth (Economic convergence and unilateralism in international cooperation)

Scenario 2: Multilateralism and inclusive economic growth (Economic convergence and multilateralism in international cooperation)

Scenario 3: Unilateralism, crisis and inequality (Economic divergence and unilateralism in international cooperation)

Scenario 4: Economic inequality, crisis and multilateralism (Economic divergence and multilateralism in international cooperation)

Block 3

In a few words, what was the main reasoning behind your personal migration *flow estimates*?

In a few words, what was the main reasoning behind your estimate of the *probability of scenarios becoming a reality*?

In your personal view, what could be the most important events or developments that would have a very large impact on migration to Europe by 2030?

Block 4

In the field of migration, I consider myself a (pick one)

- Scholar (university professor, researcher) Practitioner (civil servant, policy-maker)
 Other

I have research experience with (pick multiple)

- Migration forecasting
 Migration scenario building
 Other methodologies analysing the future of migration
 Migration from a particular region in the world

 Migration drivers (which ones)

What is your academic background? (pick multiple)

- Political science
Sociology

Demography

Economics

Law

Psychology

Other

My country of residency is

Regions of expertise (pick multiple)

Africa

Americas

Asia

Europe

Oceania

Please indicate the years of experience you have in the field of migration

0 10 20 30 40 50 60 70

Years of experience
in migration

To successfully evaluate the survey, we require two rounds of survey responses from the same participants. In the second round, you will have the chance to adjust your answers based on the aggregate and anonymized results of the other experts surveyed. We guarantee that all your responses will remain anonymous. Please provide your contact information below.

Last

name

First

name

Instituti

on

My email is

Verify email

We would like to include your name in the annex of the study. At no point of the analysis or communication of survey results will your name be linked to the answers you provided.

Please click below:

- I hereby **agree** with having my name included on the list of respondents.
- I hereby **DO NOT agree** with having my name included on the list of respondents.

Powered by Qualtrics

Default Question Block

FUTURE EUROPEAN MIGRATION SCENARIOS IN 2030: PLAUSIBLE, PROBABLE AND RELEVANT?

FINAL SURVEY

Welcome to the second and final round of this Delphi survey!

This time you will compare your own responses with the aggregated and anonymized estimates from other **178** leading experts. **You have the chance to adjust your initial estimates if you wish to do so.**

To refresh your memory, we will start by presenting you the four migration scenarios again.

The same remarks from the first round apply:

1. Please note that we ask for your **personal opinion** as an expert, and not as a representative of any institution or employer.
2. There are no “right” or “wrong” answers.
3. We would like to stress that this survey is **absolutely anonymous**. We will not quote individual opinions, nor share your information with third parties.

4. Respondents will get access to the anonymized dataset and early access to the publication.

5. If you do not want to adjust your estimate, please leave the space empty.

Yours sincerely,

International Organization for Migration's Global Migration Data Analysis
Centre Netherlands Interdisciplinary Demographic Institute

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No Ares (2017) 5627812-770121.

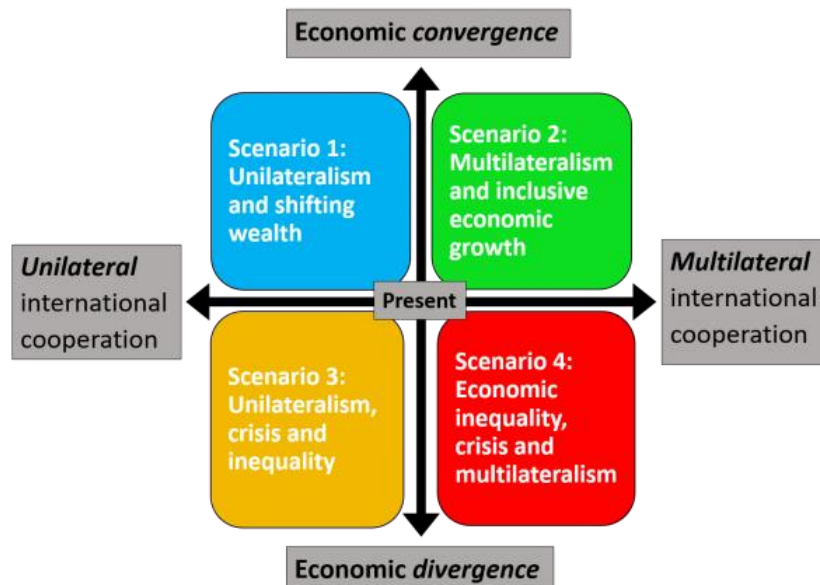
Block 1

INTRODUCTION

The scenarios are developed along two axes, taking into account two key future migration drivers.

1. The vertical axis shows **economic convergence** (top) versus **economic divergence** (bottom) between the EU-28 and main sending regions: Africa, Asia and Eastern Europe.
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The graph reads as follows. The point where the two axes cross corresponds to the world in 2019 in terms of economic convergence/divergence, and multilateralism/unilateralism. The interaction of the two variables and their levels produces four distinct migration scenarios in 2030.



NARRATIVES OF MIGRATION SCENARIOS

Try to imagine the world in 2030, as described below:

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Summary: In 2030, protectionism and unilateral international cooperation are on the rise. Asia and Africa have caught up with Europe economically. Wealth within Africa and Asia is heavily concentrated in the richest 5% of society.

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EU cohesion is weakened. While some EU countries seek collaboration, others continue pursuing an agenda of unilateral protectionist policies with little interest in addressing global challenges. China consolidates its global economic dominance. Migration policies are focused on bilateral agreements to regulate labour shortages in the EU. Little is done to address humanitarian migration. Meanwhile, EU limits access to social services for migrants.

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Countries in the EU have not seen any relevant growth since 2025. China, India and Turkey are attractive destinations for migrant workers due to spectacular economic opportunities.

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3. Environmental degradation. Increased impact of weather events: floods, droughts, wildfires, landslides.
4. Automation and digitalization will impact labor markets and particularly affect low and medium-qualified workers.

PROBABILITY OF SCENARIOS BECOMING REAL

• Aggregated responses and your estimate are in the table below:

	Scenario 1:	Scenario 2:	Scenario 3:	
50% said at least (median)	25	18	25	
Average (mean)	28.3	19.2	26.9	
Your estimate				

• If you wish to change your response please use the space below. Answering "YES" will open a slider question to respond.

YES

NO

- **What is the probability of each of the scenarios becoming a reality in 2030 measured by a percentage between 0 (very improbable) and 100 (very probable)?**
- **The percentages must add up to 100 across all scenarios.**
- If all scenarios are equally probable, each should have
- 25. Aggregated responses and your estimate in the table below:

	Scenario 1:	Scenario 2:	Scenario 3:	Scenario 4:
50% said at least (median)	25	18	25	
Average (mean)	28.3	19.2	26.9	
Your estimate				

Very improbable Half-half Very probable
 0 10 20 30 40 50 60 70 80 90 100

**Scenario 1:
Economic convergence and unilateralism**

0

**Scenario 2:
Economic convergence and multilateralism**

0

**Scenario 3:
Economic divergence and unilateralism**

0

**Scenario 4:
Economic divergence and unilateralism**

0

Total

ESTIMATE OF TOTAL INFLOWS TO THE EU

• Aggregated responses and your estimate are in the table below:

	Scenario 1:	Scenario 2:	Scenario 3:	Scenario 4
50% said at least (median)	2,000,000	2,450,000	2,300,000	2,500,0
Average (mean)	2,275,000	2,554,000	2,572,000	2,813,0
Your estimate				

• If you wish to change your response please use the space below. If you do not want to adjust your response, please leave the space empty.

<input type="checkbox"/> Scenario 1: Economic onvergence and multi- laterarism	<input type="checkbox"/> Scenario2: Economic convergence and multi- laterarism	<input type="checkbox"/> Scenario 3: Economic convergence and multi- laterarism	<input type="checkbox"/> Scenario 4: Economic convergence and multi- laterarism
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

CONFIDENCE IN THE ESTIMATE

• Aggregated responses and your estimate are in the table below:

	Scenario 1:	Scenario 2:	Scenario 3:	Scenario 4
50% said at least (median)	50	50	50	50
Average (mean)	45.4	45.5	45.4	45.3
Your estimate				

• If you wish to change your response please use the space below considering the following scale. If you do not want to adjust your response, please leave the space empty.

Confidence level	Per cent scale
-------------------------	-----------------------

Very confident	80-100
Confident	60-79
Half-half	40-59
Unsure	20-39
Very unsure	1-19

<input type="checkbox"/> Scenario 1: Economic convergence and multi- laterarism <input type="text"/>	<input type="checkbox"/> Scenario2: Economic convergence and multi- laterarism <input type="text"/>	<input type="checkbox"/> Scenario 3: Economic convergence and multi- laterarism <input type="text"/>	<input type="checkbox"/> Scenario 4: Economic convergence and multi- laterarism <input type="text"/>
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ESTIMATE OF LABOUR IMMIGRATION TO THE EU

• Aggregated responses and your estimate are in the table below:

	Scenario 1:	Scenario 2:	Scenario 3:	Scenario 4:
50% said at least (median)	900,000	1,000,000	800,000	1,000,000
Average (mean)	962,000	1,213,000	865,000	1,142,000
Your estimate				

• If you wish to change your response please use the space below. If you do not want to adjust your response, please leave the space empty.

<input type="checkbox"/> Scenario 1: Economic convergence and multi- laterarism <input type="text"/>	<input type="checkbox"/> Scenario2: Economic convergence and multi- laterarism <input type="text"/>	<input type="checkbox"/> Scenario 3: Economic convergence and multi- laterarism <input type="text"/>	<input type="checkbox"/> Scenario 4: Economic convergence and multi- laterarism <input type="text"/>
--	---	--	--

CONFIDENCE IN THE ESTIMATE

• Aggregated responses and your estimate are in the table below:

	Scenario 1:	Scenario 2:	Scenario 3:	Scenario 4:

50% said at least (median)	50	50	50	50
Average (mean)	44.2	45.3	45	45.5
Your estimate				

- If you wish to change your response please use the space below considering the following scale. If you do not want to adjust your response, please leave the space empty.

Confidence level	Per cent scale
Very confident	80-100
Confident	60-79
Half-half	40-59
Unsure	20-39
Very unsure	1-19

<input type="checkbox"/> Scenario 1: Economic convergence and multi- laterarism	<input type="checkbox"/> Scenario2: Economic convergence and multi- laterarism	<input type="checkbox"/> Scenario 3: Economic convergence and multi- laterarism	<input type="checkbox"/> Scenario 4: Economic convergence and multi- laterarism
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

ESTIMATE OF HIGH-SKILLED IMMIGRATION TO THE EU

. Aggregated responses and your estimate are in the table below:

	Scenario 1:	Scenario 2:	Scenario 3:	Scenario 4
50% said at least (median)	70,000	90,000	65,000	80,000
Average (mean)	106,000	140,000	93,000	123,000
Your estimate				

* If you wish to change your response please use the space below. If you do not want to adjust your response, please leave the space empty.

Scenario 1: **Scenario2:** **Scenario 3:** **Scenario 4:**

<input type="checkbox"/> Economic convergence and multi- laterarism	<input type="checkbox"/> Economic convergence and multi- laterarism	<input type="checkbox"/> Economic convergence and multi- laterarism	<input type="checkbox"/> Economic convergence and multi- laterarism
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

CONFIDENCE IN THE ESTIMATE

. Aggregated responses and your estimate are in the table below:

	Scenario 1:	Scenario 2:	Scenario 3:	Scenario 4
50% said at least (median)	50	50	50	50
Average (mean)	46.2	48.3	44.3	45.1
Your estimate				

- If you wish to change your response please use the space below considering the following scale. If you do not want to adjust your response, please leave the space empty.

Confidence level	Per cent scale
Very confident	80-100
Confident	60-79
Half-half	40-59
Unsure	20-39
Very unsure	1-19

<input type="checkbox"/> Scenario 1: Economic onvergence and multi- laterarism <input style="width: 100%;" type="text"/>	<input type="checkbox"/> Scenario2: Economic convergence and multi- laterarism <input style="width: 100%;" type="text"/>	<input type="checkbox"/> Scenario 3: Economic convergence and multi- laterarism <input style="width: 100%;" type="text"/>	<input type="checkbox"/> Scenario 4: Economic convergence and multi- laterarism <input style="width: 100%;" type="text"/>
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ESTIMATE OF ASYLUM APPLICATIONS TO THE EU

- Aggregated responses and your estimate are in the table below:

	Scenario 1:	Scenario 2:	Scenario 3:	Scenario 4:
50% said at least (median)	500,000	480,000	590,000	679,000
Average (mean)	508,000	518,000	699,000	859,000
Your estimate				

- If you wish to change your response please use the space below. If you do not want to adjust your response, please leave the space empty.

<input type="checkbox"/> Economic onvergence and multi- laterarism <input style="width: 100%;" type="text"/>	<input type="checkbox"/> Economic convergence and multi- laterarism <input style="width: 100%;" type="text"/>	<input type="checkbox"/> Economic convergence and multi- laterarism <input style="width: 100%;" type="text"/>	<input type="checkbox"/> Economic convergence and multi- laterarism <input style="width: 100%;" type="text"/>
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CONFIDENCE IN THE ESTIMATE

- Aggregated responses and your estimate are in the table below:

	Scenario 1:	Scenario 2:	Scenario 3:	Scenario 4
50% said at least (median)	40	42.5	45	50
Average (mean)	41	42.7	41.7	42.2
Your estimate				

- If you wish to change your response please use the space below considering the following scale. If you do not want to adjust your response, please leave the space empty.

Confidence level	Per cent scale
Very confident	80-100
Confident	60-79
Half-half	40-59
Unsure	20-39
Very unsure	1-19

Economic onvergence and multi-laterarism
 Economic convergence and multi-laterarism
 Economic convergence and multi-laterarism
 Economic convergence and multi-laterarism

ESTIMATE OF IRREGULAR BORDER CROSSINGS TO THE EU

- Aggregated responses and your estimate are in the table below:

	Scenario 1:	Scenario 2:	Scenario 3:	Scenario 4:
50% said at least (median)	150,000	100,000	250,000	200,000
Average (mean)	232,000	153,000	566,000	452,000
Your estimate				

- If you wish to change your response please use the space below. If you do not want to adjust your response, please leave the space empty.

<input type="checkbox"/> Economic onvergence and multi- laterarism	<input type="checkbox"/> Economic convergence and multi- laterarism	<input type="checkbox"/> Economic convergence and multi- laterarism	<input type="checkbox"/> Economic convergence and multi- laterarism
<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>

CONFIDENCE IN THE ESTIMATE

• Aggregated responses and your estimate are in the table below:

	Scenario 1:	Scenario 2:	Scenario 3:	Scenario 4:
50% said at least (median)	50	43	50	50
Average (mean)	42.4	42.9	44	43.1
Your estimate				

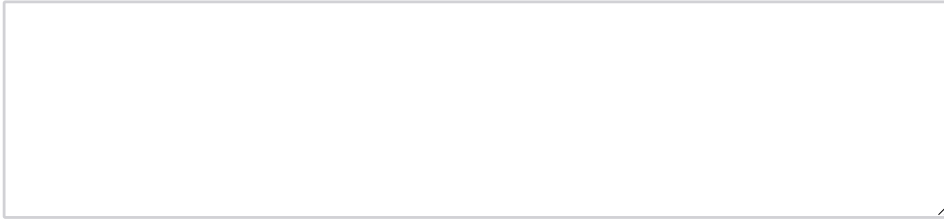
If you wish to change your response, please use space below considering the following scale. If you do not want to adjust your response, please leave the space empty.

Confidence level	Per cent scale
Very confident	80-100
Confident	60-79
Half-half	40-59
Unsure	20-39
Very unsure	1-19

<input type="checkbox"/> Economic onvergence and multi- laterarism	<input type="checkbox"/> Economic convergence and multi- laterarism	<input type="checkbox"/> Economic convergence and multi- laterarism	<input type="checkbox"/> Economic convergence and multi- laterarism
<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>

FINAL QUESTION

Why did you or did not change your responses in this round of the survey compared to the first round? Please provide your **reasons** in the space below:



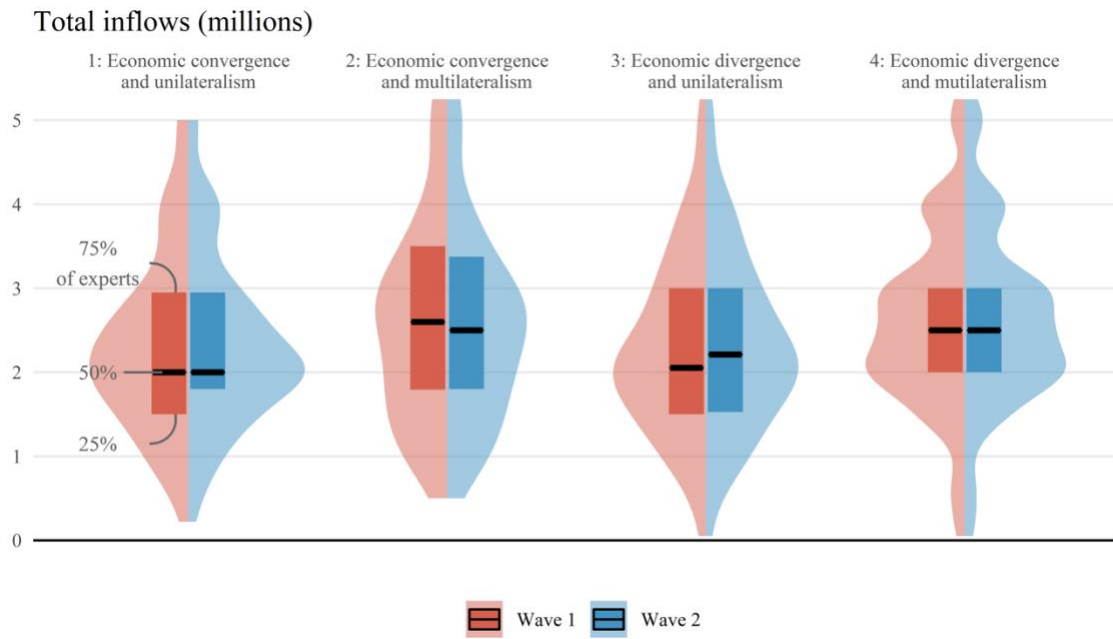
Powered by Qualtrics

Appendix 2. Pilot survey participants

A pilot survey was conducted online with 17 selected participants and then evaluated in an in-person workshop. List of pilot survey participants who agreed to be named:

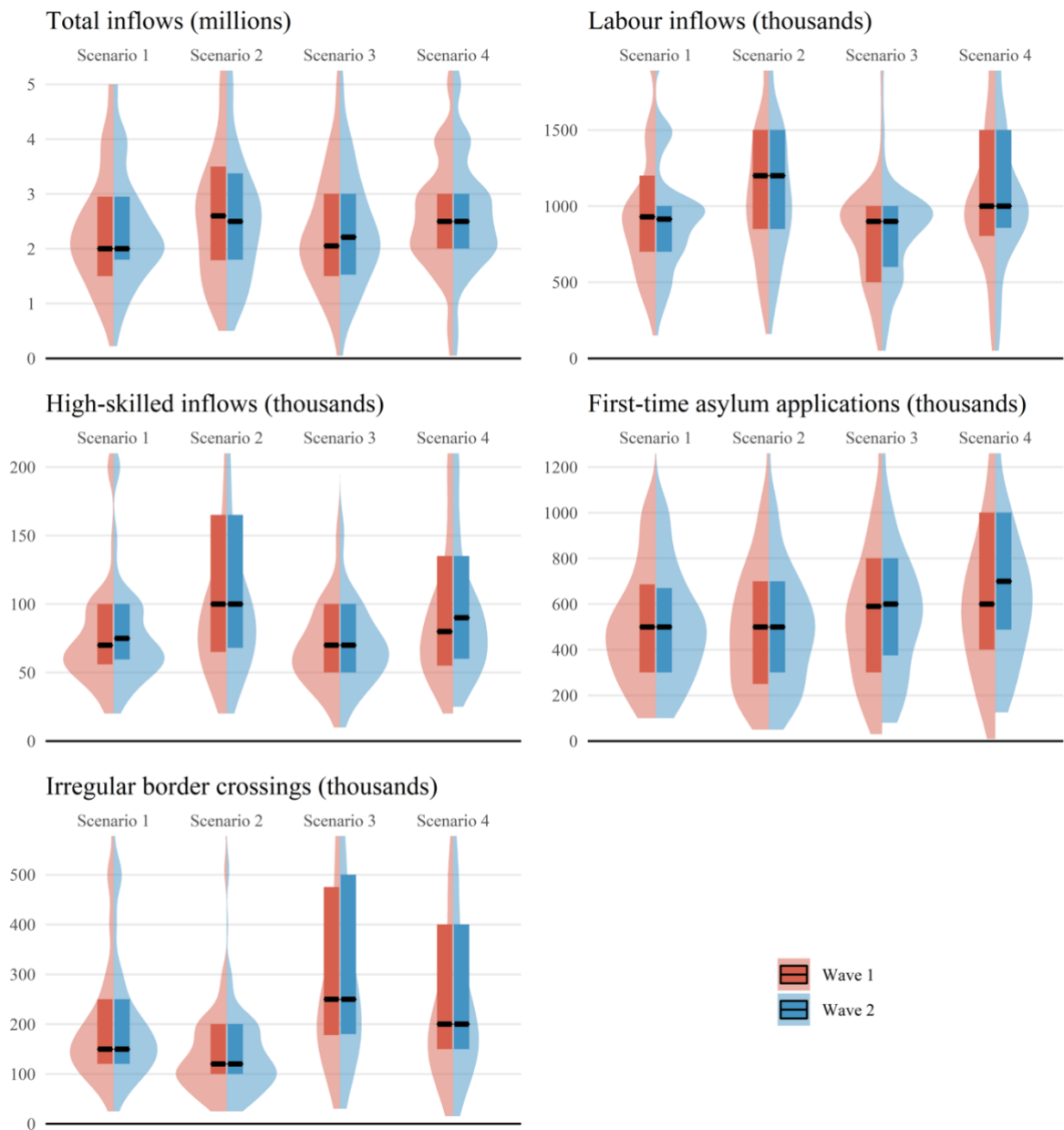
Ayla Bonfiglio	Luca Lixi	Marcin Stonawski
Kate Cornford	Fabrizio Natale	Teddy Wilkin
Marcello Crammia	Birte Nienaber	Arkadiusz Wiśniowski
Andreu Domingo i Valls	Philip Rees	
George Groenewold	Gregor Reisch	
Carsten Kessler	Alice Szczepanikova	

Appendix 3. Variation and convergence of expert estimates in the first and second wave of the Delphi survey, total immigration inflows to the EU in 2030 in millions



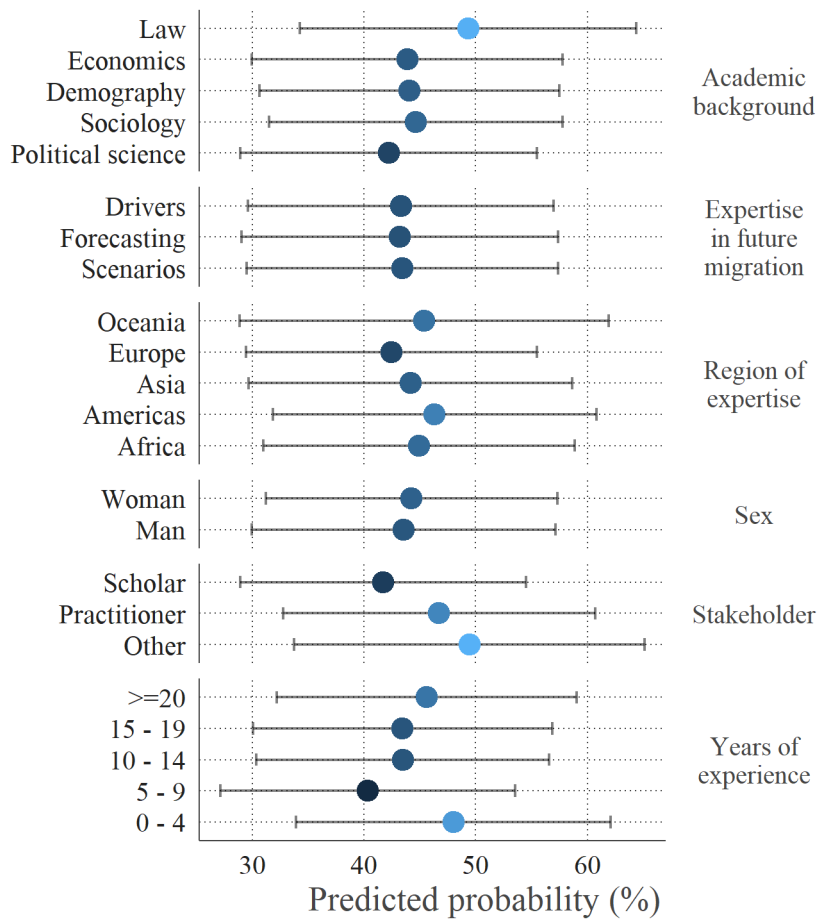
Source: Own calculations based on the Delphi survey. Based on the net expert sample.

Appendix 4. Variation and convergence among experts between round 1 and round 2 of the Delphi survey



Source: Own calculations based on the Delphi survey. Based on the net expert sample.

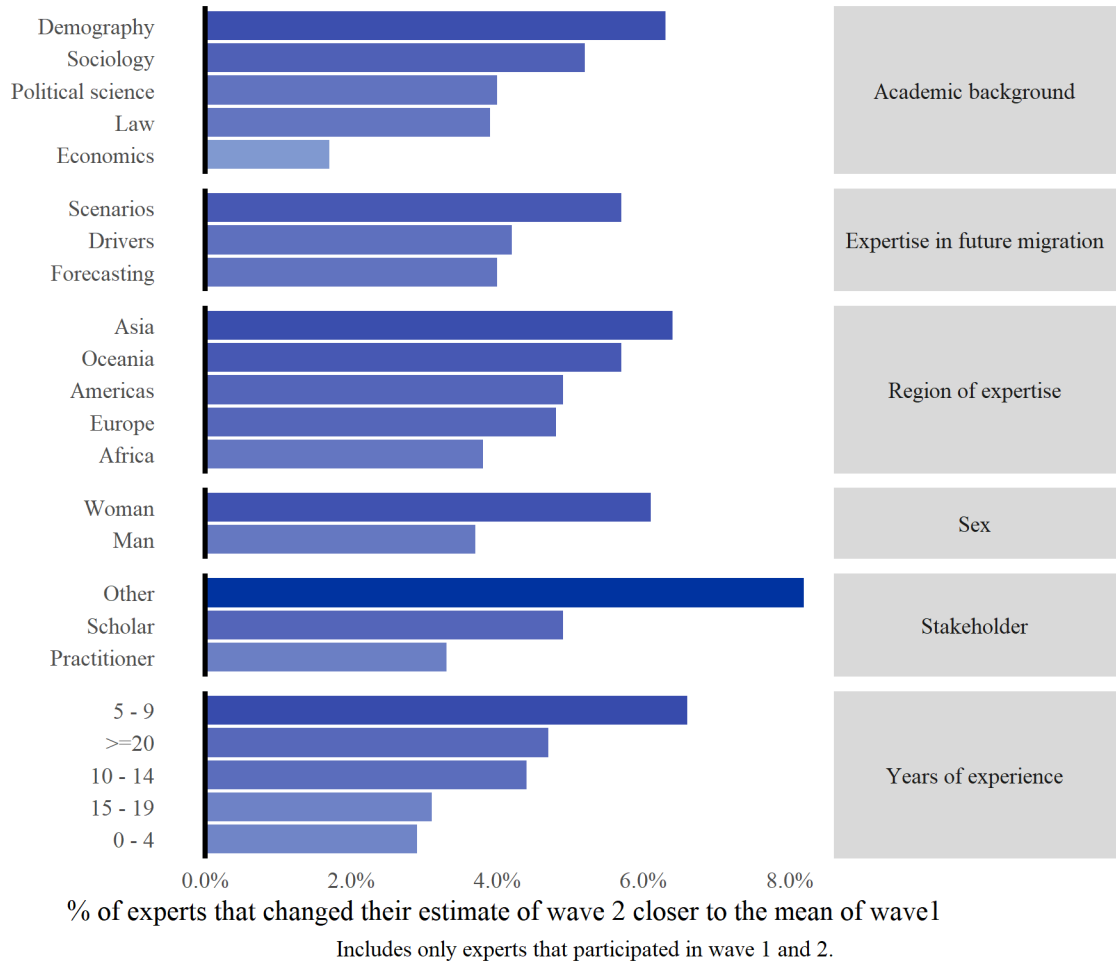
Appendix 5. Experts' confidence in their own predictions



Note: 6077 observations. Predicted values adjusted for expert categories (as seen on the right side) holding covariates at their observed values.

Source: Own calculations based on the Delphi survey. Based on the net expert sample.

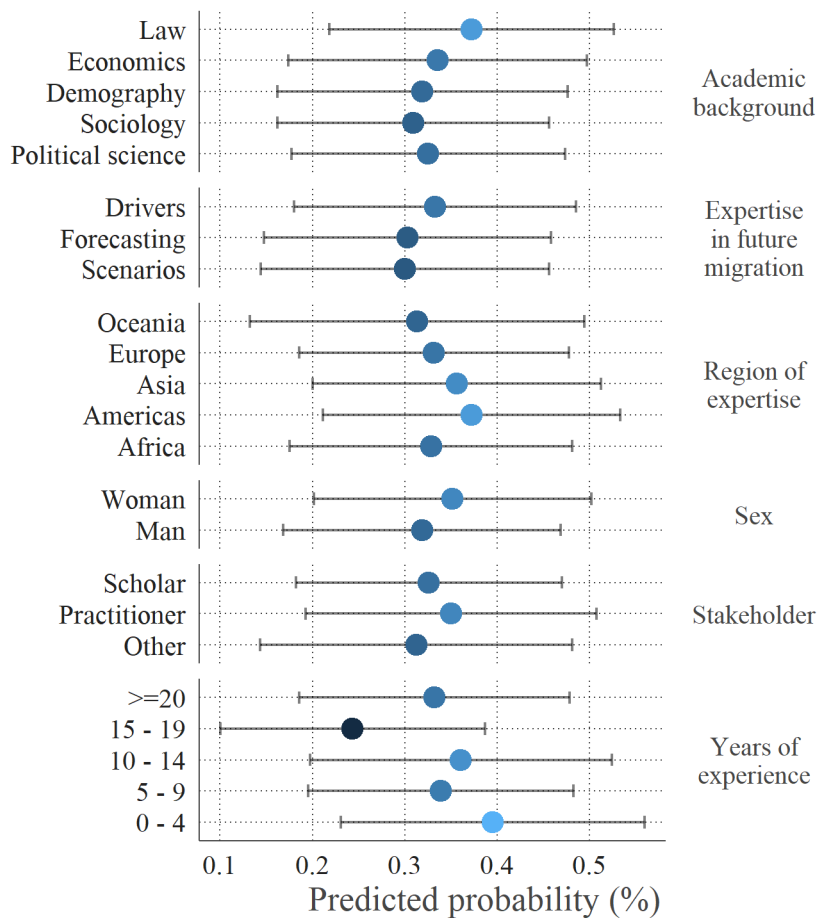
Appendix 6. Convergence - % of experts that changed their estimate in wave 2 to move closer to the mean of wave 1



Source: Own calculations based on the Delphi survey. Based on all experts.

Appendix 7. Impact of expert composition on average predictions

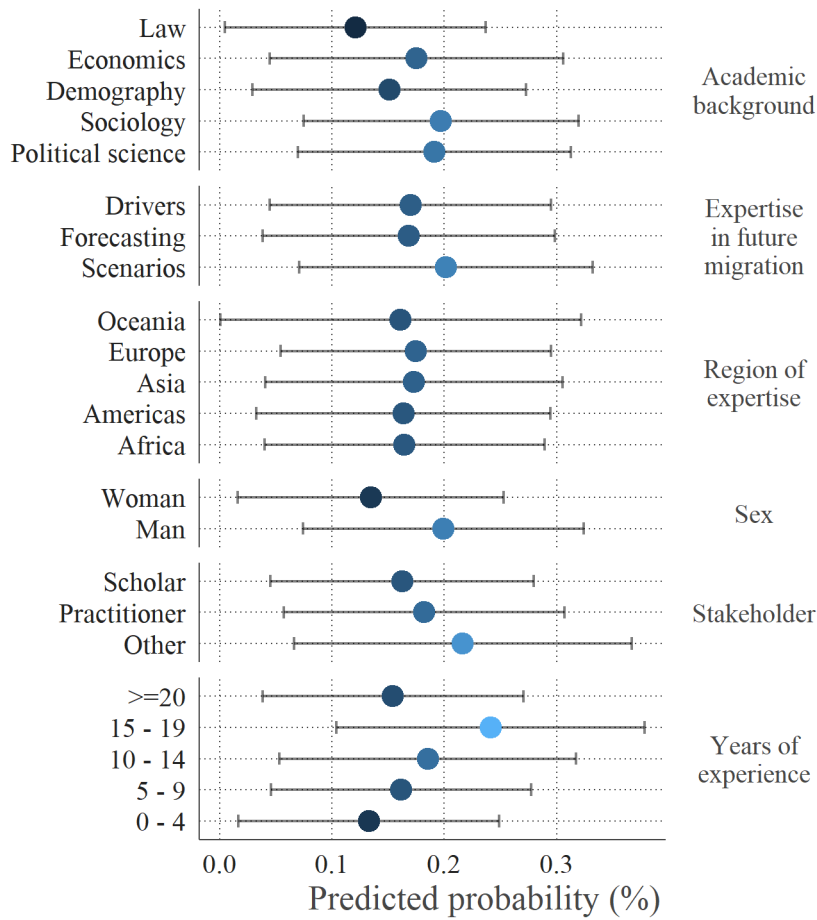
Average predicted probability of being in bottom 25% of estimates:



Note: 6018 observations. Predicted values adjusted for expert categories (as seen on the right side) holding covariates at their observed values.

Source: Own calculations based on the Delphi survey.

Average predicted probability of being in top 25% of estimates:



Note: 6018 observations. Predicted values adjusted for expert categories (as seen on the right side) holding covariates at their observed values.

Source: Own calculations based on the Delphi survey.

Appendix 8. Eurostat and UN WPP projections of net migration and Delphi expert estimates of total immigration to the EU-28 in 2030 (in millions)

	UN WPP (net migration)	Delphi (total immigration)				Eurostat (net migration)		
Scenario	-	1	2	3	4	low	base	high
Immigration projection	3,35	2,35	2,68	2,43	2,79	0,69	0,94	1,38

Note: Estimates are given in five-year intervals for the UN WPP projections. To arrive at the value for 2030, we took the mean of the 2025-30 and the 2030-35 intervals. The Eurostat projections are made for individual countries but summed here for better comparison. The United Kingdom is missing in Eurostat's predictions. The Delphi estimates represent mean expert estimates for each scenario.

Appendix 9. Data and calculation details for the ARIMA and linear forecasts

We compare the average responses from experts with results from standard probabilistic forecasting approaches.⁶⁸ First, relying on the same data that was provided to experts (see table below for the data sources), we estimate an ARIMA (random walk) model, an out-of-sample prediction of a univariate linear regression model and a final model based on the second one but where the ‘crisis’ years 2015-16 were imputed with a moving average of the two previous and following years. All models estimated the mean, and the 50, 80 and 95 percent predicted intervals.⁶⁹ To estimate the ARIMA (0,1,0) model, we followed the modelling procedure indicated in Hyndman and Athanasopoulos (2021, chapter 9). A random walk approach was favoured because our migration data are non-stationary and have longer up- and downward trends combined with sudden changes in direction.

Regarding all three forecast models it should be noted that they are based on short time series data (11 observations) and therefore unlikely to produce reliable results (Disney et al., 2015). However, our aim is not to select the most appropriate forecast models – which would require distinct models for each of the immigration flows and significantly longer time series (at least 20 observations according to Disney et al., 2015, p. 28). Nor is our aim to integrate expert judgement and time series data, which has been done elsewhere using a Bayesian framework (see for example Abel et al., 2013 or Bijak, 2011).

Sources of immigration flow data:

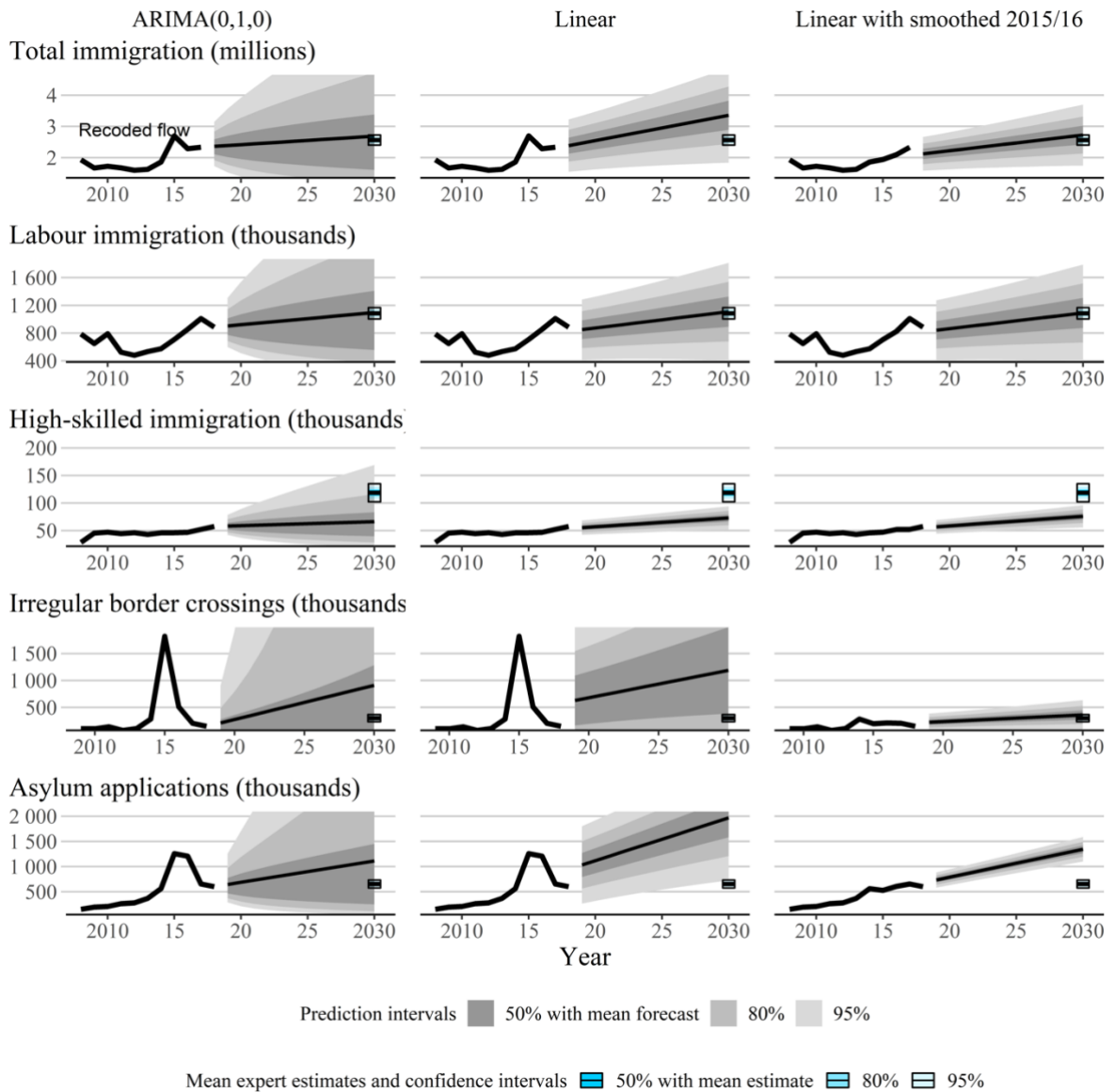
Immigration flow	Source
Total	Eurostat, “Immigration by age group, sex and country of previous residence”. Available at https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=migr_imm5prv&lang=en Data set: migr_imm5prv
Labour	Eurostat, “First permits issued for remunerated activities by reason, length of validity and citizenship”. Available at http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=migr_resocc&lang=en Data set: migr_resocc

⁶⁸ Probabilistic forecasts “specify the chances for future migrations to occur, given a set of assumptions about the underlying probability distributions” (Bijak et al., 2015).

⁶⁹ In the second linear trend model, we imputed the years 2015 and 2016 with moving averages, thereby smoothing the peaks observed for some immigration groups in these years.

High-skilled labour	Eurostat, “First permits issued for remunerated activities by reason, length of validity and citizenship”, data set (2020b). Available at http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=migr_resocc&lang=en Data set: migr_resocc (filter: highly skilled workers and researchers)
First-time asylum applications	Eurostat, “Asylum and first-time asylum applicants by citizenship, age and sex”. Available at https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=migr_asyappctza&lang=en Data set: migr_asyappctza
Irregular border crossings	Frontex, “Detections of illegal border-crossings statistics”, data set (2020). Available at https://frontex.europa.eu/along-eu-borders/migratory-map (last accessed on January 21, 2022).

Appendix 10. ARIMA and linear forecasts compared to expert estimates (mean and confidence intervals)



Note: For details on the forecast models and the 2015/16 imputation, see section 3.2 above. Calculations using the net expert sample.

Source: Own calculations based on the Delphi survey, Eurostat (2020) and Frontex (2020).

FINAL CONCLUSIONS AND FUTURE RESEARCH

This dissertation set out to explore different aspects of past and future immigration in Europe and to assess the impacts it can have on income inequality, polarization, and natives' well-being.

In particular, the dissertation aimed to contribute to better understanding the social implications of immigration, by employing a variety of novel and exploratory methods, and keeping a firmly European perspective. The three empirical chapters asked big questions: How is immigration linked to inequality? Is it contributing to a growing polarization of incomes? How do natives feel when faced with immigration? What is the future of immigration in Europe? Will we see permanently high levels of asylum seekers coming to Europe, like we have seen following the Syrian war in 2015/16?

Like pieces of a puzzle, each chapter adds a small part of evidence to those grand questions. Chapter 1 reveals once again the generally disadvantaged position of immigrants in many countries across Europe and shows how, because of their position, they tend to push up national levels of inequality. Somewhat surprisingly, this is true not only for immigrants born outside of the EU, but also remains valid for immigrants born in other EU countries. Despite years of political, economic, and social integration, natives and European migrants thus do not fare equally yet. Chapter 1 takes a compositional approach and contributes a comparative view across countries and years that is unlike most studies focusing on native displacement due to immigrant inflows.

Chapter 2 provides new evidence on the impact of immigration on natives' well-being, a broad measure of social impact. Given the extraordinary proportion of Luxembourg's immigrant population and the dependency of its economy on foreign workers, Luxembourg represents an interesting case study in that regard. The chapter finds no effect of immigration on the well-being of the native population overall. Yet, it does provide evidence of small negative effects on younger, college-educated Luxembourgers. This contrasts with previous studies and emphasizes the importance of economic and historical circumstance.

It is generally risky business to attempt to foresee the future, so Chapters 3 and 4 are breaking into new ground. This concerns both their methodological strategy, combining migration scenarios with an expert Delphi survey, and their objective, which is to provide estimates of the volume and composition of immigration inflows in Europe in 2030. Based on the current political discourse, the chapters importantly show that it is unlikely we will see sustained high levels of forced or irregular migration as we have seen in 2015/16. However, skilled and labour immigration are expected to rise.

Taken together, the dissertation chapters thus provide nuance and new detail on how Europe should think of immigration, and points toward policy avenues that it might need to explore to manage the impacts and avoid harm. Yet, each chapter naturally has its limitations and, in some cases, opens almost as many questions as it answers. As a result, several avenues for future research could be imagined:

First, Chapter 1 on the contribution of foreign-born households to income inequality and polarization raises many interesting points, especially in relation to income polarization, that deserve more attention in the future. However, within our research framework that covers several years, indicators and countries, there was naturally a tradeoff to be made concerning our ability to take into account specific country contexts. The weak effects on polarization should be further investigated, both conceptually and empirically. In addition, the analysis of cross-country variation and moderators draws attention to the role of different welfare state regimes, with promising hypotheses to test and develop. Given the lack of comparable data, it might be useful to focus on country case studies that allow for a more detailed assessment of the impact of welfare states on immigrants, and consequences thereof for their location on the income distribution.

Second, further assessment of the impact of immigration on the well-being of natives would suggest additional analysis on the role of cross-border workers in Luxembourg. This would ideally be based on their place of residence outside of Luxembourg, commuting patterns, and place of work inside Luxembourg.

Third, there is much scope to further experiment and develop forecasts of migration. While the methodology underpinning Chapter 4 is quite exploratory, it highlights once more the many challenges and open questions associated with such undertakings. It will be interesting to see in the future, sometime after 2030 when data will be available, how far our estimates stray from reality. What we already know is that neither the Covid-19 pandemic nor the war in Ukraine are reflected in our estimates, already rendering them less reliable. However, such events, known as “black swans” because they are rare and disruptive, are naturally extremely difficult to foresee and are perhaps better incorporated into modelling through uncertainty planning.

On a personal level, my future research is likely to expand its focus, covering more regions outside of Europe, and getting even closer tied to migration policy developments inside of the European Union. As of now, this already includes ongoing work in the field of asylum, readmission, reintegration, and climate-related displacement. I certainly look forward to combining all these strands and puzzle pieces of evidence, to grow and contribute to shaping future policies.