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Online Appendix I

Detailed Discussion of Projection Scenarios*

Policy-based Population Projections for the European Union: A Complementary Approach

Philip Cafaro, Patrícia Dérer

1 Introduction

When we look at the major demographic trends of the past century in Europe, three stand out. First, fertility rates have declined to below replacement rate and have remained there. Second, after growing relatively slowly for much of the century, Europe's population has leveled off and is now poised to naturally decline (a region-wide trend that masks important differences among countries). Third, over the past century, Europe has changed from a major migrant sender region to a major receiver. While most EU nations historically have not seen themselves as "immigrant nations" like the United States, today many western European countries allow in more immigrants annually as a percentage of their populations than the U.S. (Spain and the UK), have higher percentages of foreign-born residents than the U.S. (Germany and Ireland), or both (Austria and Sweden).

These three trends seem likely to continue, broadly speaking, and modeling them is an important part of our projection efforts. But while population projections always rely more or less on extrapolating from previous trends, it is important to realize the degree to which Europe is entering demographic *terra incognita* as it moves further into the 21st century. EU nations are on the cutting edge of what some demographers are calling the "second demographic transition": where fertility rates remain permanently well below replacement rate, as citizens of advanced industrialized nations become comfortable with small families (*Lesthaeghe* 2015). We do not know how such societies may evolve demographically in the future, since they are a new phenomenon in human history.

* This Online Appendix contains additional information regarding the article: DOI 10.12765/CPoS-2019-14en, URL: <http://www.comparativepopulationstudies.de/index.php/CPoS/article/view/310/284>.

Meanwhile, many EU migrant sender countries in Africa and the Middle East are entering a different sort of unknown territory: continuing rapid population increase in a world where climate change and other global ecological stressors could lead to crumbling ecosystem services and declining food production (*Guengant/May* 2011). These worrisome trends have the potential to send huge numbers of their citizens seeking better lives in the EU (*Docquier* 2018). The most recent UN population projections show many sub-Saharan nations tripling or quadrupling their populations by 2100 (*United Nations* 2017). Whether such increases will actually materialize, and if they do, how Europeans will respond to the resulting demographic pressures, are simply unknown.

Another layer of uncertainty involves who will make migration policy in the years to come: individual countries, the EU's most powerful countries, or the EU as a whole. In recent years, national governments have ceded significant control over migration policy to the European Commission, through region-wide asylum policies and border controls – only to wrench it back in some instances (*Lavenex* 2006; *Collett* 2015). We have seen Germany and Sweden assert a *de facto* claim to make migration policy for the whole EU, in 2015, by combining expansive national asylum policies with moral demands that the rest of the EU follow suit. And we have seen Hungary and the United Kingdom emphatically reject such claims: Hungary by refusing to take in any asylum seekers, the UK by voting to leave the EU, in large part over immigration policy. At this point, it seems fair to say that we do not know who will be making immigration policy for Hungary and Sweden in the future: Hungary and Sweden, their more powerful neighbors, the European Parliament, or some combination of all three.

Similar uncertainty holds regarding economic and social policies that affect fertility rates. There appears to be broad consensus among EU policy-makers and their constituents on the need to keep national fertility rates high enough to avoid steep population declines and mitigate aging (*European Commission* 2014). Nevertheless, there are wide differences within EU countries in their levels of support for family-friendly child-care and employment policies, a robust economic safety net, and other policies that significantly influence fertility rates (*Thévenon* 2011). In such a world, policy-making obviously will take place under relatively strong uncertainty. Yet this does not preclude the need to link possible policy choices to their likely demographic consequences. Our projection scenarios seek to capture a proper range of policy options, neither exaggerating nor downplaying what is politically and demographically possible.

2 Mortality

Regarding mortality rates, we assume continued improvements in medicine and health science and consequent increases in longevity over the course of the 21st century. Although such increases are not guaranteed, we think they are likely, particularly given universal, affordable health care region-wide. While medical breakthroughs or different health care spending scenarios might impact longevity, their

impacts are so speculative and uncertain that we see no reason to run alternative policy scenarios around possible mortality rates. Instead, we have followed the demographic consensus represented by the “baseline” scenario for future life expectancies in the latest Eurostat projections, incorporating them (by sex) into our projections until 2080 and then holding them constant until the end of the century. For the EU, we averaged the member states’ values for both sexes and weighted them based on population numbers. This has average EU lifespans increasing from 81.0 years today to 89.2 years by 2080.

3 Fertility scenarios

In contrast to mortality rates, national fertility rates will be affected by explicit policy choices in the coming years, in ways that can be understood and modelled. In some cases, these effects may be indirect, as when cuts to social services in the name of budget austerity lead to economic stress and declining birth rates. In other cases, policy changes may seek to affect those rates and numbers directly, as when countries pay families a bonus for having more children. In either case, policy impacts may be substantial. As noted in the main text, half a century of trial and error have taught policy-makers what works for keeping fertility rates relatively high in developed nations: first, comprehensive Nordic-style policies that make work-life balance easier for women and couples; second, strong economic safety nets generally and more egalitarian societies (*Björklund 2006; Luci-Greulich/Thévenon 2013; Reibstein 2017*).

Regarding the first factor, when societies train women to have careers outside the home, they must find ways for them to combine this with having children – or accept significantly lower fertility rates and significantly higher frustration among young couples looking to start families (*De Rose et al. 2008*). While generous funding for child-related benefits is a part of this package, other components are also important, including a society-wide commitment to gender equality (*Oláh/Bernhardt 2008; Oláh 2015*). As one researcher notes: “in general, national fertility is possibly best seen as a systemic outcome that depends more on broader attributes, such as the degree of family-friendliness of a society, and less on the presence and detailed construction of monetary benefits” (*Hoem 2008*).

Regarding the second factor, the evidence is clear from the EU and elsewhere that hard economic times and economic uncertainty drive down fertility rates (*Sobotka et al. 2011; Frejka/Gietel-Basten 2016; Matysiak et al. 2018*). Countries that fail to cushion their citizens from economic hardship, or that fail to provide viable pathways to career success for their younger citizens, tend to have lower fertility rates than countries that support their citizens’ economic security. In contrast, France and the Scandinavian nations, which combine generous economic safety nets and a comprehensive commitment to equality between the sexes with subsidies and benefits for raising children, have the highest fertility rates in the EU (*Thévenon 2011*).

In the main text, we introduce the five fertility policy scenarios listed in table 1, which we take the opportunity to describe in greater detail in this appendix:

Tab. AI-1: Projection assumptions made under different fertility scenarios

Fertility Scenario	Policy changes	Impact on fertility rates
(1) status quo economic and family support policies	Continue existing level of family support, existing economic safety net, existing levels of economic equality and equality between the sexes	Lower fertility countries: + 0.2 TFR Medium fertility countries: + 0.1 TFR Higher fertility countries: no change in TFR (2016 value)
(2) moderate egalitarian policy shift	Improve economic safety net, decrease economic inequality within society, increase policies that support family formation, commit to equality between the sexes	All three categories: status quo TFR + 0.15
(3) strong egalitarian policy shift	Greatly improve economic safety net, greatly decrease economic inequality within society, greatly increase policies that support family formation, strongly commit to equality between the sexes	All three categories: status quo TFR + 0.3
(4) moderate neo-liberal policy shift	Reduce economic safety net, accept growing economic inequality within society, decrease support for family formation, ignore inequality between the sexes	All three categories: status quo TFR - 0.15
(5) strong neo-liberal policy shift	Greatly reduce economic safety net, accept greatly increased economic inequality within society, greatly decrease support for family formation, ignore inequality between the sexes	All three categories: status quo TFR - 0.3

Source: own design

In the *status quo policy scenario*, with nations continuing their existing economic and family support policies, we hold TFR steady for higher fertility countries and phase in small fertility increases for lower and medium fertility countries. There is good evidence of such a rebound from low fertility for many EU countries, and clear evidence of the end of extra-low fertility in Eastern Europe (Goldstein *et al.* 2009; Myrskylä *et al.* 2009 2013; Lutz *et al.* 2019). TFR has increased in the past few years in most EU countries, mainly due to an end to the trend of women postponing motherhood to later in life. We thus follow the majority of demographers who expect a slight upsurge in lower fertility EU countries and a partial convergence among EU

countries' fertility rates (*Lanzigi 2010; Rees et al. 2012*). Such a convergence finds expression, for example, in Eurostat's projections and in many (but not all) projections by EU national statistical bureaus.

In the two *egalitarian policy scenarios*, *moderate* and *strong*, we visualize countries enacting policies that make it easier for couples to form and sustain families. Such policies can include financial payments or tax incentives for childbearing. More important are family leave policies that provide substantial time off to raise children, with full or close to full reimbursement for lost wages, and a guarantee that one can return to one's job; opportunities for part-time jobs for parents who want to spend more time with young children; and available, affordable, high-quality childcare for young children. These scenarios also involve countries creating or sustaining generous economic safety nets and willingly re-distributing wealth so as to sustain a relatively egalitarian economic structure. Such economic policies increase fertility rates within advanced nations, because most citizens have the economic security needed to raise children in confidence. This appears to be key in avoiding sharp downturns in fertility levels during periods of economic stagnation or recession.

Under these egalitarian scenarios, which could look different in their policy details from one country to another, we predict TFRs will rise by either 0.15 (for a relatively strong effort) or 0.3 (for an even stronger, more comprehensive and more expensive effort), compared to the status quo scenario. As noted, there is much disagreement among demographers about the effectiveness of policy in influencing fertility (*Gauthier et al. 2013; Luci-Greulich/Thévenon 2013*). But we presume Scandinavia's high fertility rates are not a function of the long winters. These scenarios represent a conservative estimate of the potential impact of family-friendly, economically-egalitarian policies on national fertility rates, at least for our lower and medium fertility countries. They may overestimate the impact further policy improvements could have in higher fertility countries like France, that have already gone a considerable way in enacting such policies. However, given the relatively large gaps between desired and achieved fertility rates among women throughout the EU, we assume continued room to increase fertility rates, even in relatively high fertility countries.

In contrast, in the two *neo-liberal policy scenarios*, *moderate* and *strong*, we imagine countries retreating from their current levels of family support or cutting their economic safety nets, or both. There is strong evidence that such cuts undermine individuals' sense of economic security and can substantially depress fertility (*Kiester 2010*). An obvious example is the huge fertility decrease in Eastern Europe in the decade after the fall of communism (*Frejka/Gietel-Basten 2016*). There is recurring pressure in the EU today to make such cuts, often in the name of budget-balancing and "economic competitiveness." In fact, some successful family-friendly policies designed to boost fertility rates in EU nations were ended or drastically cut back in the wake of the 2008 recession (*Matysiak et al. 2018*). Given recent trends of persistently high unemployment among young workers and stagnating wages generally, it is easy to imagine economic life becoming harder for EU residents of reproductive age, so that fertility rates decline.

Under the two neo-liberal scenarios, we project TFRs declining by either 0.15 or 0.3 across all countries, compared to the status quo scenario. Again, it is possible that some lower fertility countries, which already have relatively weak economic safety nets and poor commitments to gender equality, do not have as far to fall and thus are particularly unlikely to reach the very low fertility levels projected for them under the strong neo-liberal scenario. Then again, the degree to which political leaders who are both pro-natalist and pro-laissez-faire will sacrifice one goal for the other is yet another question to which demographers do not know the answer.

We believe these five scenarios accurately capture the policy choices facing EU countries as they consider ways to boost fertility rates, an explicit goal of most countries and of the EU as a whole. The strong neo-liberal scenario is less likely to be implemented in most countries than a more moderate scenario, given relatively strong commitments to a decent economic safety net and to the equal value of all citizens. Similarly, the strong egalitarian scenario is less likely to be achieved in many countries than a more moderate scenario, given its difficulty and expense, and the fact that economic egalitarianism conflicts with the interests of the wealthy and politically powerful. For these reasons, we believe our three middle fertility policy scenarios capture the range of most likely outcomes and graph them with solid lines in our projections, compared to the dashed lines for our two “outlying” scenarios (see appendix III). But the pressures for austerity and laissez-faire economics, on the one side, and for equality and human dignity on the other, are substantial. Hence these outlying scenarios remain politically possible and worthy of analysis.

Finally, a technical note. As family policies fall into the national policy sphere, our EU fertility scenarios for the EU as a whole are aggregates of the separate country level projections, summing up 28 population projections for each fertility scenario. All of these country-level fertility projections assume constant status quo net migration levels (an average of the past 20 years). In this way net migration for the EU as a whole is a summing up of country-level status quo net migration.

4 Migration scenarios

As described in the main text, we project five migration scenarios for countries that have averaged net positive migration over the past twenty years. We list those scenarios again here in table 2 and describe them in more detail below.

We build the *status quo net migration scenario* by taking the average net migration into a country for the past twenty years and projecting it out to 2100. We then build four further scenarios around the status quo scenario.

The *half status quo net migration scenario* and *2X status quo net migration scenario* capture what we take to be the more likely range of policy choices, representing significant increases or decreases in net migration levels. We phase in these changes over ten years, as migration levels can be raised or lowered relatively quickly. For our purposes, we do not distinguish between economic migrants and refugees or asylum seekers, as this is largely irrelevant to our chief purpose: projecting future population numbers. Likewise, we do not distinguish between im-

Tab. AI-2: Projection assumptions under different migration scenarios for countries with net positive migration

Scenario	Annual net migration level	Fertility rate assumptions
(1) status quo net migration	Continuation of the country's average annual net migration level for the past 20 years for rest of the century	TFR the same as under status quo fertility scenarios
(2) 2X status quo net migration	2X average annual net migration level by 2026, held stable for the rest of the century	Status quo TFR + 0.05 by 2036
(3) 4X status quo net migration	4X average annual net migration level by 2026, held stable for the rest of the century	Status quo TFR + 0.2 by 2036
(4) half status quo net migration	½ average annual net migration level by 2026, held stable for the rest of the century	Status quo TFR - 0.025 by 2036
(5) zero net migration	Zero net migration by 2026, held stable for the rest of the century	Status quo TFR - 0.05 by 2036

Source: own design

migrants originating from EU and non-EU countries, although we do assume that most of the increase under our 2X and 4X status quo migration scenarios will come from outside Europe, likely due to high migration pressure from Africa and the Middle East. Policy changes to net migration levels could be justified in very different ways. For example, humanitarian demands or economic self-interest, or a combination of both, could argue for increasing immigration. Preserving social solidarity or job opportunities for current citizens, or some combination of both, could argue for decreasing it. Again, such justifications are irrelevant to our primary focus here: the impact of different migration policies on overall numbers.

One of our most difficult questions was deciding the degree to which increasing or decreasing net migration is likely to impact national fertility rates in the future.¹ A number of national statistical bureaus have stated that increased migration boosted their national fertility rates slightly in recent decades, on the order of a 0.1 increase to national TFRs (*Kulu/González-Ferrer* 2014; *Pailhé* 2017; *Kulu et al.* 2017). But that does not mean that a doubling of immigration numbers would lead to twice as big

¹ Many thanks to Tomáš Sobotka of the Vienna Institute of Demography, for sharing slides from a talk he gave on this topic in June, 2018, titled "Migrant Fertility in Europe: Accelerated Decline During the Recession Period?"

an impact. Among other things, the impact of immigration on fertility levels strongly depends on where migrants are coming from: Somali migrants into the EU have approximately 3X as many children as Iranian migrants. Such uncertainties have led many demographers to leave out migration's effects on fertility when forecasting, but this seems misleading, given it likely has some impact. *Frejka et al.* (2008) wrote several years ago that "in recent years, immigrants' childbearing raised the TFR in Northern, Southern and Western Europe by three to seven percent, exceptionally by 10 percent" (see also *Sobotka* 2008). In our projections, we have opted to modestly raise or lower fertility rates to account for changes in the percentage of immigrants among women in their child-bearing years under different scenarios (see Tables All-4 – All-5 in appendix II).

In addition to ½ and 2X status quo migration scenarios, we project a *zero net migration scenario* and a *4X status quo net migration scenario*. The former represents a strong "shutting the door" to extra-EU migration and a substantial decrease in inter-EU migration; the latter can stand as an approximation for an "open borders" policy of unlimited immigration, which is difficult to model, but possible given high and growing migration pressure from Africa and the Middle East. Neither of these two scenarios seem as likely as our three main migration policy scenarios; hence we graph them with dashed lines in our projection charts (appendix III). However, as noted in the main text, both have substantial numbers of advocates and both have been put into practice in recent years. In 2015 and 2016, Germany and Sweden tried to accommodate all the asylum seekers who reached their borders (without questioning whether some were merely economic migrants) while Hungary and Poland slammed the door on extra-EU migration in response to the resulting influx (without asking whether some were legitimate political refugees). In the former case, government policy-makers acted as if morality and international law demanded that nations allow in unlimited numbers of refugees and asylum seekers, while in the latter case policy-makers acted as if all immigration (or at least, all immigration by non-Europeans) was a bad thing.

In both intent and effect, these actions seem to approach our more extreme migration scenarios. Note further that while the 4X status quo scenario seems very high to many analysts, net migration into Germany in 2015 was even higher than it would have been under that scenario. Furthermore, a net annual migration level based on the past *five years* average rate for Germany would be even higher than the 4X status quo net migration scenarios for many of the countries we are looking at (9 out of 28), while it would be roughly comparable to the 4X scenarios for Finland, Slovenia, the Czech Republic, Portugal and Hungary. In summary: because these scenarios appear possible and because people are advocating them, we believe they deserve to be modelled.

For countries where emigration exceeded immigration over the last two decades, we instead ran the following five scenarios (Tab. AI-3).

The goal behind these five scenarios is to capture the full range of possible migration futures for these net negative migration countries: from a continuation of substantial out-migration and population decline under status quo policies; through an end to their recent hemorrhaging of younger workers (in the zero net migration

Tab. AI-3: Projection assumptions under different migration scenarios for countries with net negative migration

Scenario	Annual net migration level	Fertility rate assumptions
(1) status quo net migration	Linear increase from average annual net migration for the past 20 years to zero by 2100	Status quo TFR
(2) zero net migration	Zero net migration by 2026, held constant for the rest of the century	Status quo TFR
(3) EU status quo net migration rate	Net migration level equal to the recent average EU net migration rate by 2026, held constant for the rest of the century	Status quo TFR + 0.05 by 2036
(4) 2X EU status quo net migration rate	Net migration level equal to 2X the recent average EU net migration rate by 2026, held constant for the rest of the century	Status quo TFR + 0.1 by 2036
(5) 4X EU status quo net migration rate	Net migration level equal to 4X the recent average EU net migration rate by 2026, held constant for the rest of the century	Status quo TFR + 0.2 by 2036

Source: own design

scenario, to which most of these countries aspire); to a more or less greater convergence with richer EU nations and their more favorable economic outlooks and more welcoming attitude toward migrants. Some of the demographers we have consulted for this study are skeptical that the more expansive scenarios are possible for these countries. But the examples of Italy and Spain, which not long ago flipped from large net negative to large net positive migration countries, in just a few decades, suggest that such rapid change is possible – particularly in the face of demographic decline or pressure from overpopulated source countries, or both. Again, our goal is to help EU citizens and policy-makers think more clearly about the full range of potential demographic paths before them.

5 Combination scenarios

Family support and migration policies can change simultaneously. This led us to graph several combination scenarios to explore potential demographic effects. Obviously, strengthening family support policies and increasing net immigration levels, together, will ratchet up future national population numbers, while weakening support for family formation and decreasing net immigration levels, together, will depress future numbers more strongly than just reducing one factor or the other.

To get a sense of how impactful such combined changes might be, for positive net migration countries and the EU as a whole, we graph a *2X status quo net migration & strong egalitarian family support policies scenario* and a *½ status quo net migration & strong neoliberal family support policies scenario*. Increasing or decreasing immigration even more is possible, with potential impacts that can be roughly estimated by consulting our more extreme immigration scenarios (zero and 4X status quo net migration). Similarly, increasing or decreasing family support policies more modestly is possible, with results that would fall within the range laid out by these high and low combination scenarios. With these two combination scenarios, we thus take ourselves to be setting the range of likely policy choices and likely demographic outcomes facing the positive net migration countries.

For most of these countries, the potential demographic outcomes encompass some, often relatively modest amount of population increase or decrease over the coming century. Such demographic impacts could be the focus of political debate and decision-making in these countries, if they were better known. Arguably, policy-makers often have a choice regarding whether to sustain future populations with more immigration or by boosting residents' fertility rates. To illustrate these aspects of current EU demographic options, our combination scenarios also graph a *½ status quo net migration & strong egalitarian family support policies scenario*, which would simultaneously decrease immigration and increase support for current residents having more children, alongside the previously-graphed *status quo net migration & status quo family support policies scenario*. Our four combination scenarios for net positive migration countries are summarized below in table 4. Note that the fertility rate assumptions combine the impacts from changes to family support policies with the impacts from changes in the number of immigrants in the general population.

We treat our eight negative net migration countries somewhat differently. As already noted, these countries have low fertility rates, little immigration and often significant numbers of younger workers emigrating. Their policy-makers are primarily concerned to avert excessive, or excessively rapid, population decline. We thus have modelled combination scenarios that show the full range of options for mitigating the population decline these countries face under a continuation of status quo population policies. These five combinations are summarized in table 5 below.

Again, increasing net migration even more is possible, as is continuing negative net migration. The demographic results of following these paths, in combination with changes to family support policies, can be roughly estimated by consulting our more extreme immigration scenarios (4X EU status quo and continued net negative

Tab. AI-4: Combination scenarios for countries with net positive migration

Scenario	Annual net migration level	Fertility rate assumptions
(1) 2X status quo net migration & strong egalitarian family support policies	2X average annual net migration level by 2026, held stable for the rest of the century	Status quo TFR + 0.35 by 2036
(2) ½ status quo net migration & strong egalitarian family support policies	½ average annual net migration level by 2026, held stable for the rest of the century	Status quo TFR + 0.275 by 2036
(3) status quo net migration & status quo family support policies	Continuation of the country's average annual net migration level for the past 20 years for rest of the century	TFR same as under status quo fertility scenario
(4) ½ status quo net migration & strong neoliberal family support policies	½ average annual net migration level by 2026, held stable for rest of the century	Status quo TFR - 0.325 by 2036

Source: own design

migration). Similarly, increasing family support policies more modestly is possible, with results that would fall within the range laid out within these combination scenarios. Together, the combination scenarios projected for positive and negative net migration countries provide a fuller sense of the demographic futures on offer and the policy options available to the countries of the European Union.

Tab. AI-5: Combination scenarios for countries with net negative migration

Combination Scenario	Annual net migration level	Fertility rate assumptions
(1) 2X EU status quo net migration & strong egalitarian family support policies	Net migration level equal to 2X the recent average EU net migration rate by 2026, held constant for the rest of the century	Status quo TFR + 0.4 by 2036
(2) EU status quo net migration & strong egalitarian family support policies	Net migration level equal to the recent average EU net migration rate by 2026, held constant for the rest of the century	Status quo TFR + 0.35 by 2036
(3) EU status quo net migration & status quo family support policies	Net migration level equal to the recent average EU net migration rate by 2026, held constant for the rest of the century	TFR the same as under status quo fertility scenario
(4) Zero net migration & strong egalitarian family support policies	Zero net migration by 2026, held constant for the rest of the century	Status quo TFR + 0.3 by 2036
(5) Zero net migration & status quo family support policies	Zero net migration by 2026, held constant for the rest of the century	TFR the same as under status quo fertility scenario

Source: own design

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