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Research Article

Back to replacement migration: A new European perspective applying the prospective-age concept

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Abstract

BACKGROUND
The UN Replacement Migration report (2000) had a significant impact in academic and civil society. Its approach consisted of estimating the migration volumes required to mitigate the effects of population decline and ageing. The volume of migrants required to prevent population decline and sustain the working-age population was not particularly high, but the vast number of migrants needed to maintain the potential support ratio was highlighted as an unrealistic goal.

OBJECTIVES
In this paper the UN exercise is revisited and updated by deploying the concept of prospective age to overcome a strict chronological definition of the working-age population. The replacement migration approach is developed from a new European perspective, the temporal series is extended for an additional decade, and alternative operative age-group definitions are compared by projecting replacement migration estimations according to both classic (conventional) and dynamic (prospective) age limits.

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CONCLUSIONS
The key conclusions of the original UN publication are reasserted. In many countries the replacement migration volumes needed to sustain the decline in total population and working-age population are of an order of magnitude similar to recent observed migration. However, even under the prospective-age approach the halt of the ageing process – expressed as the maintenance of the current potential support ratio – remains an unrealistic target.

CONTRIBUTION
We propose the deployment of the prospective-age concept to define dynamic age limits in the definition of working-age population. Because the prospective-age concept is flexible it will be possible to explore other dimensions from this perspective in the future, increasing the analytical potential of replacement migration estimations as a valuable contribution to the demographic ageing debate.

1. Introduction

The Replacement Migration report (UN 2000) received a great deal of attention from both academic and civil society (Coleman 2002; Teitelbaum 2004). Although the United Nations (UN) publication has been the object of severe criticism, it nevertheless established the concept of replacement migration in the ageing debate. The report presented estimates of the replacement migration needed to: (a) maintain the size of the total population, (b) maintain the size of the working-age population (aged 15 to 64), and (c) maintain the potential support ratio (PSR), i.e., the ratio of the working-age population (aged 15 to 64 years) to old-age population (65 years or older). An unavoidable reduction in the ratio of working-age to old-age populations emerged as one of the core future challenges for economies and their social security systems, with migration unable to prevent this progression.

This paper revisits the UN proposal almost twenty years after its original publication. In our view, because subsequent studies and discussions have focused on the goal of the potential support ratio the discussion of replacement migration has become severely skewed. The UN itself originally presented this specific scenario as unrealistic.

Through reaffirming the relevance of replacement migration to demographic ageing research, we propose incorporating the prospective-age concept into replacement migration estimations. Calculating and integrating prospective age gives a new paradigm for conceptualizing population ageing and operationalizing dynamic age limits in the definition of working-age populations.

In this study we revisit and update the UN proposal by assessing replacement migration estimations according to both conventional and prospective-age limits. We adopt a European perspective, focusing on the Western and Southern European countries considered in the original study (United Kingdom, Germany, France, and Italy), to which we add Spain. Spain is the fifth most populated country in the EU (thus one of the 'Big Five') and registered the highest immigration inflows in the European Union over the 2002–2005 period (Arango 2005). In addition, the analysed period extends until 2060.

The paper contains five subsequent sections. In the first we review the literature on replacement migration and prospective age, before presenting our research methodology in the second. In the third section we compare the observed net migration volumes and UN replacement migration estimations for 1995–2015 and present replacement migration estimations for 2015–2060 according to both conventional and prospective-age concepts. In the fourth section we readdress the replacement migration debate under this innovative perspective, and then close with our conclusions.

2. Theoretical framework

2.1 Replacement migration: Main approaches

Replacement migration can be defined as the volume of migrants needed to achieve specific demographic goals. This topic gained popularity at the beginning of the 21st century following the publication of the UN report (UN 2000). This report estimated the volume of migrants needed to offset the effect on population volumes and structures of low fertility and high life expectancy over the period 1995–2050 for eight countries (Germany, Korea, France, Italy, Japan, the United Kingdom, Russia, and the United States), as well as for Europe and the then 15-member European Union. Two of the main goals, maintaining the volume of the total and of the working-age population, appeared feasible, while one was deemed impossible: sustaining the ageing process by maintaining the potential support ratio (PSR) at 1995 levels (UN 2000).

The authors of the UN report concluded that the size of the total population could be maintained until 2050 by net migration inputs of similar magnitude to those already observed in the countries under review. The working-age population could only be maintained by significantly increasing the net migration values. However, keeping the potential support ratio constant at 1995 levels would require impossible volumes of migrants, subsequently leading this scenario to be repeatedly deemed "demographically

unrealistic".[6] The UN report did discuss several alternatives to deal with the unavoidable population ageing process, such as changes in the retirement age, increases in labour participation, and changes in the social security contributions and benefits associated with working and retired people. In the European Union (15 countries in 1995), 863,000 migrants per year would be necessary to maintain the population size until 2050, with 1,447,000 required to sustain the working-age population and 12,736,000 migrants needed to maintain the PSR (the "unrealistic" scenario) (UN 2000).

The report reached two main conclusions, which have since remained remarkably consistent across replacement migration studies. The first is that a reasonable increase in net migration can delay the implications of an ageing population, whether by ensuring stability or by slowing the decrease in total and working-age populations. The second is that increasing migration inputs will not reverse the population-ageing process. According to the UN, contemporary societies will have to face the advantages and disadvantages associated with population ageing, updating their work–life and retirement-related social policies and programmes while simultaneously reinforcing their immigrant integration policies (UN 2000). The report stated repeatedly that the replacement migration volumes necessary to maintain the PSR were unrealistic, and computed that the alternative retirement age needed to achieve this goal would in most cases be above 75 years of age.

The UN exercise, often taken as a recommendation for future population policies, led to a broad-reaching debate and was heavily criticised by several authors. The major critique pointed to the exceptionally large number of migrants required to achieve the projected targets. This argument was particularly strong in Coleman's paper, entitled "Why everyone is going to have to live in Korea" (Coleman 2002). Coleman argued that maintaining the Korean PSR at the 1995 level would require the world's entire population to live in Korea by 2050. Coleman perceived the UN report as catastrophist and linked it to his concerns over the ethnic diversification of Europe and the United States as a consequence of high immigration, low fertility, and increased emigration of resident populations (Coleman 2006). He considered that the report dismissed negative implications of high immigrant inflows regarding social conflict, social cohesion, and national identity (Coleman 2002).

Although the replacement migration concept became associated with an unreachable amount of migration, the impossible magnitude of the required migration was clearly a consequence of the UN scenario for sustaining the PSR – the "unrealistic"

[6] The UN report was particularly clear on this matter: "Readers should keep in mind that the results of scenario VI are for illustrative purposes only" (UN 2000: 3). This warning was repeatedly stated as a note to all the tables setting out the results for the different countries and regions: "Scenario VI is considered to be demographically unrealistic" (UN 2000).

UN goal. While the UN report recognized that the estimates for maintaining total population and working-age population size was relatively high, they might nevertheless be considered a temporary situation as they would be "considerably lower in the future, irrespective of migration flows" (UN 2000: 60).

The UN report also received criticism from authors alleging an overvaluation of the role of migration, while broadly ignoring the innovative capacity of societies (see Saczuk 2013 for a review). For example, some researchers disagreed with approaching population declines only from a negative perspective and also pointed out the lack of explanations in the methodological options adopted (Espenshade 2001; Coleman 2002). Espenshade (2001) also criticised the UN's almost exclusively demographic approach to the ageing process, disregarding the economic and other social science perspectives when framing the problem. Meyerson (2001) contested the lack of environmental issues in the UN report, although the demographic trends and the solutions proposed did hold implications in this regard. Saczuk (2003: 12) considered that the report, despite trying to deal with "unavoidable economic problems in the future, does not take into consideration any solutions other than demographic."

Despite such criticisms, new studies have extensively explored the concept, discussing its implications within the context of population ageing. In some cases they apply the UN methodology (e.g., Vishenevsky 2000; Hablicsek and Tóth 2002; Rosa, Seabra, and Santos 2004; Burcin, Drbohlav, and Kucera 2005; Bouvier 2001; Keely 2009; Saczuk 2013), whilst in others they enlarge and enrich the simulations of replacement migration (Bijak, Kupiszewska, and Kupiszewski 2008; Bijak et al. 2013; Johansson and Rauhut 2006; Castro, Martins, and Silva 2015; Peixoto et al. 2017).

For example, Bijak and collaborators present an extended international comparison using the UN methodology for 27 European countries (Bijak, Kupiszewska, and Kupiszewski 2008; Bijak et al. 2013). For the 2002–2052 period they compute the replacement migration necessary to prevent population decline and the maintenance of three population ratios: the classic potential support ratio (PSR), the economic elderly support ratio (EESR) (i.e., the ratio of the number of active persons to those aged 65 or over), and the labour market support ratio (LMSR) (i.e., the ratio of the active population to the inactive population). According to the authors, for all 27 European countries an annual inflow of almost 35 million migrants would be required to keep the PSR constant and about 26 million to maintain the EESR, dropping to 15 million to support the LMSR. As a result, in 2052, immigrants and their descendants would constitute around 72%, 67%, and 61% of the resident population, respectively. Thus, the migration flows required to stop population ageing or its specific economic consequences appear as unrealistic as in the original UN report.

Replacement migration studies have also progressively integrated non-demographic dimensions. For example, some research projects – ESPON (Johansson

and Rauhut 2006), DEMOSPIN (Castro, Martins, and Silva 2015), and MIGSUB (Peixoto et al. 2017) – estimate the replacement migration required to meet human resource needs according to different socioeconomic scenarios. This interrelationship between the demographic and the economic dimensions is explored (directly or indirectly) through the working-age population concept in conjunction with other variables, such as prospective economic growth and labour productivity.

The size of the working-age population is crucial to determining the extent of the demographic decline and the corresponding need for replacement migration. The working-age population encapsulates demographic (age structure), economic (active population proxy), and political (retirement age limits) meanings. The way in which this is defined becomes crucial to address the interplay between demography and other dimensions. It is precisely to overcome the inaccuracies of the static demographic definition of this concept across time that the prospective-age approach needs to be introduced into the discussion.

2.2 Prospective age: New definitions for working-age and old-age populations

Sanderson and Scherbov (2005, 2007) introduced a new concept of age: prospective age. Classic chronological age measures the number of years already lived, while prospective age is an alternative measure of time that depends on remaining life expectancy at a particular given age. Prospective age is thus derived from age-specific life expectancy. As life expectancy increases over time, this age-specific life expectancy becomes longer so that the same remaining life expectancy is reached at chronologically older ages (Sanderson and Scherbov 2005). Furthermore, the authors proposed a new definition of the old-age group as those with 15 years of remaining life expectancy, and computed new prospective old-age dependency ratios (Sanderson and Scherbov 2008). The authors chose this threshold because it was the remaining life expectancy at 65 years in the 1970s in several low-mortality countries (Sanderson and Scherbov 2015). It became the reference commonly adopted by prospective-age studies.

The prospective-age concept triggered a line of research that has resulted in important developments since 2005. It is currently being integrated into a new research paradigm, The Characteristics Approach, which strives to conceptualize population ageing beyond the chronological dimension, fostering new multidimensional measures of ageing (Sanderson and Scherbov 2013).

This paper proposes the deployment of the prospective-age concept in international replacement migration studies. However, we would stress that a similar perspective was implicit in the original UN report, which pointed to new working-age limits as a means of stabilizing the PSR until 2050. For example, in the observed

European countries the age limit needs raising to 72 in the United Kingdom, to 74 in France, and to 77 in Germany and Italy (UN 2000).

In this paper the prospective definition of old age systematically serves to define the limits of the working-age and old-age population groups in accordance with the expected life expectancies of men and women between 2015 and 2060. By allowing the progressive calibration of the concept alongside the gains in life expectancy, the prospective working-age group provides an alternative indicator of potential labour force availability in any population. It also constitutes a critical review of the evolution of support indexes across both time and space.

3. Methodology

This research has a European perspective and covers the period from 2015 to 2060. It includes all four European countries in the original UN study with the addition of Spain, in order to take into account the five largest Western and Southern European countries (Germany, United Kingdom, France, Italy, Spain). These countries comprised about 62% of the EU-28 population in 2015. They furthermore illustrate a significant variety of demographic situations, particularly as regards their migration histories, ranging from countries in which there is a long tradition of immigration to others in which the change from emigration to immigration occurred only relatively recently (e.g., Van Mol and De Valk 2016; Dumont 2015).

Replacement migration is estimated through both classic (chronological) and dynamic (prospective) definitions of working-age and old-age populations. There are three main methodological steps: (1) demographic projections for the five countries in a zero-migration scenario, based on recent Eurostat assumptions of fertility and mortality; (2) computation of the prospective working-age thresholds, also according to Eurostat assumptions of mortality; and (3) replacement migration estimations, according to both classic and prospective limits.

Baseline data for demographic projections comes from official population data from the five countries under study, collected by Eurostat (Eurostat 2014). To generate demographic projections between 2015 and 2060 we pair this baseline data with Eurostat central scenario assumptions for future age-specific fertility rates and age-specific mortality rates for men and women, for each country, according to the cohort component method. We present a summary of these assumptions in Table 1. Based on these premises, we then define the prospective-age limit for the working-age population of men and women in each country (age with 15 years of remaining life expectancy), with working age being defined as between 20 and the age limit at which remaining life expectancy is 15 years.

Table 1: Assumptions of fertility, life expectancy at birth, and prospective-age limits, by country (2015–2060)

			Life expectancy				Age with 15 years of remaining life expectancy			
	Fertility rate		Male		Female		Male		Female	
	2015	2060	2015	2060	2015	2060	2015	2060	2015	2060
Germany	1.49	1.64	78.0	84.9	83.0	89.0	68.7	74.0	72.3	76.9
Spain	1.33	1.88	79.7	85.9	85.3	90.3	70.0	74.8	74.0	77.9
France	1.96	1.99	78.7	85.5	85.0	90.3	70.4	74.9	74.6	78.1
Italy	1.34	1.60	79.9	85.9	84.6	90.0	69.7	74.4	73.4	77.6
United Kingdom	1.80	1.86	78.9	85.4	82.7	89.0	69.4	74.4	72.3	77.1

Source: Eurostat and own calculations.

In this study, replacement migration estimations were computed annually in order to maintain: (a) the total population size, (b) the working-age population size, and (c) the potential support ratio. These figures were then estimated according to the classic and prospective definitions of the working-age population: the working-age population defined as 20–64 years[7] (a slight adaptation of the original UN definition, 15–64, adopted for comparison), versus the working age population defined as the interval between 20 years and the age limit at which remaining life expectancy is 15 years. In our exercise we accept negative volumes of replacement migration when required to maintain the established demographic goal (the UN exercise did not consider negative net migration, as the minimum replacement migration level was zero). We also incorporated a set of assumptions concerning the age and sex structure of the migrant population: We adopted the same age structure as that used in the UN exercise (considering both sexes) and considered the migrant flow sex-balanced (50% of each sex). The fertility and mortality rates attributed to migrants are equal to those of the resident population.

Despite the methodological care used in this exercise, a couple of caveats must be taken into consideration. First, we used available data from EUROSTAT and the UN that is of debatable quality, and adopted a set of assumptions regarding future mortality and fertility rates: hypotheses that, inevitably, will drift away from reality. Second, the specificities of migration type (economic migrants, family migration, refugee flows, student migration, etc.) and the complex integration process of migrants in destination societies (such as the dynamic of migrants' fertility and mortality patterns) were not included in the model. Though these are relevant issues, they add unnecessary complexity and clearly exceed the scope of our analysis: this exercise aims only to estimate the order of magnitude of replacement migration.

[7] The prospective working-age definition used by Sanderson and Scherbov (2008).

4. Results

Before presenting the results returned from this analysis, the real net migration volumes for 1995–2015 are compared with the replacement migration estimations from the original UN study for the same period. This is followed by an assessment of the classic and the prospective estimations of the replacement migration necessary to maintain the working-age population size and the potential support ratio between 2015 and 2060 in the five countries under analysis.

4.1 Observed net migration volumes and UN replacement migration estimations (1995–2015)

In the original UN report the projections covered the period 1995–2050, showing figures for net migration by quinquennium. We can now compare the actual observed net migration and the UN estimates for the four EU countries included in the 2000 report for the two decades between 1995 and 2015 (see Table 2).

Table 2: Observed net migration and UN estimates for replacement migration to keep constant the total population, working age population, and potential support ratio, by country, 1995–2015, in thousands

Country	Observed net migration Eurostat (1996–2015)	UN replacement migration estimates (1995–2015)		
		Constant total population	Constant working-age population	Constant potential support ratio
United Kingdom	4,231	0	940	10,825
Germany	4,620	4,495	6,105	36,670
France	1,874*	0	895	16,640
Italy	4,538	3,155	4,945	23,910

Note: *Missing data in the years 1996 and 1997.
Source: UN (2000) and Eurostat (net migration plus statistical adjustment).

According to Eurostat, the total volume of cumulative net migration between 1995 and 2015 in the United Kingdom, Germany, and Italy was about 4.5 million in each. France, however, returned the significantly lower number of circa 1.9 million.

The required replacement migration for the basic demographic goal of sustaining total population size was always overtaken by the magnitude of incoming migration flows. Actual migration greatly exceeded the number required to keep the working-age population stable in the United Kingdom (more than 4 million vs. less than 1 million required) and in France (1.8 million vs. less than 1 million). In Italy, net migration was almost equal to the required number (4.5 million vs. 4.9 million). However, in Germany

the actual net migration figures between 1995 and 2015 fell below the UN estimation (4.6 vs. 6.1 million). Nevertheless, observed net migration accounted for about 76% of the volume required to keep the working-age population constant.

Nonetheless, in all these countries observed net migration was much lower than the estimated volume required to keep the potential support ratio constant. This is hardly surprising, as this goal was always deemed unattainable, even by the original UN publication (UN 2000).

4.2 Updating replacement migration estimations (2015–2060): Classic and prospective approaches

Although the comparison between reality and the UN estimates for the 1995–2015 period supports the importance of replacement migration in the four European countries, our approach assesses how replacement migration responds to new definitions of working age based on the prospective-age concept.

The next paragraphs compare the volumes of replacement migration incorporating dynamic age groups based on the prospective-age concept (with the working age defined as between 20 years and the age limit at which the remaining life expectancy is 15 years) with a static definition for this age group. Table 3 presents the average annual net migration in 1995–2015 and the annual net replacement migration estimates while keeping constant the total population and the working age population between 2015 and 2060, applying both static and prospective definitions.

The annual net migration needed to maintain the total population size between 2015 and 2060 exceeds the real annual average values observed between 1995 and 2015 in two countries: Germany (302,000 net migrants needed, compared with the 231,000 recorded in recent decades) and Italy (249,000 net migrants per year needed, compared to the 227,000 arriving annually in the recent past). The average figures for the two last decades are close to 77% and 91% of the estimates for the replacement migration required to keep the population total constant in these two countries, respectively.

In the remaining countries the replacement migration estimates are clearly lower than the observed volume of net migration. In the United Kingdom the total of migrants needed to maintain the population size constant is only about 2.4% of that observed in recent decades (5,000 vs. 212,000). In Spain the estimated replacement migratory volumes are also much lower than recently observed trends, standing at around 29% of the former (79,000 vs. 273,000).

Table 3: Observed average annual net migration and replacement migration estimates for keeping the total population and the working age population constant (classic and prospective limits) in 2015–2060, by country, in thousands

			Replacement migration (2015–2060)					
	Observed annual net migration (1996–2015)		Constant total population		Constant static working-age population		Constant prospective working-age population	
Country	Sum	Annual average	Sum	Annual average	Sum	Annual average	Sum	Annual average
United Kingdom	4,231	212	225	5	6,890	150	1,705	37
Germany	4,620	231	13,898	302	23,547	512	15,546	338
France	1,874*	104	–2,047	–44	2,413	52	–798	–17
Italy	4,538	227	11,453	249	18,025	392	14,272	310
Spain	5,457	273	3,615	79	10,487	228	8,181	178

Note: *Missing data in the years 1996 and 1997.
Source: Average annual net migration 1996–2015: Eurostat (net migration plus statistical adjustment); Replacement migration 2015–2060: own calculations.

The French case stands out: This is the only country under study in which to keep the total stable between 2015 and 2060 there needs to be outflow from the projected residents. This French demographic specificity is related to immigration from the late 1950s to the 1970s, which reinforced the relative weight of fertile ages (Aubry et al. 2005). Additionally, and more importantly, they seem to reflect public population policies that have been implemented in this country at least since the Second World War (Rosental 2011). In France, maintaining a pro-natalist policy has ensured the continuation of a young age structure, at least within the European context, as well as a considerable demographic dynamic (Aubry et al. 2005).

Estimates of the working-age population vary according to the static and prospective-age limits applied (Table 3). As would be expected, when using the conventional perspective (working age: 20–64 years old) the migration volume needed to maintain the working-age population stable is larger than that needed to maintain the total population size. Again, in Germany and Italy the replacement migration volumes estimated for 2015–2060 clearly exceed the observed annual averages in 1995–2015 (512,000 vs. 231,000 and 392,000 vs. 227,000 respectively). In the United Kingdom, France, and Spain the estimates of the required net migration flows are significantly lower than the observed net migration during the 1996 to 2015 period: in the United Kingdom the required net migration flow is about 71% of the observed net migration (150,000 vs. 212,000), in Spain it is roughly 84% (228,000 vs. 272,000), and in France it is 50% (52,000 vs. 104,000).

The introduction of the concept of prospective age provides dynamic definitions of the age groups. If the operational definition of the elderly is set at 15 years of remaining life expectancy, then the working-age group increases and the elderly group decreases.

Therefore, the volume of replacement migration needed to keep the prospective working-age group (as well as the prospective potential support ratio) constant is smaller than the estimates returned by the classic age limits. In other words, as the extent of the working-age population increases, and people continue their presence in the labour market further into the life cycle, meeting the shortfall requires fewer replacement migrants.

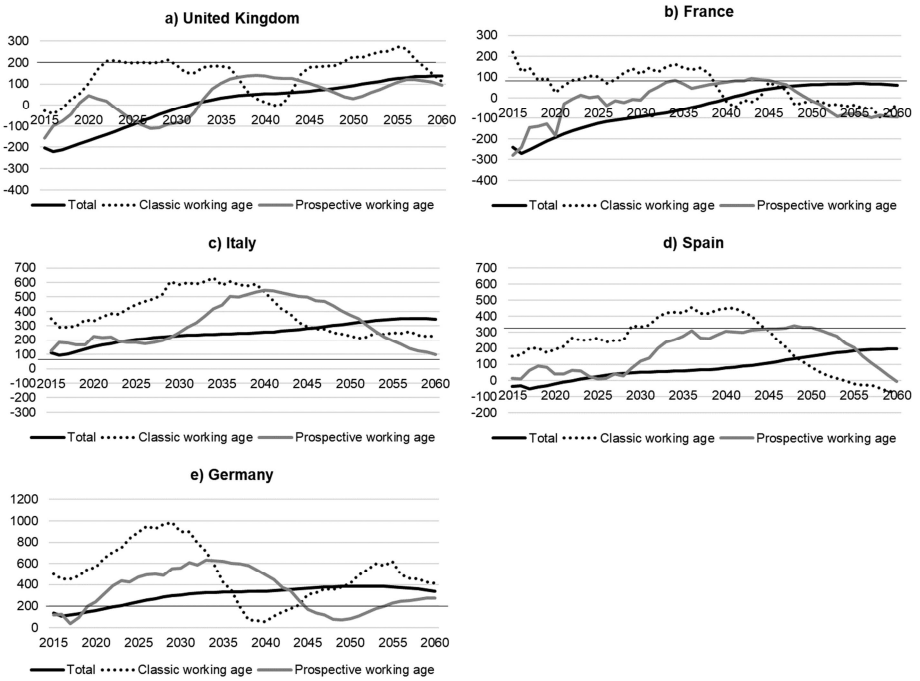
According to our calculations, in France no additional migrants would be needed to sustain the prospective working-age population size and total population size. In the United Kingdom the replacement migration needed to maintain the prospective working-age level would be about 37,000 per year (about one-quarter of the 150,000 resulting from the traditional definition). In all the other countries there are significant differences, even if not so large: 338,000 vs. 512,000 in Germany (that is, two-thirds) and almost 80% in Italy and Spain (310,000 vs. 392,000 and 178,000 vs. 228,000 respectively). In comparison to the actual flows registered in 1995–2015, the magnitude of the estimated prospective-age replacement migration is significantly lower than the migration actually observed in France, the United Kingdom, and Spain, but remains around 40% higher in Germany and Italy.

The global volume of replacement net migration for the 2015–2060 period conceals considerable annual variation (Figure 1). Previous replacement migration exercises have shown this kind of pattern when reporting both the mid- and long-term effects derived from the current 2015 age structures and replacement migration cycles.

Replacement migration cycles interlink with the indirect medium-term effects of migration flows. As replacement migrants become included in the resident population the age structure changes, gradually becoming younger. The migrant input represents an important contribution to births and growth in the young population; subsequently, these young people reach working (and fertile) age, thereby reducing the required replacement migration total. However, in the long run the migrant population also ages, increasing the need for new migrant inputs to compensate for their transition from the working-age population to the old-age population.

When considering the migration evolution needed to ensure a constant working-age population in accordance with the static definition, downward movements are clearly visible in the United Kingdom during the mid-2030s, in Germany during the whole of the 2030s, in Italy during the 2040s, and in Spain after 2040. When applying prospective-age groups the shape of the cycle remains roughly the same but smoother and postponed in time, as would be expected. In the United Kingdom, however, the required prospective-age migration volume is rather low and has correspondingly shorter replacement migration cycles. France demonstrates a more peculiar evolution in the annual replacement migration estimation, as reported above.

Figure 1: Annual net migration needed to keep constant total population, classic working-age population, and prospective working-age population between 2015 and 2060, by country (in thousands)



Note: Estimated replacement migration to keep constant total population, classic working-age population, and prospective working-age population between 2015 and 2060. The horizontal line denotes the average net migration values for the 1995–2015 period for each country.
Source: Own calculations.

Finally, despite the many previous arguments about the unrealistic goal of keeping the potential support ratio constant, we have also computed replacement migration to achieve this target, simply in order to confirm that, even with the prospective-age concept, this still remains an unattainable goal.

Table 4 presents the observed average annual net migration in 1996–2015 and the annual net replacement migration estimates for keeping the PSR constant, considering both the classic ratio and that deploying prospective age. As expected, the migration inputs required to keep the ratio between working-age and old-age populations constant still result in "demographically unrealistic" scenarios (UN 2000). Even if the prospective-age concept significantly decreases the required migration volumes (by

around 45%–60% in four cases and by 82% in Germany), the amount of net migration undoubtedly remains beyond the scope of the magnitude that actual migration achieved, even for the French case. Migration cannot be approached as a unique solution to ageing demographics.

Table 4: Observed average annual net migration and replacement migration estimates to keep the PSR constant (static and prospective-age limits), 2015–2060, by country (in thousands)

Country	Observed net migration (1996–2015)		Replacement migration estimates (2015–2060)			
			Constant PSR		Constant prospective PSR	
	Sum	Annual average	Sum	Annual average	Sum	Annual average
United Kingdom	4,231	212	98,691	2,145	39,306	854
Germany	4,620	231	111,899	2,433	15,546	345
France	1,874*	104	83,310	1,811	36,175	786
Italy	4,538	227	78,544	1,707	39,821	866
Spain	5,457	273	92,479	2,010	50,521	1,098

Note: *Missing data in the years 1996 and 1997.
Source: Average annual net migration 1996–2015: Eurostat (net migration plus statistical adjustment); Replacement migration 2015–2060: own calculations.

5. Discussion: The replacement migration debate twenty years on

The key idea of the original UN (2000) exercise was to undertake an assessment of the net migration volumes needed to achieve specific demographic goals, namely to sustain against decline and ageing in post-transitional populations. This was a geographically localized solution, as it is impossible to discuss the replacement migration concept for the planet. However, it did envision generalization, as the ageing process is spreading globally, driven by decreases in fertility and increases in life expectancy.

The main critique of the concept was the exceptional number of migrants required to achieve the projected targets, particularly to maintain the potential support ratio, as well as the neglect of other alternative solutions. However, in our opinion this criticism must now be framed in a more cautious manner. In fact, in the UN report, as also demonstrated in this paper, the volume of migration required in most countries to level the total population size was of the same order of magnitude as actual net migration in recent years. The amount of migration required to maintain the working-age population – a proxy for the labour force – was higher, but nevertheless still within the scope of recent migration levels for many countries.

The integration of migration inputs of this magnitude leads to overall positive contributions, even if limited, to the economy, fiscal systems, and old age pension

systems (e.g., Gil Alonso 2009), which partially offset concerns about implications regarding social tensions and ethnic conflict. However, the recent increase in xenophobia and anti-immigration and nationalist political discourses in Europe (e.g., Semyonov, Raijman, and Gorodzeisky 2006; Rustenbach 2010; Eatwell and Goodwin 2018), and the perceived connection between terrorism and migrant communities (e.g., Fekete 2004), which tends to ignore the social roots of such problems, point to crucial challenges that need addressing by social mobility and other policies.

However, in addition to contributing to the debate about the social impact and challenges of estimated immigration volumes, this paper aims to discuss the implications of the integration of the prospective-age concept (Sanderson and Scherbov 2005) in the rationale of replacement migration, thereby deriving further insight from the UN conclusions. On the one hand, the notion of prospective age emphasizes the postponement of old age, while on the other hand it suggests new contours to demographic ageing, reflected in the indicators and needs of population replacement. This dynamic approach presupposes a fluid view of life cycles and life events, as other authors have also proposed (e.g., Blanchet and Toutlemonde 2008, 2011).

In this paper, as in previous replacement migration exercises, we report noteworthy variability in the temporal series. In our estimates, these fluctuations – especially in the replacement migration cycles – are discussed as an intrinsic feature of population dynamics. Besides the annual random fluctuations, cycles are a significant factor in demographic processes that result from the interactions between cohort and life cycle events. Finding cycles in replacement migration estimations is not surprising. In a simulation exercise in which the adjustment process to demographic goals begins at the same exact moment for all countries, independent of their respective specific contexts, replacement migration cycles are expected. Outside the simulations, migration react to a much more complex set of factors than the precise targets in demographic simulations. Furthermore, migration is extremely volatile – much more so than births and deaths (e.g., Van Mol and De Valk 2016; Avdeev et al. 2011).

The exercise carried out, taking five major European countries as its empirical focus for the 2015–2060 period, points to the same general conclusions as the original UN report, even when using the prospective-age concept to derive dynamic definitions of key age groups. The migration volumes needed to sustain the total population size and the working-age population size are similar and sometimes lower than those occurring in the recent past. Even when not totally reached they are reached to a large extent, using either static or prospective-age definitions.

Notwithstanding this general conclusion regarding total and working-age populations, the differences between countries are interesting. The United Kingdom's demographic sustainability appears to be easily ensured by the actual average migration input when considering prospective-age estimates, suggesting that ageing pressures in

the economy and social security can be attenuated by gradually widening the working population age limits and accepting moderate levels of net migration. France stands out as a very peculiar case, where the long-term pro-natalist policy commitment appears to be contributing to a fertility rate high enough to ensure generational replacement in a context of increased longevity and relatively low average migration inputs (1995–2015) (e.g., Aubry et al. 2005). Spain also appears capable of a smooth evolution, given the high volumes of its recent migration inputs. On the other hand, Germany and Italy report the widest differences between replacement migration projections and observed average migration volumes and appear to require higher migration in the future than in the past.

This analysis is supported by the comparison of the replacement migration simulations with EUROSTAT net migration data for 1996–2015. The accuracy of these annual data series is limited: the figures are built on population census data that is adjusted by population estimations driven by sample-based surveys in the inter-census periods. The method is particularly flawed concerning emigrant flows, but also excludes immigrants that are not in a regular situation, people that arrive and leave in the inter-census period, and people that are not present in the country during the data collection. Good practice in the production and use of migration data advises combining several data sources, such as censuses, sample-based surveys, and administrative data, to devise more accurate estimates (Global Migration Group 2017). In sum, the reported historical experience of migration across countries may eventually be over- or underestimated.

Future research should account for these limitations and explore the quantitative and qualitative differences between these and other countries in order to discuss the implications of population policy regarding both explaining and coping with different rhythms in the progression of population ageing and in migration trends. For example, regions such as North America, Central and Eastern Europe, and even Japan, will provide rich and complementary demographic specificities.

Our review also reinstates the conclusion that the potential support ratio cannot be realistically guaranteed by migration. This remains valid when considering the prospective estimates for all cases considered, even France. In other words, the apparently unavoidable reduction in the potential support ratio and the consequent pressure on economic, social, and health systems cannot be met by strictly migration-related measures. The final remarks of the UN original report in this respect remain accurate: According to the UN, there are five possible responses to this challenge, which we deem still valid: adjustments in retirement ages, changes in retirement and health systems, increased labour participation, changes in contributions made by workers and employers to retirement and health systems, and programmes to integrate migrants (UN 2000: 5).

6. Final remarks

This paper revisits and updates the UN exercise on replacement migration (UN 2000), extending the temporal series for one additional decade to cover the period 2015–2060 and integrating new operative age group definitions, using the concept of prospective age. We restricted the geographical scope to Europe, although with a slight modification: To gain a wider perspective we included Spain in order to incorporate the five largest EU countries and a more diverse set of migration experiences into the analysis.

Following this review we can reassert the key conclusions of the original UN publication. Replacement migration plays a positive role in the consequences of demographic ageing, moderating total population and working-age population declines. The volume of net migrants needed to offset these consequences are realistic in that they are of an order of magnitude similar to the recently observed migration patterns of many countries. However, halting the ageing process, expressed in terms of maintaining the current potential support ratio, remains an unrealistic target, given the sheer volumes of migrants needed to attain this.

This study introduces some important innovations to the replacement migration debate. The concept of prospective age is used to determine dynamic age limits when defining the working-age population, an operative group key to accounting for the interplay between the demographic, economic, and social spheres. This innovation greatly moderates the migration inputs needed to ensure constant working-age population sizes and even the potential support ratios, demonstrating how accounting for gradual changes may calibrate the expected consequences of the ageing process.

Due to its flexibility, in the future the prospective-age concept could be used to explore other dimensions. For example, operative age groups could be calibrated in keeping with years of healthy life expectancy, or accounting for smoother transitions from working life to retirement alongside decreases in working hours associated with technological innovation, as hypothesised by Keynes in the 1920s (Keynes 1932). All in all, this concept enlarges the analytical potential of replacement migration estimation and is a valuable contribution to the demographic ageing debate.

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