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Robert Schuman Centre for Advanced Studies  
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Ageing of skills and complementary immigration in the  
EU, 2010-2025

Philippe Fargues and Ashley McCormick



European University Institute  
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## **Abstract**

This paper measures both population ageing and shrinking within the working age populations of all 27 European Union countries between 2010 and 2025, in the absence of any further migration. In this 'no migration scenario' it provides the levels of net migration that should be necessary to maintain the size of the young working age population (aged 15-44 years of age). This paper does not give analytic focus to wider non-demographic processes that can either offset or amplify the ageing of skills. For example, neither the introduction of life-long learning programmes nor the postponements to the legal age of retirement are factored into the model. Results highlight that without migrants shows the employed population aged below 45 in all EU member states will have significant levels of shortfall in maintaining the size of the 2010 labour force.

## **Keywords**

Labour Force, ageing, skills, migration.





## I. Population ageing, skills ageing and migration

Populations with below-replacement fertility and increased longevity are subjected to a process of shrinking and ageing. Shrinking refers to the declining size of the total population. Ageing can be defined in general terms as the “transformation of the age structure to relatively greater proportions in the older age groups” (UN 2001, p7).<sup>1</sup> It is usually measured as an increase in the old-age dependency ratio, which is defined as the ratio of the age group 65 years and over, divided by the age group of 15-64 years of age. Population ageing is recognised as a challenge to production and welfare systems when the population at working age decreases whilst population at retirement ages increase.

There is, however, another and apparently overlooked aspect of ageing which is taking place within the working age population: there is a gradual shift from a younger to older manpower. As a result of this shift, there has been an elevation of the average duration of time elapsed since the termination of formal education, with this process translating into an increased prevalence of outdated knowledge among the working age population. We call this process the ‘ageing of skills’.

For populations subjected to shrinking and ageing, immigration in the short and mid-term is the only way to offset negative demographic trends and replace missing natives. The notion of ‘replacement migration’ was popularised in a much debated study published in 2001 by the United Nations, which addressed the following question: what level of international migration “would be needed to offset declines in the size of a population, and declines in the population of working age, as well as to offset the overall ageing of a population[?]” (p.7). The main problem with the UN study was its methodology based on the assumption that “after the immigrants arrive in a country, they experience the average fertility and mortality conditions of that country” (p.16). By submitting the immigrant population to the same demographic patterns as the receiving population, one will automatically produce the same demographic trends characterised by shrinking and ageing. If the objective is to prevent the ‘potential support ratio’ (PSR defined as “the ratio of the size of the population aged 15-64 to the size of the population aged 65 or over”) from declining below a given value considered to be critical (3.0), then a spiralling process is triggered. More and more migrants are called to offset demographic shrinking and ageing among the receiving population. Supplementary migrants will soon be needed in order to offset shrinking and ageing among migrants of former waves.

One of the conclusions drawn by most scholars was that immigration cannot be a “solution” to ageing. Ageing is not a problem that would have a solution; instead it is a predicament to which there is no choice but to adapt<sup>2</sup>. Moreover, many scholars also argued that migration is only one among several possible responses such as: upwardly shifting the limit between supporting (active) and supported (retired) age groups (65 years of age in the UN model); increasing economic participation in working ages; increasing labour productivity; etc.

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<sup>1</sup> United Nations Population Division, *Replacement Migration: Is It a Solution to Declining and Ageing Populations?* (United Nations, 2001, ST/ESA/SER.A/206)

<sup>2</sup> MacKellar Landis F. 2000, *The Predicament of Population Aging: A Review Essay*, *Population and Development Review*, Vol. 26, No. 2 (Jun., 2000), pp. 365-397. Meyerson, Frederick A.B. 2001, *Replacement Migration: A Questionable Tactic for Delaying the Inevitable Effects of Fertility*, *Population and Environment*, Vol. 22, No. 4 (Mar., 2001), pp. 401-409. Bermingham, John R. 2001, *Immigration: Not a Solution to Problems of Population Decline and Aging*, *Population and Environment*, Vol. 22, No. 4 (Mar., 2001), pp. 355-363. Alonso, Fernando Gil 2007, *Can the rising pension burden in Europe be mitigated by immigration? Modelling the effects of selected demographic and socioeconomic factors on ageing in the European Union, 2008-2050*, *Vienna Yearbook of Population Research* 2009, pp. 123-147. Bijak Jakub, Dorota Kupiszewska, Marek Kupiszewski, Katarzyna Saczuk, Anna Kicinger 2007, *Population and Labour Force Projections for 27 European Countries, 2002-2052*, *European Journal of Population*, Vol. 23, No.1 (Mar.2007).

The failure of the UN study to prove that migration could offset population ageing does not mean, however, that the notion of replacement migration, or amore fined tune conception of migration, must be abandoned. There are several aspects of demographic shrinking and ageing that immigration can contribute to curb, according to which type of migration is considered: permanent or temporary.

Permanent migration tends to add to two demographic processes. First, to the working age population; because most migrants are within economic activity ages at the time of migration. Second, migrants add to overall demographic reproduction. Either because they migrate with their family or begin a family in the host country. But the population that permanent migration adds to is also subject to ageing. Hence there is a widely shared view that permanent migration can delay, but not sustainably curb, the decline of the potential support ratio.

Temporary migration brings workers who will leave before, or at the end of, their working life. The size of the working age population increases whilst in the non-working ages there is little or no impact on overall demographic reproduction. In arithmetic terms, temporary migration can be adjusted in order to fill losses from population shrinking in working ages, without generating any further ageing.

This paper measures ageing and population shrinking within the working age population that would occur in the European Union (EU27) and its member states between 2010 and 2025, in the absence of any further migration (a no migration scenario - no immigration and no emigration). This will be phrased as the 'no migration scenario'. It then measures what migration should be necessary in order to reach the objective of maintaining the size of the young working age population (aged 15-44 years of age). This paper does not give analytic focus to non-demographic processes that can either offset or amplify the ageing of skills. Examples of the former include: the replacement of updated knowledge with professional experience or life-long learning programmes. For the latter, postponements of the legal age at retirement can exacerbate the ageing of skills, whilst it can be a response to a rising old-age dependency.

## **II. Methodology to assess the magnitude of the problem**

How will the employed population change between 2010 and 2025 in terms of size and distribution by age and occupation in the no-migration scenario? The methodology used to answer this question is described below. It must be noted that we must focus only on the employed population (the economically active population minus the proportion that are unemployed) since the unemployed are not distributed by occupation.

### ***2.1 General approach***

The projected distribution of the employed population by age and occupation depends upon three factors:

- (a) Projected distribution of the population by age (Demography);
- (b) Future age-specific rates of economic activity (employment);
- (c) Future distribution of the employed population by occupation and age (occupation).

In order to isolate the impact of demography, a simplified approach consists in: (1) keeping the age-specific rates of economic activity constant overtime. (2) Maintaining the distribution of the employed population by occupation to 2010 levels within any given group of generations (birth cohort). By doing so, we do not take into account three important factors of adjustment over time: (a) variations in economic participation; (b) changes in the occupational distribution at the entry into employment; (c) inter-occupation mobility.

## 2.2 Data

(a) Population distribution by age (absolute numbers) with no migrants was provided by EUROSTAT population projections:

$P(x,2010)$  (observed number)

$P(x,2015)$ ;  $P(x,2020)$  and  $P(x,2025)$  (projected number)

(b) Rates of economic activity:

In 2010  $w(x,2010)$  provided by the European Labour Force Survey. For subsequent years rates are assumed to remain constant at any given age  $x$ :

$$w(x,2010) = w(x,2015) = w(x,2020) = w(x,2025)$$

Active population distribution by age (absolute numbers)

$$W(x,t) = P(x,t) \cdot w(x,2010) \text{ for any year } t \text{ from 2010 until 2025}$$

(c) Distribution of the employed population by occupation

In 2010, provided by the LFS, in relative terms at age  $x$ :  $p(x,O,2010)$

$$\sum_o p(x, o, 2010) = 1$$

For subsequent years - 2015, 2020 and 2025 - the proportional distribution of the employed population has been estimated as follows:

For cohorts aged 25 and above in 2010, the distribution is assumed to remain unchanged by cohort. The absolute number of employed persons in occupation  $O$  at age  $x$  in years 2015, 2020 and 2025 at age  $x$  ( $x \geq 25$ )

$$O(x+5,2015) = W(x+5,2015) \cdot p(x,O,2010)$$

$$O(x+10,2020) = W(x+10,2020) \cdot p(x,O,2010)$$

$$O(x+15,2025) = W(x+15,2025) \cdot p(x,O,2010)$$

For cohorts aged below 25 in 2010 (i.e. below 30 in 2015, below 35 in 2020, and below 40 in 2025), thze distribution is forecast from the above (in a function of Excel – below):

$$\text{FORECAST} = a + b\bar{x}$$

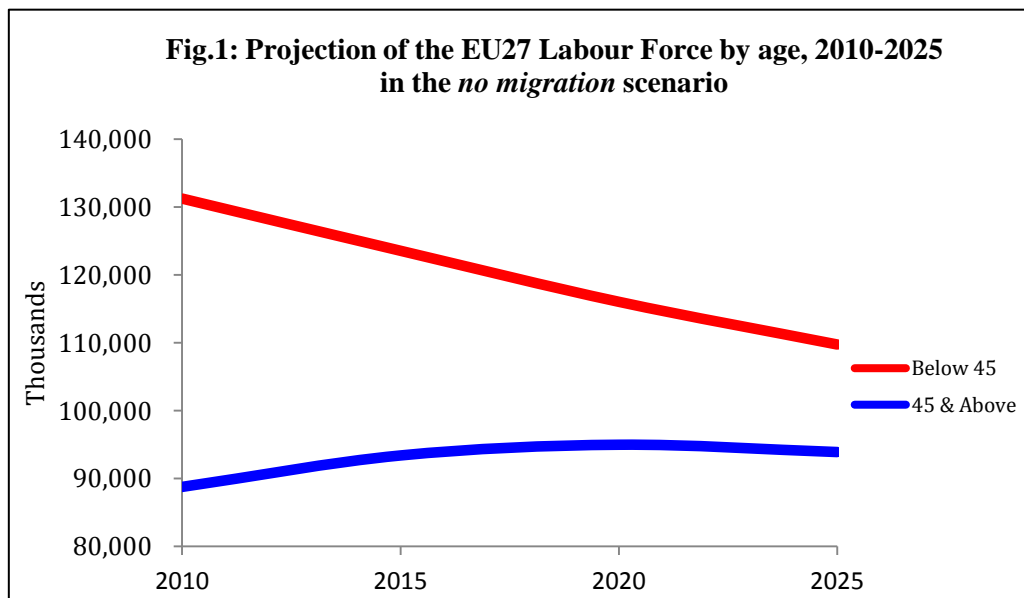
$$a = \bar{y} - b\bar{x}$$

$$b = \frac{\sum(x - \bar{x})(y - \bar{y})}{\sum(x - \bar{x})^2}$$

Whereby  $x$  (age groups: 15-19,20-24, etc) and  $y$  (proportional values).

### III. Findings

The overall finding of the EU wide-projection (an aggregation of country-level projections of each member state) for all occupations in figure 1, highlights that between 2010 and 2025 the total labour force will decrease from 220,016,308 to 203,655,867 i.e. lose 7.44% of its initial value (in 2010). It is important to note that this will eventuate only **if: (a) the rate of economic participation remains unchanged and (b) the EU neither receives nor sends any further migration after 2010**. These simplifications are made with all subsequent results. The population aged over 45 years of age remains fairly consistent with an increase of less than 6% in a 15 year period. Conversely, in the same time period, the population aged below 45 will decrease by over 16%. The absolute figures are highlighted within table 1. These findings highlight that the ageing of skills is a continual and on-going process for EU27 countries, which will be given further analytic focus in this paper.



Source: own calculation based on Eurostat population projections with no migration ([http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=proj\\_10c2150zmp&lang=en](http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=proj_10c2150zmp&lang=en))

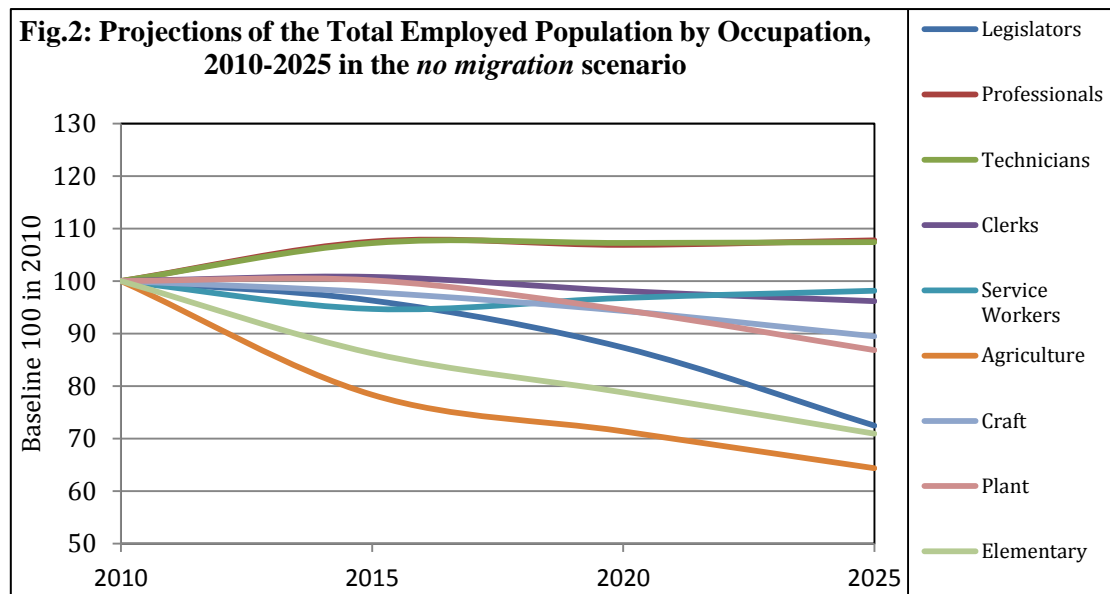
**Table 1 - Total Projections of the EU27 Labour Force by age, 2010-2025 in the no migration scenario (thousands)**

Age Group	2010	2015	2020	2025
Below 45	131,245	123,559	116,039	109,751
45 & Above	88,771	93,399	94,980	93,905
<b>Total</b>	<b>220,016</b>	<b>216,959</b>	<b>211,019</b>	<b>203,656</b>

Source: *ibid.*

If active populations are disaggregated by occupation (1-digit ISCO code) then projections for all ages of the total EU labour force (figure 2) indicates that only technicians and professionals will see a rise

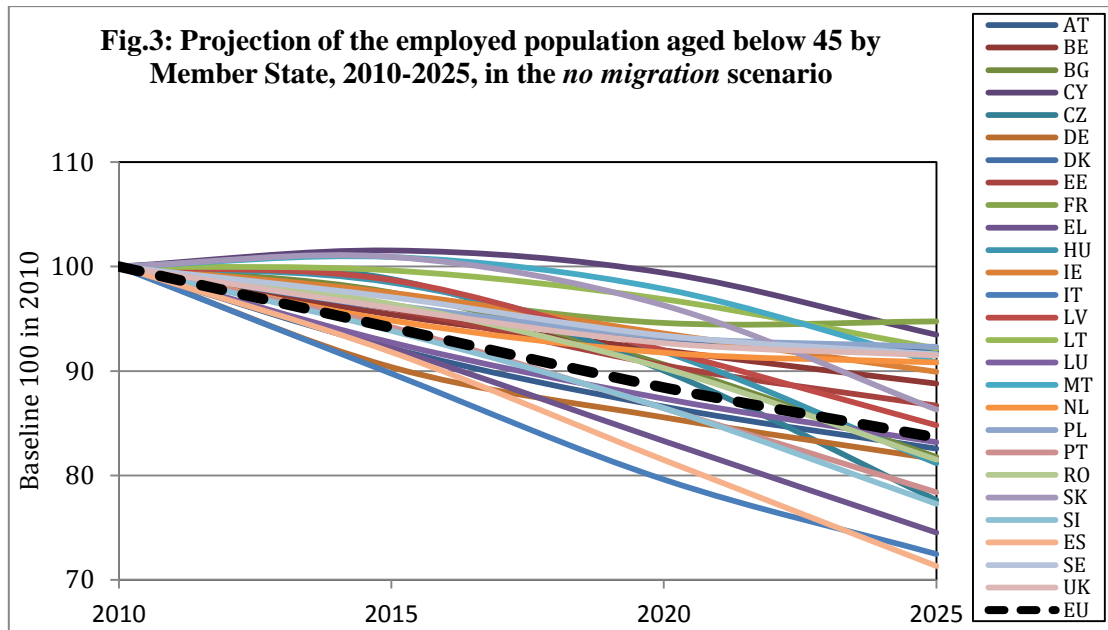
in employed persons in 2025. Whereas the remaining seven occupations will see a reduction in the absolute number of employed persons. Although the number of clerks and service workers looks set to remain around only slightly lower than the figure in 2010.



Source: own calculation based on Eurostat population projections without migration ([http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=proj\\_10c2150zmp&lang=en](http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=proj_10c2150zmp&lang=en)) and the European Labour Force Survey.

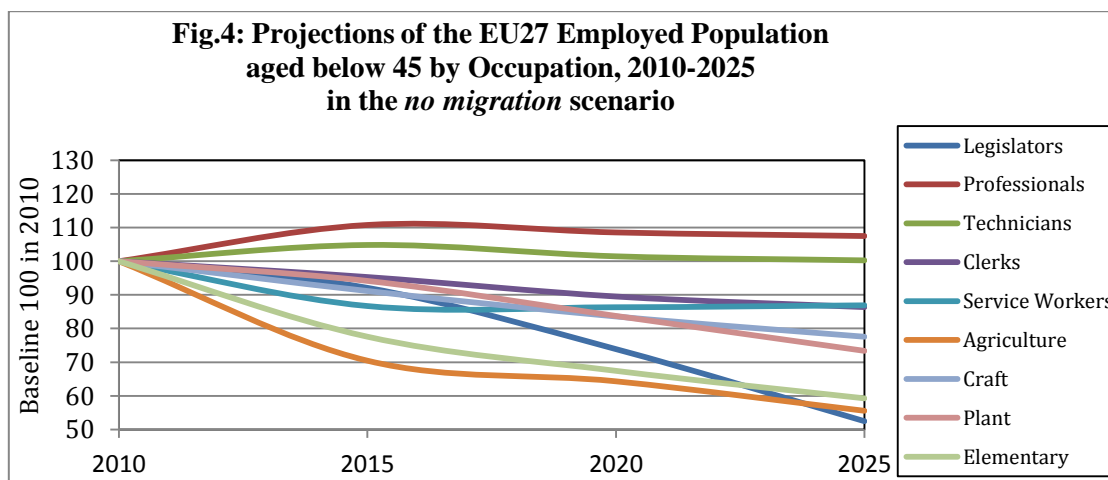
As highlighted in figure 1 there will be a significant reduction of the below 45 age group. The remainder of the analysis will give focus to this group as the future of the economy of both European member states and Europe as a whole are heavily reliant upon the ‘young workforce’. Furthermore young highly skilled migrants are more likely to spur innovation and create a positive economic impact in a given country (Venturini, 2012)<sup>3</sup>. Figure 3 shows an arresting and consistent trend for all EU member states, namely an **overall reduction for the labour force aged below 45** in the absence of migration after 2010. Countries that are less affected by this trend are France and Cyprus, which manage to have a relative reduction of less than 10%. Mediterranean countries (i.e. Italy and Spain) on the other hand are likely to experience a nearly 30% reduction in the working age population aged below 45, in the space of 15 years. These future patterns are likely to have significant impacts upon every economy in the EU, as well as Europe as a whole.

<sup>3</sup> 2012, Innovation and Migration with F.Montobbio, C. Fassio, MPC Analytical Note, 2012/05. (<http://www.migrationpolicycentre.eu/docs/MPC%202012%20EN%2008.pdf>)



Source: own calculation based on Eurostat population projections without migration ([http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=proj\\_10c2150zmp&lang=en](http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=proj_10c2150zmp&lang=en))

Even though all countries will see a decline in the labour force aged below 45, figure 4 highlights that not all occupations in the EU will see a sizeable decline. In fact some occupations will see increases or a continuation in the employed population i.e. professionals and technicians. However, figure 4 makes it very clear that most professions will experience decline in the employed workforce. Groups of occupations such as legislators, elementary and agricultural workers will face the most critical population shrinking and ageing of skills. The impact upon the future productive capacity of each industry that these occupations provide labour will clearly significant and undesirable.



Source: own calculation based on Eurostat population projections without migration ([http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=proj\\_10c2150zmp&lang=en](http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=proj_10c2150zmp&lang=en)) and the European Labour Force Survey.

Tables 2 and 3 show the relative change, for each EU country, of the working population aged below 45 and 45 and above (respectively) from 2010 to 2025. Each country has been ranked based on their relative share in 2025 in comparison to 2010. Countries such as France and the UK have a more positive demographic outlook than in comparison to the likes of Germany, Italy, Greece and Spain.

**Table 2 - Relative Change to Labour Force Aged Below 45 by EU country, 2010-2025**  
**Baseline 100 in 2010 for each country**

Country	Above Average				Country	Below Average			
	2010	2015	2020	2025		2010	2015	2020	2025
France	100	97	95	95	<b>EU Average</b>	<b>100</b>	<b>94</b>	<b>88</b>	<b>84</b>
Cyprus	100	102	99	93	Luxembourg	100	93	87	83
Poland	100	96	93	92	Austria	100	92	87	83
Lithuania	100	100	97	92	Bulgaria	100	98	91	82
Denmark	100	96	93	92	Germany	100	90	86	82
Sweden	100	97	93	92	Romania	100	96	90	82
UK	100	96	93	91	Hungary	100	98	92	81
Malta	100	101	98	91	Portugal	100	94	86	78
Netherlands	100	95	92	91	Czech Republic	100	99	90	78
Ireland	100	97	94	90	Slovenia	100	94	86	77
Belgium	100	95	92	89	Greece	100	92	83	75
Estonia	100	96	91	87	Italy	100	90	80	72
Slovakia	100	101	96	86	Spain	100	92	81	71
Latvia	100	99	92	85					

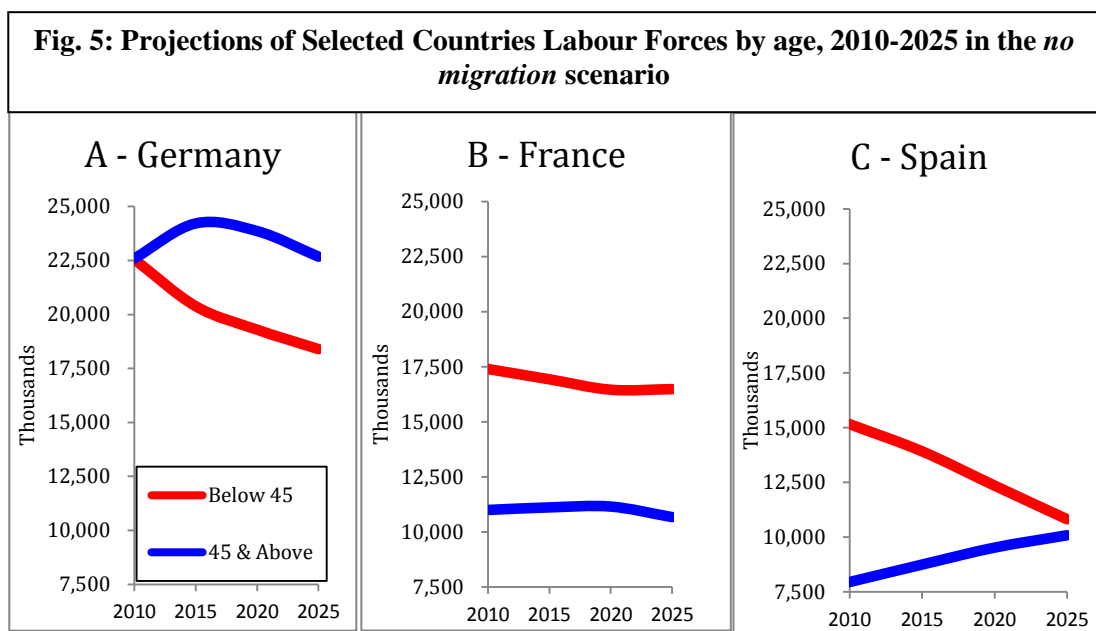
**Table 3 - Relative Change to Labour Force Aged 45 & Above by EU country, 2010-2025**  
**Baseline 100 in 2010 for each country**

Country	Above Average				Country	Below Average			
	2010	2015	2020	2025		2010	2015	2020	2025
Ireland	100	109	118	129	<b>EU Average</b>	<b>100</b>	<b>105</b>	<b>107</b>	<b>106</b>
Spain	100	110	120	127	Sweden	100	102	104	103
Romania	100	106	110	117	Denmark	100	103	104	102
Cyprus	100	104	108	113	Slovenia	100	101	100	102
Portugal	100	104	109	113	Austria	100	109	109	101
Czech Republic	100	97	103	113	Germany	100	107	106	100
Greece	100	106	111	113	Bulgaria	100	97	98	100
Italy	100	108	113	108	Netherlands	100	104	105	99
Poland	100	106	110	108	Lithuania	100	103	103	98
Hungary	100	95	98	108	Estonia	100	97	97	98
Luxembourg	100	110	111	108	Latvia	100	100	99	97
Slovakia	100	97	98	106	France	100	101	101	97
UK	100	106	108	106	Belgium	100	102	92	96
					Malta	100	94	90	93

Source for both tables: own calculation based on Eurostat population projections without migration ([http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=proj\\_10c2150zmp&lang=en](http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=proj_10c2150zmp&lang=en)) and the European Labour Force Survey.

In order to further illustrate population shrinking and the ageing of skills within European member states analysis will be specific to three European Member states, Germany, France and Spain. Germany's trends in the employed population below 45 years of age are similar to the overall EU27 average in figure 3. Conversely France and Spain have markedly different trends to the EU27 average. Whereas France will experience a 10% reduction in the employed population aged below 45 (lower than the EU27 average), on the other hand Spain will have an almost 30% reduction in their labour force (higher than the EU27 average).

Figure 5A shows that in Germany a significant gap opens between the employed labour force aged below 45 and those aged 45 and above. Whereas France (figure 5B) has a more positive demographic picture in figure 5B, with the population aged below 45 remaining higher than the workforce aged 45 and over. Spain on the other hand (figure 5C) has a more dramatic trajectory, with the two age groups almost being equal by the end of the projection period (2025). Although the demographic momentum in each country will see a reduction in their respective populations, the impacts will be significantly felt more in Spain than in France, especially in the ageing of skills.

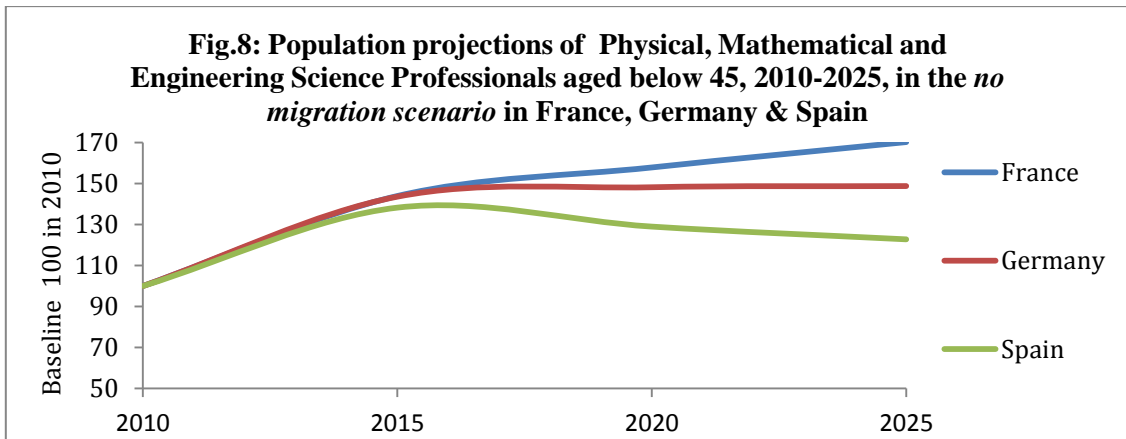


Source: own calculation based on Eurostat population projections without migration ([http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=proj\\_10c2150zmp&lang=en](http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=proj_10c2150zmp&lang=en))

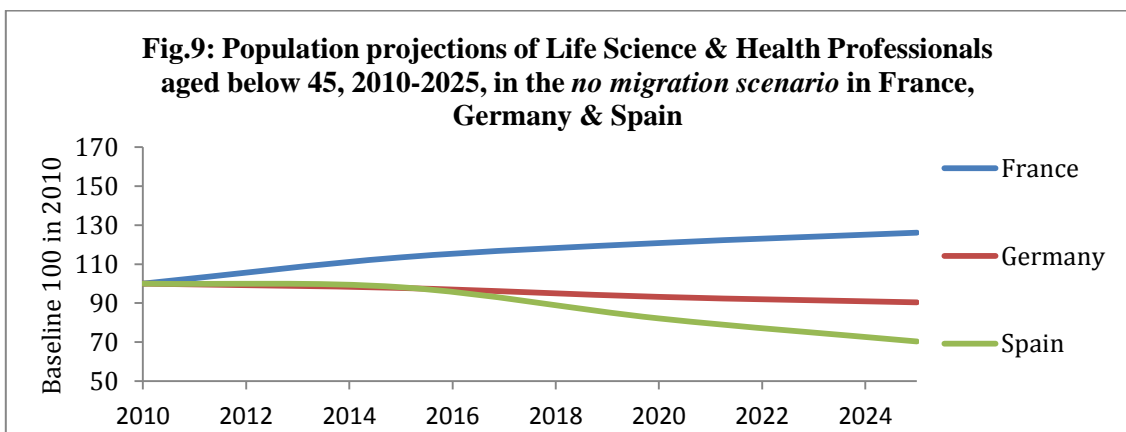
To further illustrate the impact of the ageing upon skills specific occupations (2-digit ISCO code) have been selected. Although the wider findings (Figure 5) highlight that the employed population in all countries are ageing, it is also important to note that the impact of ageing is diverse by occupation and country. Yet, analysing these patterns on a finer scale into more specific professions, the impact of demography combines with other strong factors of change that also affect the number of employed persons in a given profession. On the supply side, there are rising levels of education, which are also subject to changing patterns of study. Hence each industry is susceptible to change with patterns in education, including those that do not require higher qualifications. From a demand and supply side there are also issues of inter-occupational mobility i.e. person moving from one occupation to another. Unfortunately there has been no systematic study that provides pan-EU27 data to highlight patterns of change. Hence the projected results in figures 8 to 10 do not account for such changes.

Figure 8 highlights that there will be an increased supply of engineers aged below 45. Yet the available supply without migrants highlights that Germany and especially France will have significantly more supply in relative terms.

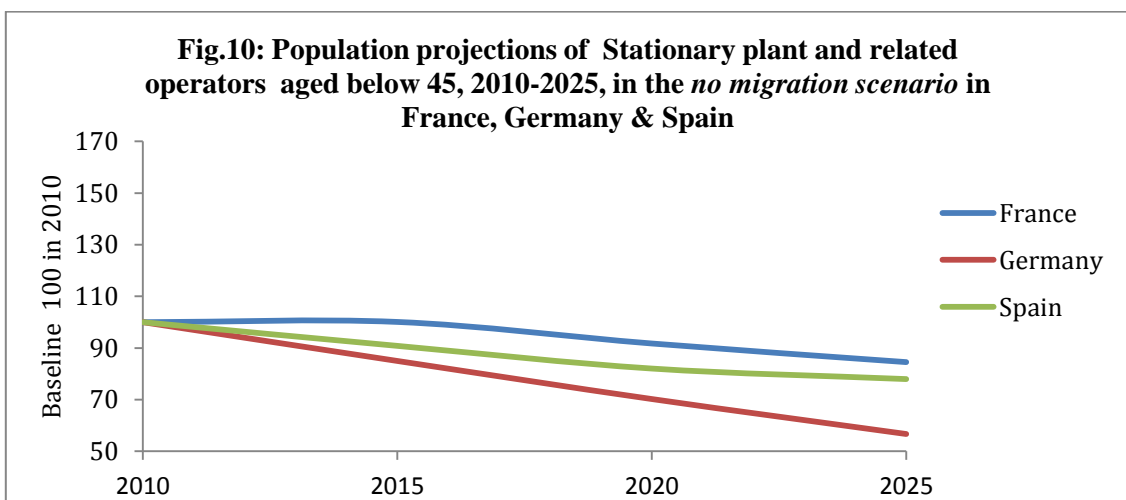




Health professionals (see figure 9) are another occupation that require high levels of education. However France is the only country projected to have an increased supply of person aged below 45 in 2025, with Germany having a very small reduction, whilst Spain is likely to experience a significant decline in supply.



In more elementary occupations the demographic effects of ageing are also clear. For example in figure 10 reductions are experienced in all three countries. However France continues to have the highest relative share of stationary plant and related operators.



The impacts of both the ageing of skills and shrinking of populations in EU27 countries are therefore diverse. Although the results are contingent upon levels of inter-occupational activity, levels of education, the rate of unemployment, the changing structure of demand, the results from figure 3 are startling, which provides all EU27 countries with a demographic predicament will eventuate in the medium-term, rather than the long-term.

#### IV. Conclusion

There are a variety of policy responses that can help to mitigate future demographic impacts upon the employed workforces of EU27 countries. In order to accurately assess the required magnitude of policy responses, an over-simplified, but quantifiable, objective could be to maintain the current levels of employed persons aged below 45 for each EU27 member state.

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**Table 4 –Number of additional workers needed to maintain employment at its 2010 level in the EU and EU27 below 45 years of age**

Age Group	Required Number of additional workers	Percentage of 2025 Employed Population
<i>EU Average</i>	21,493,724	10.55%
Spain	4,347,048	20.80%
Germany	4,157,436	10.12%
Italy	3,575,447	20.52%
UK	1,621,584	5.31%
Romania	1,188,527	12.67%
France	914,132	3.37%
Greece	801,085	17.99%
Portugal	714,005	13.82%
Czech Republic	710,735	14.75%
Hungary	501,642	12.95%
Netherlands	486,003	5.90%
Austria	466,782	12.15%
Bulgaria	363,858	12.07%
Belgium	338,045	7.52%
Sweden	240,328	5.02%
Slovakia	235,080	9.28%
Slovenia	145,726	16.15%
Denmark	143,698	5.13%
Ireland	141,019	6.41%
Latvia	106,495	10.26%
Poland	102,867	5.01%
Lithuania	77,009	4.98%
Estonia	63,098	10.07%
Luxembourg	24,736	12.59%
Cyprus	16,543	3.99%
Malta	10,796	6.85%

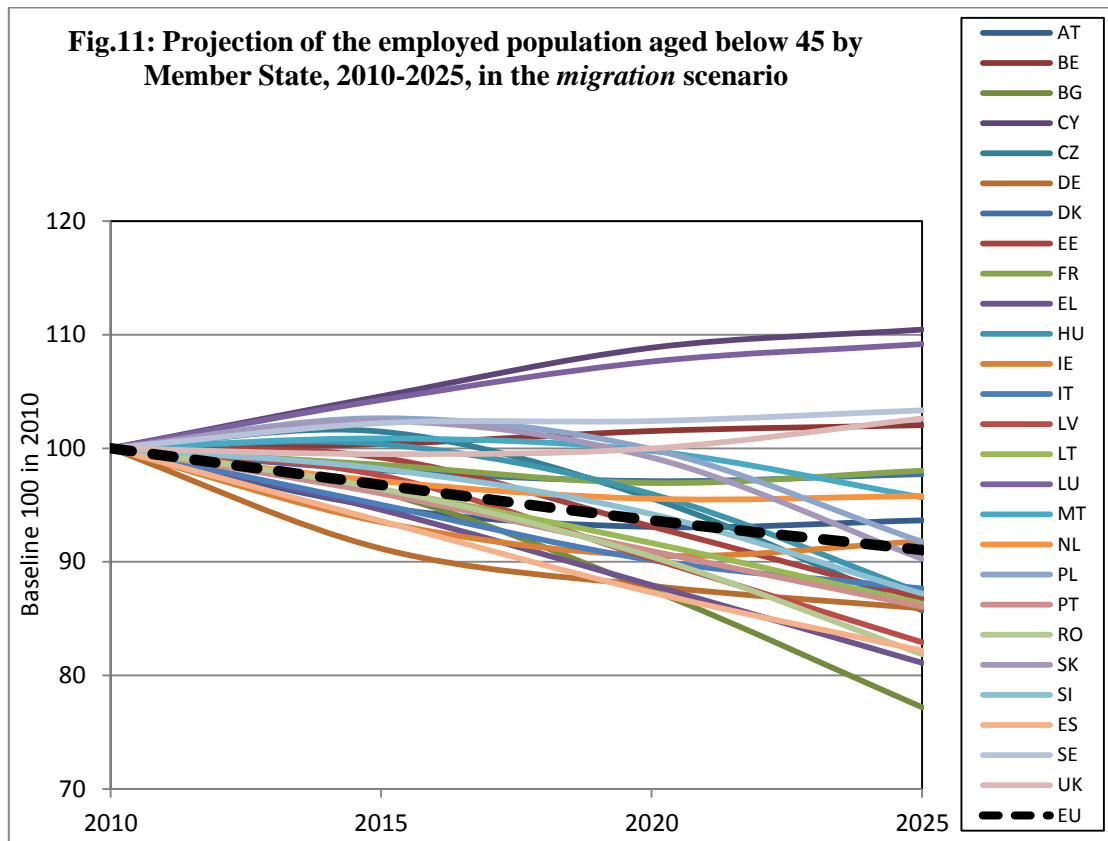
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Clearly the implications of an ageing workforce will have sweeping effects across many of the EU27 countries. Spain, Greece and Italy are very prescient examples of countries that require significant policies to cope with such changes. One method may be to increase economic participation, especially of women. However their impacts will not be sufficient, given the magnitude of this issue. For example, the EU may require over 21 million new workers in 2025, this cannot be solely alleviated by increases in female economic participation. Another potential factor is to increase the levels of occupational mobility in countries that are experiencing imbalances by occupation; however such structural changes may take some time to implement and would not meet quantitatively the needs of table 4. Complementary immigration is another option. Based on these research findings, it is clear that migration that directly complements the requirements of EU member states will become central to fulfilling the demands of their respective job markets.

## V. Appendix

EUROSTAT also provides projections with migrants. Results with migrants are given, using exactly the same methodology as section 2, which can be compared to figure 3. By comparing the two figures migrants have a significant and positive impact on the number of employed persons aged below 45 by member state.

However, there are problems with the assumptions made with migrants in the EUROSTAT projections<sup>4</sup>. One issue is what the assumptions actually are – where have they been derived from? The meta-data notes do not give any apt description or links to ascertain what the assumptions are. Hence the migration scenario has not been included in the main body of analysis.



Source: own calculation based on Eurostat population projections with migration  
 ([http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=proj\\_10c2150p&lang=en](http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=proj_10c2150p&lang=en))

<sup>4</sup> EUROSTAT migration assumptions can be accessed here:  
[http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=proj\\_10c2150zma&lang=en](http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=proj_10c2150zma&lang=en)

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