How reducing differentials in education and labor force participation could lessen workforce decline in EU28

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Introduction

Following several decades of low fertility levels, the working age population (generally defined as those aged between 15 and 64) is or will soon be shrinking in many European countries, while the number of elderly will expand, giving rise to an increase in the old-age dependency ratio which can be amplified by the extension of life expectancy. In other words, Europe will see unavoidable population aging. Demographic projections of the expected ratio between the working age population and elderly are likely to be quite accurate for the medium-term, because immediate changes in fertility only have an effect once the new children will reach the working age, and because immigration, at plausible levels, only slightly affects the age structure of host societies (Bijak, Kupiszewska, and Kupiszewski 2008; Marois 2008; David A. Coleman 1992; D. Coleman 2008). Indeed, population aging is more a matter of structure than absolute number. More elderly generally means more people in a situation of economic dependency, and less people in the working age group to support them, which raises policy concerns on the fiscal burden for future generations and the viability of social programs.

When analyzing demographic projections in terms of economically active population in the labour market rather than in terms of the working age population, prospective consequences of population aging are reduced. Although the age and sex structure of a population is a major determinant of its labour force population size, recent trends in labour force participation are showing important changes that should also be accounted for when projecting labour force. First, future cohorts will likely be more educated than older ones, and more educated tend to keep their attachment to the labor market longer in life. Consequently, older workers of the future are more likely to be economically active at an older age than current older workers (Barakat and Durham 2014; Loichinger 2015; Hasselhorn and Apt 2015). Second, in many countries, the labour force participation rates continue to increase among the population age 55 and over (Loichinger 2015). Third, women are working more than ever. A big gender gap still exists in many European countries, but it gradually narrows, especially among the population with higher education (OECD 2016a). Thus, a decline of the working age population does not necessarily translate into an equivalent decline in the labour force, highlighting the importance of including this dimension in population projections.

When taking into account these recent trends, labour force projections of many nations show that they would not experience a decline in their labour force size over the next half century. The economic dependency ratio, however, is expected to sharply increase everywhere (Loichinger and Marois 2018), because these favorable economic trends are not yet sufficient to offset the effect of broad demographic trends in the age structure of the population. However, changes in labour force participation rates could drastically change the future outlook. For instance, Loichinger and Marois (2018) showed that if labour force participation rates in all European countries reach those observed in Sweden by age, sex, and

education levels (where the rates are the highest), the European Union would not only avoid a decline of its labour force size, but its economic dependency ratio would also remain quite stable.

In this paper, we assess the impact of different analytical scenarios on the future labour force of European Union Member States. Using a microsimulation projection model (CEPAM-Mic) that includes 12 socioeconomic dimensions, namely country of residence, age, sex, education, region of birth, duration of stay, age at immigration, education of the mother, religion, language and their interaction, we measure how reducing inequalities in labour force participation and education would impact the future economic structure of the population. As we already know that increasing labour force participation could be a good asset in managing consequences of population aging, this paper focuses on alternative scenarios concerning specific sub-groups that show lower achievements in education and in labour market participation. More precisely, according to the capabilities of the projection models and available data, alternative scenarios were built concerning three important aspects of inequality, namely:

1. The gender gap in labour force participation,
2. The lower labour force participation of international immigrants,
3. The inequality in the educational attainment for children from low- and medium-educated mothers and children with foreign sociocultural background.

In short, scenarios built in this paper go beyond variations around a baseline scenario, such as what is usually done by statistical agencies with “high” and “low” assumptions of fertility, mortality and migration. The proposed scenarios investigate how sociological dynamics among sub-populations could shape the future labour force in the Europe Union.

METHODS: The CEPAM-Microsimulation model (CEPAM-Mic)

This research is part of the Centre of Expertise on Population and Migration (CEPAM), a joint research project of the International Institute for Applied Systems Analysis (IIASA) and the Joint Research Centre (JRC) of the European Commission. The microsimulation projection model used for this research, named CEPAM-Mic, allows the study of alternative scenarios and their consequences for future population trends in the European Union. Microsimulation is a powerful tool that can be used to make population projections when the number of dimensions becomes large (Van Imhoff and Post 1998), because statistical models are used to project life-course transitions and events. Such a model is very flexible and characterized by the stochastic simulation of individual life courses based on derived parameters and individual characteristics.

CEPAM-Mic allows the projection of the population for EU28 member countries under several socioeconomic and ethnocultural dimensions. An exhaustive description of the model and its modules can be found in other papers (Bélanger et al. 2018; Marois, Sabourin, and Bélanger 2017; Sabourin, Marois, and Bélanger 2017; Marois, Sabourin, and Bélanger 2018). Simultaneous simulation of individual life courses through various statistical modeling enables the model to dynamically implement interactions between variables such as age, sex, education, education of the mother, place of birth, duration of stay for immigrants, age at immigration, labour force participation, etc.

The core demographic modules are the same in all scenarios and assumptions are defined following recent trends in fertility, mortality and migration. In short, fertility rates are estimated from logit regressions

taking into account, age, education, region of birth, age at immigration, duration of stay, and country of residence and are calibrated on future trends estimated in Lutz et al. (2018). Mortality rates by age, sex and educational attainment are taken from Lutz et al. (2018). Rates for internal mobility between European countries and international migration are estimated from Eurostat (period 2013-2016) and an update for the period 2009-2016 of Raymer et al.'s (2013) Bayesian estimates of European migration[1]. Characteristics of future international immigrants are derived from information on recent immigrants in the base population, itself built from the EU-LFS, the EU-ESS and Eurostat census data. The scenarios assume a volume of about two million international (non-EU) per year. Alternative scenarios featured in this paper concern education and labour force participation modules. CEPAM-Mic includes three levels of education, either:

(1) Low: Lower secondary or less (ISCED 1 and 2);
(2) Medium: Upper secondary completed (ISCED 3);
(3) High: Postsecondary (ISCED 4+).

The highest level of education that an individual will be reach during the life course is set probabilistically at birth (or at arrival for immigrants who arrived during childhood) with parameters estimated with an ordered logit regression. The models explicitly take into account the influence of personal characteristics and the education of the mother. Sex- and country-specific cohort parameters are also included and extrapolated to establish assumptions for future cohorts. The model equation is thus formulated as follows:

Eq. 1 $$\ln\left(\frac{E_{ij}}{1-E_{ij}}\right) = \beta_{0j} + \beta_{1j}Ct_i + \beta_{2j}Cr_i + \beta_{3j}(Ct_i * Cr_i) + \beta_{4j}X_i + \beta_{5j}Z_i \qquad (1)$$

Where

- E_{ij} is the probability that an individual i reaches level of education j, where j equals High or Medium;
- Ct is the country;
- Cr is a discrete variable for cohorts (1940-44=1; 1945-49=2, …, 1975-1979=8);
- X is a set of sociocultural variables;
- Z is the education of the mother.

Sociocultural variables include language, religion, and place of birth. As such, the education module implements differentials in the educational pathways for children with a foreign sociocultural background as well as for different social classes as reflected by the education of the mother.

The labour force participation module, on the other hand, is applied to individuals aged between 15 and 74. When a change occurs to the characteristic of an individual (age, education, duration of stay, etc.), the module determines probabilistically whether or not he/she participates in the labour force. The labour force participation status is imputed through a Monte-Carlo experiment in which a random number is compared to the probability of being active: a successful trial means that the simulated individual is active.

[1] The authors would like to acknowledge Erofili Grapsa for the update of Bayesian estimates of migration flows.

Parameters are estimated from sex- and country-specific logit regressions on a binomial variable representing participation in the labour force, using pooled data from the 2010 to 2015 files of the annual EU Labour Force Survey. Equation 2 below describes the modeling of labour force participation (P):

Eq.2 $\text{logit}(P) = \beta_0 + \beta_1 AGE + \beta_2 EDU + \beta_3 YEAR + \beta_4 (AGE * EDU) + \beta_5 (AGE * YEAR) + \beta_6 (EDU * YEAR) + \beta_7 (AGE * EDU * YEAR) + \beta_8 IMMIG + \beta_9 (IM15 * EDU)$

Where:

- $\beta_0 + \beta_1 + \beta_2 + \beta_4$ capture the joint effect of age and education on labour force participation rates[2]. Education is divided into 3 categories:
    1. Low (L): Lower secondary or less (ISCED 0, 1 ,and 2);
    2. Medium (M): Upper secondary completed (ISCED 3);
    3. High (H): Postsecondary (ISCED 97: 4, 5A, 5B and 6; ISCED 2011: 4, 5, 6, 7, 8);
- $\beta_3 + \beta_5 + \beta_6 + \beta_7$ capture the age and education specific trends in labour force participation;
- β_8 is a set of parameters for an immigration variable (IMMIG) combining place of birth[3], age at arrival and duration of stay. The variable is divided in five categories:
    1. Born in EU28;
    2. Generation 1.5 born outside EU28;
    3. Generation 1 born outside EU28, duration of stay < 5;
    4. Generation 1 born outside EU28, 5 <= duration of stay < 10;
    5. Generation 1 born outside EU28, 10 <= duration of stay;
- β_9 is a set of parameters estimating the labour force returns on education for migrants born outside the European Union and who arrived at the age of 15 or above (IM15).

Comparing probabilities by sex, education and country for 2015 with those of the age group X-5 in 2010, we compute entry and exit rates to build a labour force participation table for a synthetic cohort. The table is then used to assume net future participation rates.

In addition to the sex differential, regression models also account for another important source of inequalities in regards with labour force participation, as they explicitly take into account differentials between EU28 natives and foreign-born as well as the integration process through parameters for the duration of stay (β_8). In addition, interaction parameters between the place of birth and education (β_9) allows the model to account for the fact that the return for education differs for immigrants and natives. Taking these parameters into account allows the creation of assumptions on future participation rates with immigration differentials.

CEPAM-Mic has thus many advantages compared to traditional labour force projections, as it can incorporate heterogeneity among different groups, while also having a more complex modeling of education, which is a major determinant of labour force participation. This allows the model to capture inequalities in labour force participation and education between many sociocultural groups. Consequently, by changing parameters associated with these groups, the model is very flexible in the

[2] The LFS does not provide information on labour force participation rates in the UK for the age group 70-74. It was assumed to be half of the value observed for the age group 65-69 for each education level.

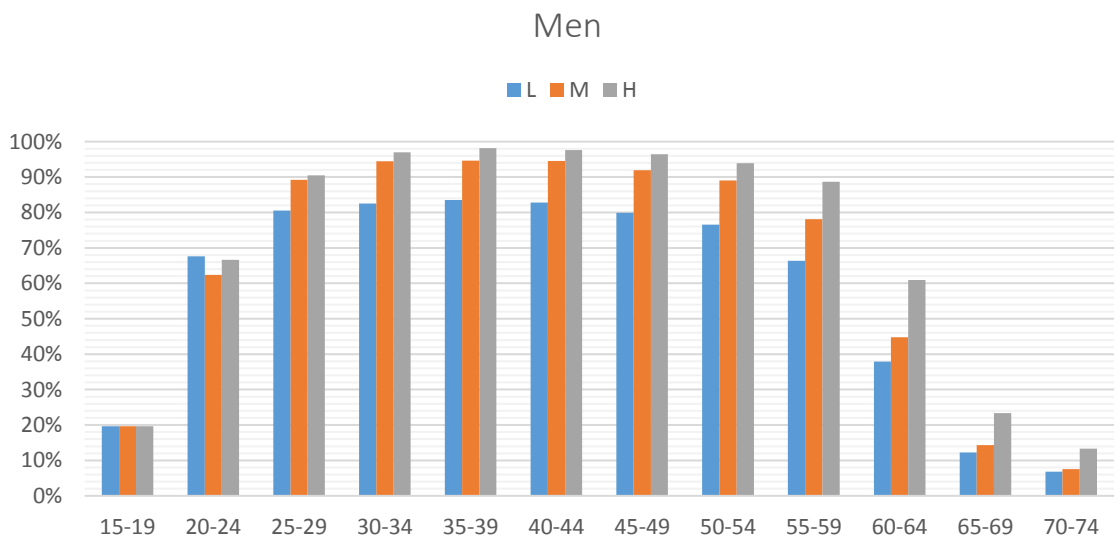
[3] For Germany, the question on the country of birth is not asked in the LFS. We use the nationality as a proxy to distinguish EU28 migrants from international immigrants.

construction of alternate scenarios that may prove relevant and useful to European policy makers in regards to analysis of the future education and labour force.

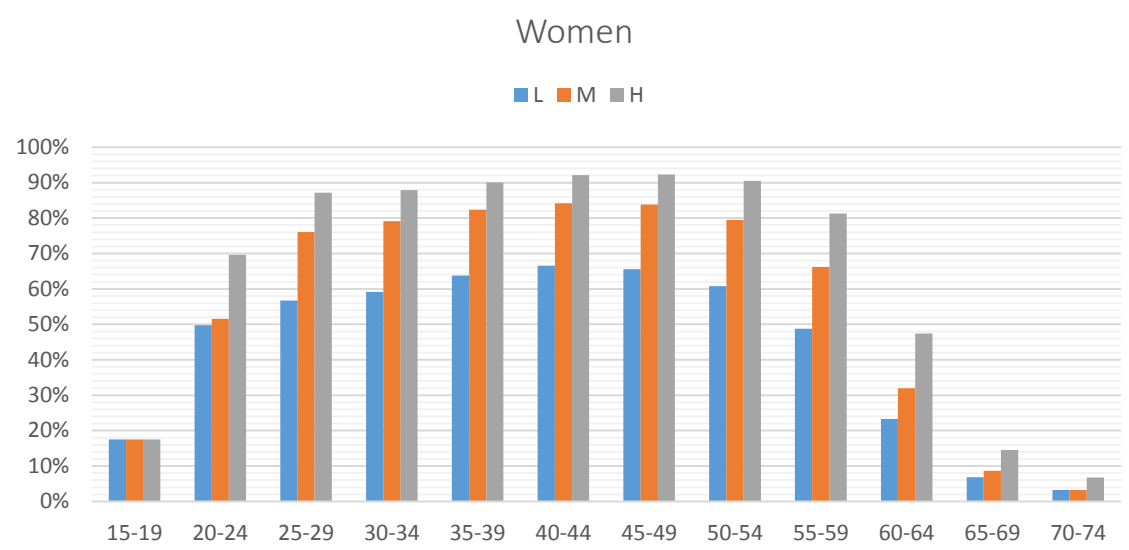
Inequalities in the labour force participation and in education

Workforce participation rates for women have increased drastically in the past decades, but still, an important gender gap remains in all countries and for every age-education group (Cipollone, Patacchini, and Vallanti 2014; Loichinger 2015). Figure 1 below shows the current data for males and females, by age and education (calculated with parameters from eq. 2 presented in the methods section above, see Marois, Sabourin, and Bélanger (2018) or further details). Rates are lower for females at every age group and every education level. Although education is strongly associated with labour force participation for both males and females, the education gradient is steeper for women. Despite improvement in female labour force participation everywhere in the past decades, low educated women have lower participation rates than men or high educated women. Indeed, the negative impact of having a low level of education on labour force participation is much larger for females then for males. The difference in labour force participation rates between low and high education is in general less than 15 percentage points for men, while it sometimes exceed 25 percentage points for women. Altonki and Black (1999) summarized the explanation of these differences as gender differences in preferences, driven by pre-market gender discrimination in child rearing practices, differences in comparative advantages, which however tend to decline when fertility declines, and differences in decisions regarding human capital investments, which may affect the field of study.

Figure 1 – Probability of being active[4] for EU-born individuals, EU28, 2015



[4] Converted from the average of country specific parameters.



Source: Marois, Sabourin, and Bélanger (2018)

Another important inequality in labour force participation affects immigrants, who encounter several difficulties in their economic integration that reduce their potential to contribute (Büchel and Frick 2005; Kahn 2004; Model and Lin 2002; Bevelander 2005; OECD 2010). In general, the labour market outcomes for international immigrants at their arrival are much lower than natives with similar characteristics, but the rates tend to improve with increasing number of years in the host country (Borjas 2008; Alba and Nee 1997). Previous analysis have clearly shown these dynamics in the labour force participation in the European Union (Marois, Sabourin, and Bélanger 2018). In the table 1 we reproduce the parameters for immigration variables (see equation 2 in the section below for details on the model). In general, immigrants arriving after age 15 tend to have much lower participation rates than natives at the time of their arrival, but their situation improves with the passage of years. After 10 years of stay, their outcome is similar to that of natives in many countries. For female immigrants, however, the gap is, in general, not eliminated after 10 years.

Gender inequity in terms of labour force participation appears to be an issue affecting immigrants more strongly than natives. In addition, the effect of education is reduced for immigrants (Table 2, see Marois, Sabourin, and Bélanger (2018) for detailed results). For women specifically, having a high education level is about 50% less efficient for female immigrants than for native females in terms of labour force participation. These observations are in accordance with other studies showing that in some immigrant communities, both gender and immigrant status and their interaction are correlated with lower participation, resulting in much wider gender differentials in workforce participation among immigrant than among natives. (Donato, Piya, and Jacobs 2014; Dustmann et al. 2003; Boyd 1984; Adsera and Chiswick 2007). Immigration is often seen by governments as a tool to smooth the expected decline in labour force size (Termote 2011). However, lower participation rates among some groups of immigrants and differentials in educational attainment can limit the potential for contributions.

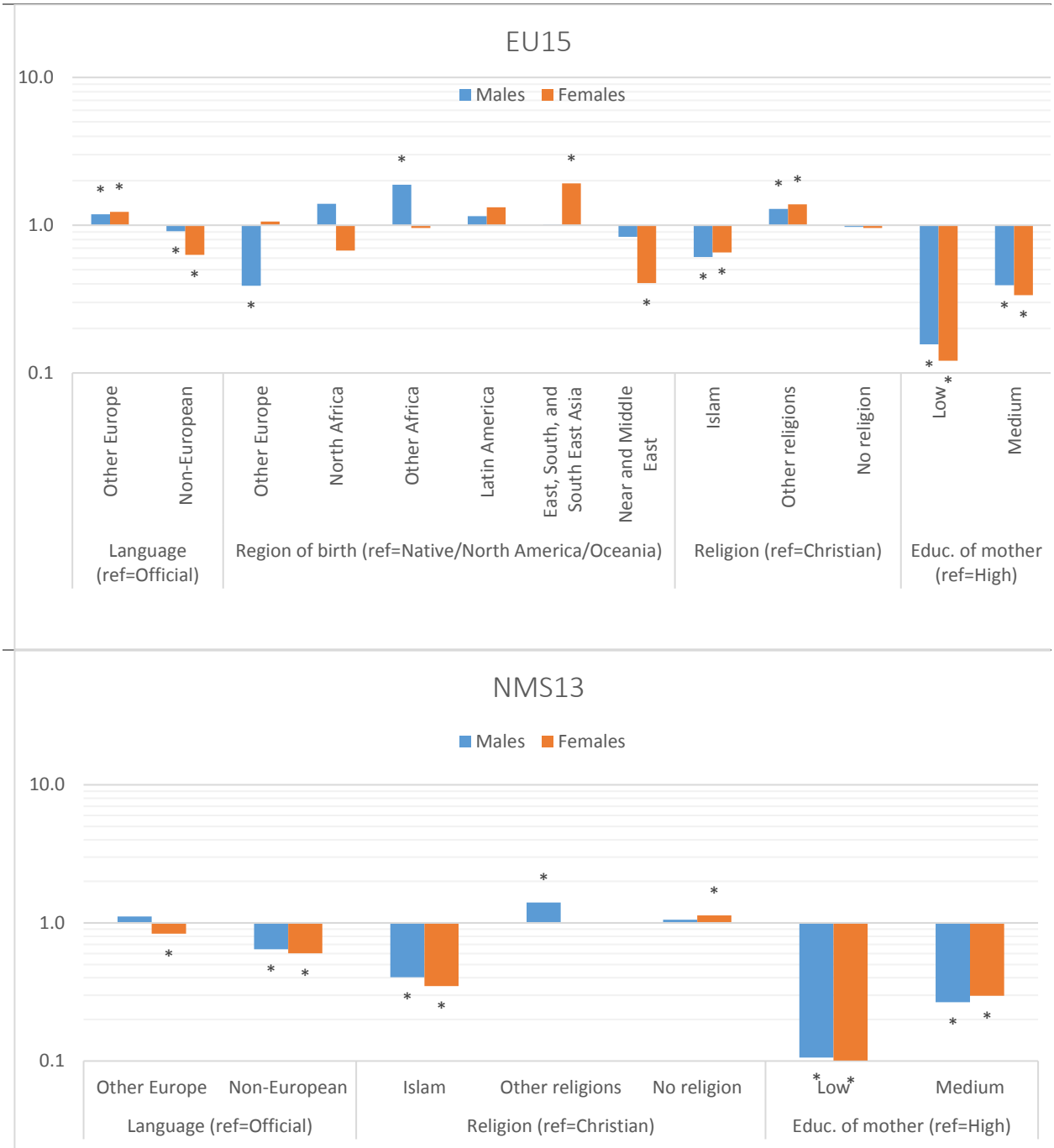
Table 1 - Average value of β_8 (IMMIG, see equation 2), EU28, 2010-2015		
	Women	**Men**
Born in EU28	Ref	Ref
Generation 1.5 born outside EU28;	-0.220	-0.180
Generation 1 born outside EU28, duration of stay <5;	-1.642	-0.936
Generation 1 born outside EU28, 5<=duration of stay <10;	-1.258	-0.520
Generation 1 born outside EU28, 10<=duration of stay;	-0.755	-0.223
Source: Marois, Sabourin, and Bélanger (2018)		

Table 2 – Average value of the parameters for education and its interaction with immigration				
	Women		**Men**	
Level	**EDU (β_2)**	**EDU*IM15 (β_9)**	**EDU (β_2)**	**EDU*IM15 (β_9)**
Low	-1.753	0.817	-2.005	0.590
Medium	-0.753	0.467	-0.751	0.153
Source: Marois, Sabourin, and Bélanger (2018)				

This general pattern is not the same everywhere however. In some countries, such as Germany, Belgium and the Netherlands, an important gap remains for immigrants established for a decade or more, even for males (see Marois, Sabourin, and Bélanger (2018) for detailed results). In Denmark, the situation even appears to deteriorate with time. On the other hand, immigrants tend to have higher participation rates in southern Europe countries. In addition, in most countries, immigrants arrived during before 15 (generation 1.5) tend to have similar labour force participation as natives, for both males and females, showing evidence of integration. In some countries, however, immigrants from generation 1.5 (immigrants arrived before the age of 15) still encounter difficulties, such as in the Netherlands, UK, and Belgium.

Since education is strongly related to labour force participation, differentials in the educational pathway would also impact labour force participation at the adulthood. Many empirical studies show differences in the educational pathway following the socioeconomic and cultural background of children. First, the education of parents is a strong determinant of child education (Shavit, Yaish, and Bar-haim 2007). In the figure 2, we present the odds of getting to a high level of education given a set of characteristics (see Marois, Sabourin, and Bélanger et al. (2017) for further details). As revealed by the odds ratio of about 0.02, the likelihood of children from low educated mothers to get a postsecondary level are several times lower than those from highly educated mothers, for both males and females and in all regions. Thus, education of the mother is a main driver of observed inequalities in educational attainment. Shavit et al (2007) explain this link by mechanisms related to economic and cultural resources, influence of other family members, track placement and incentives to make more ambitious educational choices.

Figure 2 - Odds of obtaining high level of education to odds of obtaining low or medium level of education



Source : Marois, Sabourin, and Bélanger et al. (2017)

Second, many studies in Europe and in the USA have found that some groups such as foreign-born children or racial minorities have lower educational outcomes (Heath and Brinbaum 2007; Riphahn 2003; Hirschman 2001). Odds by language and by religion of figure 2 illustrate that many groups with a foreign sociocultural background have a much lower likelihood of obtaining a postsecondary level than others.

These groups include those speaking a non-European language at home and Muslims in both EU15 and NMS13, and females born in the Near- and Middle-East and males born in another European country living in the EU15. Among contextual factors explaining these differences, we can state that children with foreign sociocultural background have in many cases specific issues of inequalities related to neighborhood and schools conditions (Gronqvist 2006; Pong and Hao 2007), as well as unequal access to resources (Zhou 2009). Moreover, cultural differences may also influence the educational pathway (Heath and Brinbaum 2007).

Building alternative scenarios for the future

The analysis of the inputs of CEPAM-Mic show three major inequalities in terms of labour force participation. The first is for women in general compared to men, especially for low educated women. The second is the discrepancy between immigrants and natives, especially for females and recent immigrants, compared to natives. The third concerns a disadvantage in the access to postsecondary education for children with a low educated mother or foreign sociocultural background, which both reduce their propensity to participate in the labour force. All these inequalities are explicitly taken into account using distinct parameters in the projection model, and we can thus create « what if » scenarios by changing them.

A reference scenario is first built as a baseline. Using the most plausible assumptions on future trends, this scenario gives the expected composition and size of the projected labour force population if past trends continue and if observed inequalities remain. In other words, we used all the parameters described in the section above. In addition to this reference scenario, four “what if” alternative scenarios were built to assess how reducing the previously mentioned inequalities could affect the future labour force. The first three alternative scenarios assess the effect of a change to each of the specific differentials mentioned above, while the last one combines all three scenarios. These 5 scenarios (reference + 4 alternatives) are listed below. All 5 scenarios share the same assumptions in regards to fertility rates, mortality rates, and migration.

1. *Reference*. The modeling of educational attainment follows cohort trends and takes into account the odds of getting a postsecondary degree for children with low-educated mothers is much lower than others. The labour force participation module explicitly takes into account sex, age, and education differentials by country, as well as the lower participation rates observed for immigrants and increasing of participation with the duration of stay. In order to take into account the cohort effect, the entry and exit rate method is applied to get participation rates of future elderly.
2. *Equality in education*. This “what if” scenario assigns the same chance to achieve a given educational level to all children regardless their background. It does so by removing the negative effect of having a low or a medium educated mother and the negative effect of sociocultural variables on the likelihood of attaining postsecondary education. In other words, taking mother’s education as an example, it assumes that children born from a low educated mother have the same chance to get a high education level than children born from a highly educated mother. This is achieved by setting to 0 the parameters for the variables “education of the mother” and for the sociocultural variables with negative parameters when assigning an education level to new births and future immigrants admitted during childhood. Since education is a major determinant of

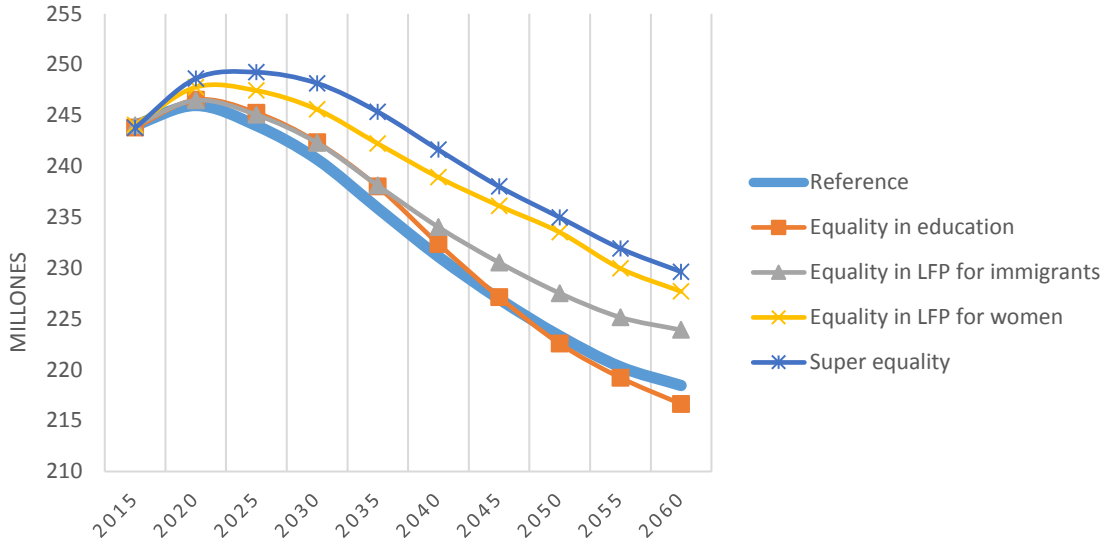
labour force participation, this scenario shows the effect of targeted investments in education that would eliminate barriers to educational attainment of most vulnerable children.

3. *Equality in labour force participation for immigrants*. This scenario assumes a convergence of labour force participation between immigrants and natives with a similar age-sex-education profile for the time horizon 2050. In other words, all parameters for immigration variables in terms of labour force participation gradually converge to 0, as well as the parameters interacting with education. This scenario shows the impact of efficient policies focusing on a better economic integration of immigrants.
4. *Equality in labour force participation for women*. In this scenario, disparities between men and women in labour force participation observed almost everywhere, for every age group and at every level of education, are progressively removed. We assume that for every sub-groups, the rate for women reaches that of men by 2050. This scenario shows the impact of efficient social programs favoring the labour force participation of women.
5. *Super equality*. This scenario combines assumptions on the reduction of inequalities of the three previous ones. In other words, it assumes that women and immigrants have no labour force participation rates distinct from other groups, and that the achievement of postsecondary education is the same for everyone.

Results for the European Union

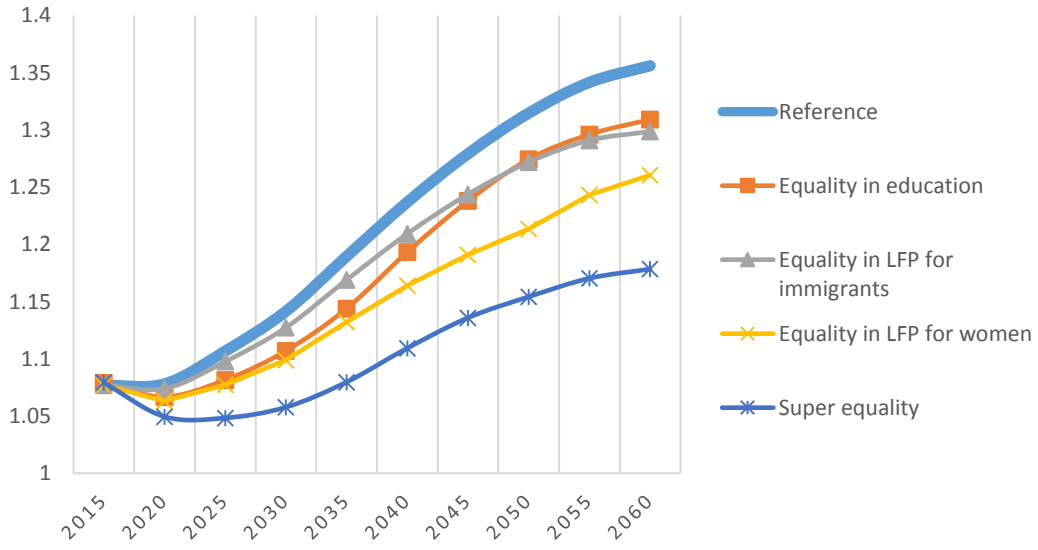
According to the reference scenario, the labour force size of the European Union is expected to decline by about 26 million by 2060, as shown in figure 3, passing from about 244 million workers in 2015 to 218 million in 2060. This decline is the consequence of fertility that is below replacement level for many decades in most European countries, resulting in more workers retiring than young entering the labour market. The expected improvement in labour force participation for women and older workers, although mitigating this decline, is not sufficient to prevent it altogether. As the size of the inactive population would grow while boomers are retiring, the labour force dependency ratio (LFDR), which is the ratio of the inactive to active, would consequently increase from about 1.08 in 2015 to 1.36 in 2060 (figure 4). This projected population dynamic resulting from population aging is observed in most developed nations and is similar to other labour force projections (Loichinger and Marois 2018; Loichinger 2015; European Commission and Economic Policy Committee 2017).

Figure 3 – Projected labour force size of the European Union according to 5 scenarios, 2015-2060



Source: Authors' calculations

Figure 4 – Projected labour force dependency ratio of the European Union according to 5 scenarios, 2015-2060



Source: Authors' calculations

The scenario reducing inequalities in education gives about the same labour force size by 2060. As the working-age population is much more educated in this scenario, one might expect a positive impact on the size of the number of workers because of the higher labour force participation rates of more educated. However, this positive impact, that we can see for the first decades of the projection, is later cancelled by lower fertility which reduces further the labour force population in the longer term, because CEPAM-Mic

explicitly implements differentials in fertility according to education. As an example, women who are still student at the age of 20-24 have an odds ratio of 0.24 compare to those who dropped school after the secondary level. Thus such an improvement in women's educational attainment, though increasing their labour force participation, also reduces the overall size of next generations and indirectly, the number of workers. However, when looking at the labour force dependency ratio (LFDR), the positive impact of this scenario is more apparent. The expected LFDR in 2060 is reduced by about 0.05 (1.31 vs 1.36), which represents 18% of the projected increase in the reference scenario. Improving the access to education thus only slightly increases the size of the labour force in the long term, but also reduces significantly the number of inactive people and as a consequence, improves policy-relevant indicators on the fiscal impact of population aging such as the LFDR.

Table 3 - Projection results

	Change in the labour force size in 2060 compared to 2015	**% of reduction of the reference scenario's expected decline in LF size**	**Change in the LFDR in 2060 compared to 2015**	**% of reduction of the reference scenario's expected increase in LFDR**
Reference	-25,589,832	-	0.28	-
Equality in education	-27,171,822	-6%	0.23	18%
Equality in labour force participation for immigrants	-20,113,299	21%	0.22	21%
Equality in labour force participation for women	-16,348,456	36%	0.18	34%
Super equality	-14,150,470	45%	0.10	64%

The scenario removing inequalities for immigrants in labour force participation yields in a more significant impact on the labour force size than does removing inequalities in education. Compared to the reference scenario, the expected decline in the labour size by 2060 is reduced by 21%, as the size drops to about 224 million workers. In addition to increasing the number of workers, turning inactive immigrants into active ones also reduces the increase of the LFDR by 18%, to 1.30 in 2060 (vs 1.26 for the reference scenario). Our low fertility and quite high immigration assumptions produce a strong estimated increase of the proportion of immigrants among the working age population throughout the projection. Given these assumptions, the positive impact of this "perfect integration" scenario, though small for the first years, becomes more and more significant over time.

The gender equality scenario yields the more positive impact on both the labour force size and the labour force dependency ratio. If labour force participation rates of women gradually reach those of men by 2050, the expected decline of the labour force size would be reduced by about 36% compared to the reference scenario. The impact of this alternative scenario on the LFDR is also major, but an increase would still occur, consequence of the sharp increase of the number of elderly In 2060, the ratio would

reach 1.26, meaning 34% of the expected increase from the reference scenario could be cancelled by a strong increase of labour force participation of females.

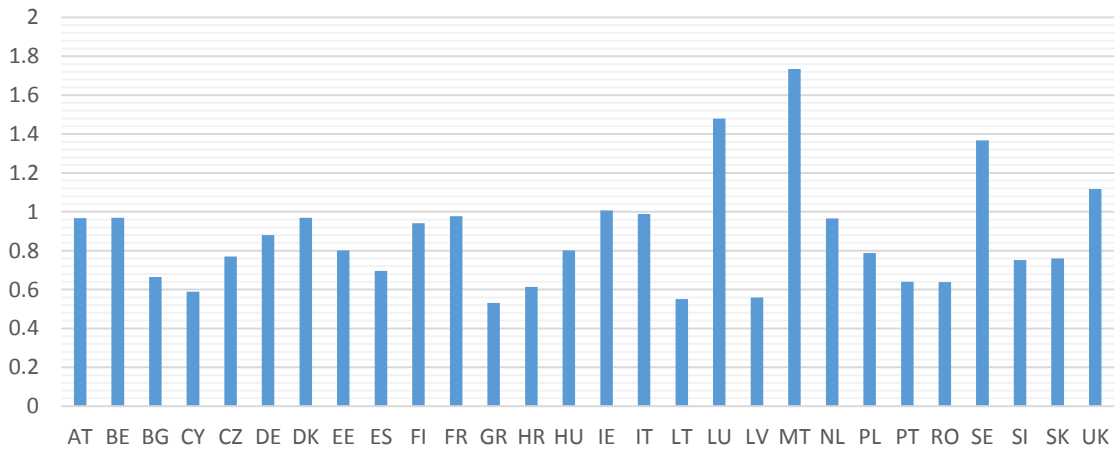
Finally, the scenario combining the positive assumptions of the three previous scenarios results in a labour force size of about 230 million in 2060, which is 6% lower than the size in 2015. Although this scenario cannot prevent the expected increase in the LFDR, it would significantly reduce the pace of its growth. The ratio would thus reach 1.19 in 2060, which is only 0.13 higher than the ratio observed in 2015. When considering this indicator, two thirds of the economic impact of the population aging would thus be cancelled (compared to the reference scenario), in addition to preventing a significant decline of the labour force size.

Results for countries

Although all European countries are now facing population aging, their demographic dynamics differ widely. For instance, in 2016, fertility levels varies from 1.34 in Spain to 1.92 in France (Eurostat 2018a), and whilst the net migration was strongly positive in Germany and United Kingdom, other countries, especially in Eastern Europe, experienced net emigration (Eurostat 2018b). Moreover, significant differences among European countries in terms of economic integration of immigrants, gender imbalance in labour force participation, or educational dynamics are also observed. These heterogeneities in demographic and social dynamics are explicitly taken into account in the assumptions of CEPAM-Mic. As a result, alternative scenarios generate different outcomes when looking at country-specific results.

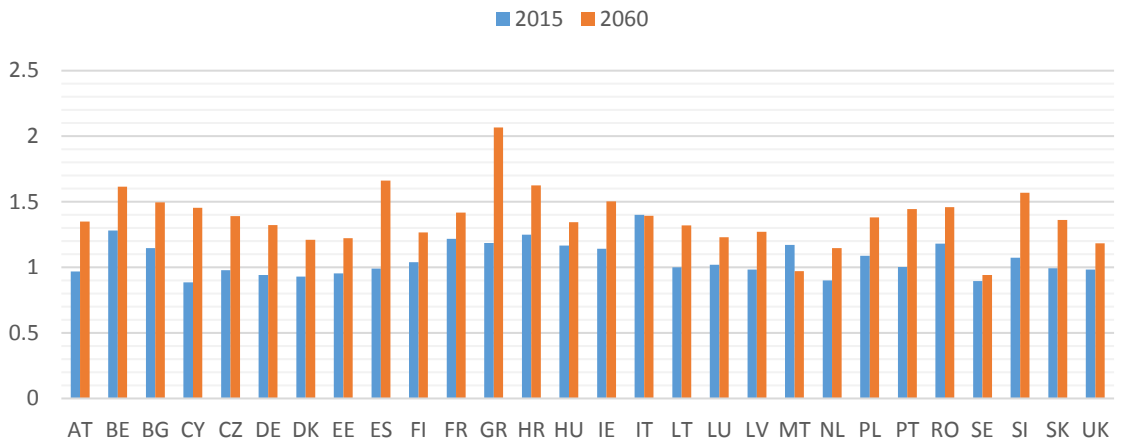
First, in figure 5, we present the expected labour force size by country in 2060 for the reference scenario (2015=1). In the reference scenario, whilst an overall decline is expected in the European Union, many countries would experience an increase. In Sweden and United Kingdom, which stand out with relatively high immigration and fertility levels, the labour force size in 2060 would overtake the size in 2015 by more than 10%. At the opposite end, the decline of the labour force would be more drastic in most Eastern Europe countries as well as in some Western Europe nations with low fertility such as Portugal, Spain, and Greece, where the labour force size in 2060 would be less than 80% of its size in 2015.

Figure 5 – Projected labour force size in 2060 by country, reference scenario (2015=1)



Source: Authors' calculations

Figure 6 – Projected labour force dependency ratio in 2015 and 2060 (reference scenario)



Source: Authors' calculations

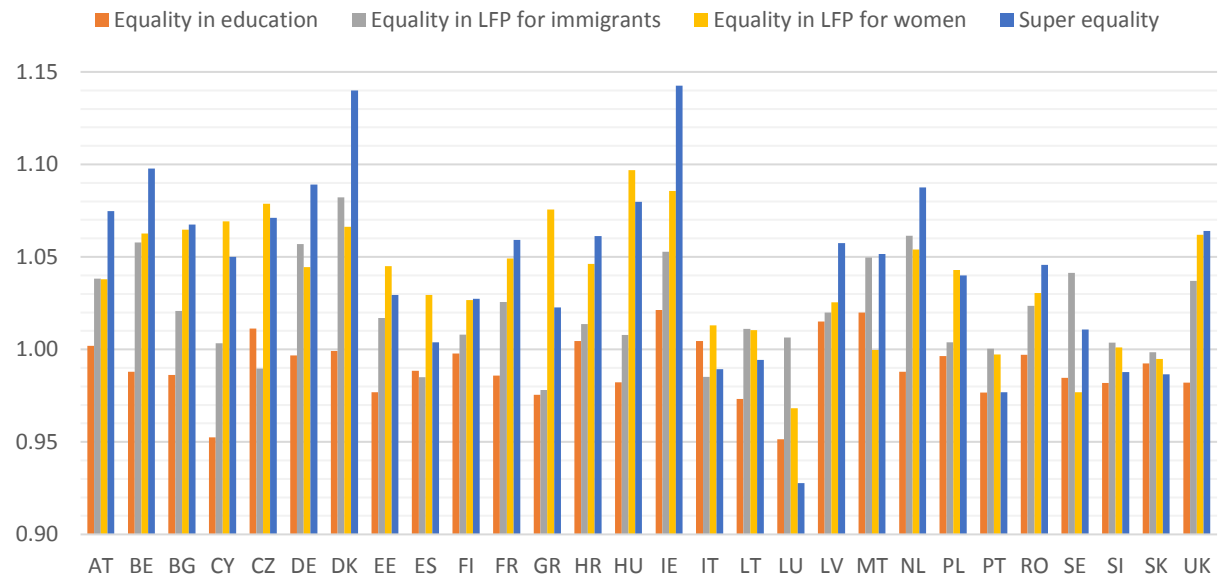
Similarly, due to variations in the pace of population aging and in trends in educational attainment, projected LFDR also vary by country. In figure 6, we see that overall, in 2015, many countries had a ratio close to 1, meaning that there were about as many workers as inactive people. As population aging will continue in Europe over the coming decades, the projected LFDR for 2016 are higher than those observed in 2015 for all countries except Italy. Interestingly, Sweden is the only country which will still have more workers than dependents by 2060, as expressed by its ratio below 1. This is because of both their relatively high fertility and immigration rates and their high labour force participation rate. The LFDR will be much higher in low fertility and low mortality countries, such as Greece and Spain. In Eastern Europe where the fertility is also very low, an increase is offset by much lower life expectancy. In Italy, the expected sharp increase in female labour force participation rates and education of future cohorts are sufficient factors to curb the projected increases of the LFDR. In consequence Italy has the highest LFDR of all European countries in 2015, but can expect to see this ratio moving toward the European average with time.

Alternative scenarios are likely to shape the future, with country-specific outcomes varying according to sociodemographic dynamics. The scenario of equal education yields a higher labour force size and lower labour force dependency ratio in countries where the proportion of low educated mothers is higher, such as Italy, Cyprus or Luxemburg (Figure 7). The scenario of equal labour force participation for immigrants manages to improve significantly both indicators in high immigration countries such as Germany, Sweden or the Netherlands, or in a country where the labour force integration of immigrants is deficient, such as Denmark, while the same scenario produces few differences for countries with low immigration (Eastern European countries) or those where the labour force participation of immigrants is already high compared to natives (Southern European countries).

In most countries, the scenario assuming gender equality in labour force participation by 2050 is the one increasing the labour force size the most. The labour force size in this scenario is 5% and above higher than the reference scenario in many countries, namely Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, France, Greece, Hungary, Ireland, Netherland and United Kingdom. However, this scenario has no additional positive effect in countries where gender equality in labour force participation is already reached among the younger cohorts, such as Sweden. Since the cohort trend assumes that these women will keep their stronger attachment to the labour market as they age, for this country, the reference

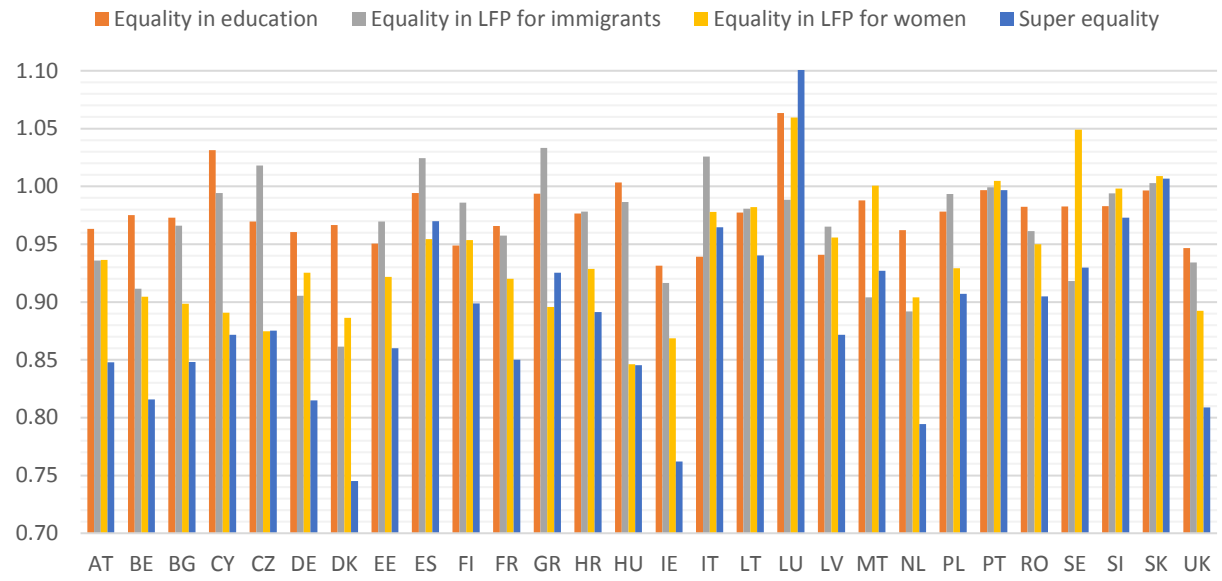
scenario yields similar labour participation rates for females in this scenario and in the gender equality scenario. In fact, since young educated women already have better participation rates than men in Sweden, a slightly negative effect is even observed. Finally, the scenario of super equality manages to drastically change the future labour force of many countries in the European Union. In Denmark, France, Hungary, Sweden and United Kingdom, the projected LFDR in 2060 for this scenario is below what observed in 2015, meaning that in these countries, removing inequalities in education and labour force participation could completely offset consequences of population aging. Overall, for 15 out of 28 countries, the expected increase of the LFDR between 2015 and 2060 would be reduced by more than 50%.

Figure 7 – Projected labour force size of alternative scenarios in 2060 (Reference scenario = 1)



Source: Authors' calculations

Figure 8 – Projected LFDR of alternative scenarios in 2060 (Reference scenario = 1)



Source: Authors' calculations

Discussion and conclusion

Population aging is a destiny in large part driven by past demographic behaviors, but its anticipated consequences in terms of labour force size and labour force dependency ratio may be avoidable. Indeed, although demographic variables, as major drivers of individual economic activity, lead to an increase of the share of elderly, other factors push in the opposite direction, such as an improvement of educational attainment across cohorts and higher participation of women. In addition, many inequalities remain in labour force participation and access to education, as many groups are under-represented among workers. In this paper, we showed that eliminating these inequalities are likely to have significant impact on the consequences coming from population aging. When the three types of inequalities analyzed in this paper are equalized to the higher levels of other groups, namely no inequalities in education for children from low educated mothers and those with a foreign cultural background, inequalities for immigrants in labour force participation and inequalities for women in labour force participation, the expected decline in the labour force size is reduced by 45%, while the expected increase in the labour force dependency ratio is narrowed by 66%. Such a scenario would seriously change the fiscal consequences of population ageing.

Among major inequalities, making gender disparities disappear would have a significant effect on the workforce in most countries. Our scenario where female participation rates reach those of men by 2050 would allow many countries to avoid the decline of their workforce and strongly reduce projected increases in the labour force dependency ratio. Gender parity in labour force participation is not unrealistic. Indeed, parity is already reach among young cohorts in some countries such as Sweden. Researches showed that labour market institutional factors and policy instruments such as childcare subsidies, parental leave, or tax incentives for sharing market work between spouses are likely to have a

positive impact on female participation (Jaumotte 2003; Cipollone, Patacchini, and Vallanti 2014; Esping-Andersen 2009). In keeping with our projections, public policies facilitating the labour force participation of women could thus be a major tool to deal with the consequences of population aging.

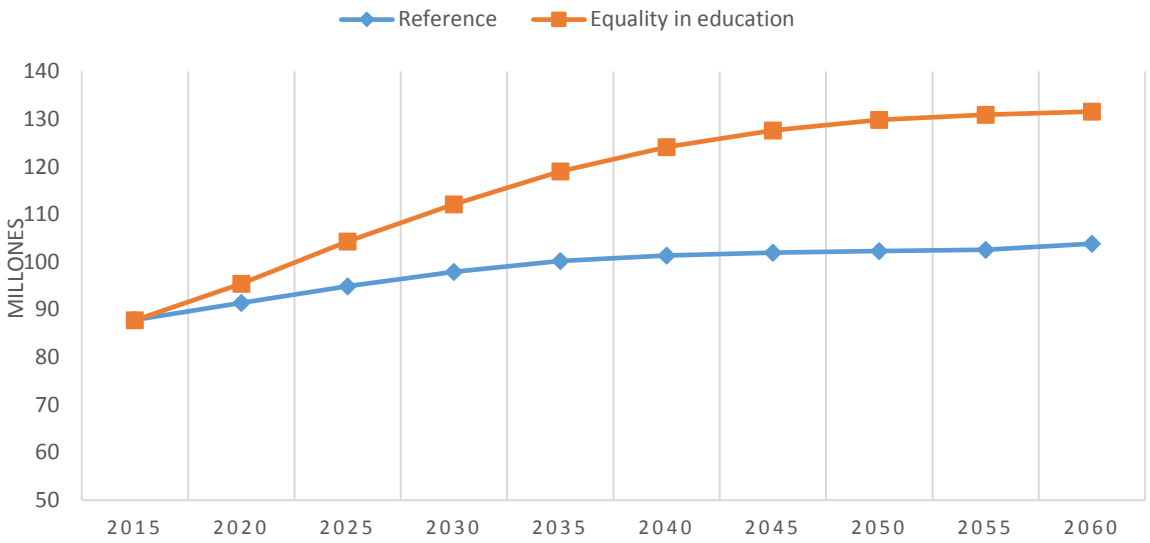
In most countries, reducing inequalities in education, though improving the LFDR in the medium run, plays a more limited role on future labour force size, because people with high education tend to have less children (Bongaarts 2001; Kohler, Billari, and Ortega 2006; Becker and Lewis 1973). While some empirical researches find a positive relationship between education and the desired fertility (Frank Heiland, Prskawetz, and Sanderson 2008; F. Heiland, Prskawetz, and Sanderson 2005), other socioeconomic and contextual factors explain the situation, such as fertility postponement due to longer education, higher lifetime celibacy for educated women, more career opportunities leading to additional postponement of childbearing, increasing opportunity costs when the income is higher, and different expectations in the cost of kids (Kohler, Billari, and Ortega 2006; Bongaarts 2002; Morgan and Rackin 2010). Regarding this mismatch, if policies could improve gender equality in households and the work-family balance to allow educated women to have the number of kids they desire, we could expect a more positive impact on the future labour force. (Oppenheimer 1994; McDonald 2000).

Looking at a different subject, this paper covered labour force participation, without considerations for the productivity, earnings or employment. This question is particularly central to the topic of the economic integration of immigrants. Although Southern European countries yield similar outcomes for immigrants and natives in terms of labour force participation rates, these countries still face several issues in economic integration of immigrants regarding income, quality of jobs, or overqualification (Fullin and Reyneri 2010; Reyneri and Fullin 2011). On the other hand, some have found that a generous welfare state and strong labour market regulations are likely to decrease participation rates of low-skilled immigrants (such as in Denmark), probably because their incentive to work become lower, while immigrants and natives yield similar outcomes in terms of labour force participation and employment in more liberal countries such as the USA (Blume et al. 2007; Hansen and Lofstrom 2003; OECD 2016b). However, in any cases considerable differences remain when looking at poverty rates or earnings. In other words, though the labour force participation rate and employment are obviously important facets of the economic integration of immigrants, public policies attempting to address economic integration should also consider indicators related to earnings. In any case, as our scenario of equality for immigrants in labour force participation leads to a significant positive impact on both the labour force size and the LFDR, our results suggest that any immigration policies should put a strong emphasize on the economic integration in order to maximize the contribution of immigration to the fiscal balance.

Concerning the equality in education scenario, other economic indicators also need to be considered for a broad evaluation of economic consequences. Indeed, some argue that the fiscal impact of a decline of the labour force size could be cancelled by an increase of the overall productivity (Börsch-Supan Axel 2003; Lee and Mason 2010; Ludwig, Schelkle, and Vogel 2012). Because, education is highly correlated with productivity, the scenario of equality in education, although having few impacts on the labour force size, could nevertheless sharply improve the general economic situation of the EU. In figure 8, we showed the projected number of workers with a high level of education in this scenario, compared to the reference scenario. The equality in education scenario yields a sharp increase of 50% in the number of high educated workers, compared to only 18% in the reference scenario, thus significantly changing the educational profile of the future labour force. Consequently, although not dramatically changing the size of the labour

force, this scenario could improve the economic outcomes of workers, which may be a good asset in counterbalancing the economic effect of population aging.

Figure 9 – Projected labour force with high education in EU28, 2015-2060



Source: Authors' calculations

Many governments have cut social programs in the past decades as an answer to economic crisis or systematic deficit. These austerity measures are however likely to affect the labour force participation of some sub-populations, such as women through cuts in work-family conciliation or child-caring (Karamessini and Rubery 2014), or immigrants through cuts in training (McHugh and Challinor 2011). In light of our projections, these short-term measures to balance budgets could have negative long-term effects on the fiscal balance if they increase inequalities in labour force participation. In other words, public spending into social policies seeking to reduce inequalities could be seen as a long-term investment rather than an expense.

Although population aging is a demographic certainty, its broad consequences including increasing of the labour force dependency ratio, are also driven by other components. This paper showed a policy-oriented use of microsimulation population projections. Indeed, the model used, CEPAM-Mic, allows the simultaneous projection of several socioeconomic and ethnocultural dimensions and their interaction. Nowadays, many inequalities remain when looking at the labour force participation, especially for women, immigrants, those with low educated mothers, or those with a foreign cultural background. The alternative scenarios developed for this paper went beyond traditional demographic scenarios using variants of assumptions on fertility, mortality and migration. The 5 scenarios presented in this paper have the same demographic assumptions, but differ in assumptions on labour force participation and educational attainment for the subgroups mentioned above. We showed that reducing inequalities in labour force participation and education could lessen the decline of the labour force size and significantly narrow the increase in the labour force dependency ratio driven by unavoidable population aging.

This paper pointed out some of the subgroups still affected by comparatively lower labour force participation and educational outcomes, and showed how increasing their standing would impact the

future labour force in the European Union, but it did not investigate how reaching these objectives would be possible. Thus, we argue in favor of further studies to investigate mechanisms driving inequalities and how public policies are likely to narrow them, rising outcomes to the higher levels observed among other subgroups within the population.

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