The effects of international migration on the pension systems in Europe

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ABSTRACT: Ageing of populations in Europe is a well-known and ever-increasing process, so the pressure on pension systems becomes more and more acute in some European countries. International migration contributes to population dynamics in both origin and destination countries, easing or aggravating demographic problems. It is well known that in Europe the increase in migration flows is not enough to compensate for the population-ageing process and its negative consequences. Based on a data set of macroeconomic indicators for all EU member states and using panel data analysis, this article discusses the effects of some socio-economic indicators on the pension systems in selected European countries, the focus being on international migration. The current analysis is a follow-up on a previous approach that clusters the EU countries with respect to migration flows into EU/EFTA periphery-sending and centre-receiving countries. The central hypothesis in the paper is that the pension systems are affected by international migration (measured as the crude rate of net migration) and that a high level of emigration leads to a higher pressure on the pension system. The hypothesis was tested using panel data analysis for the period 2004–2013. The analysis was conducted for both the total sample and the two clusters (EU/EFTA centre-receiving countries and EU/EFTA periphery-sending countries), excluding Switzerland, Cyprus, and Iceland. The following indicators were selected for the state, society and economy sectors as they are the most relevant: average wage, adult education level, Gini Index, Human Development Index, urban population, median age, expenditure on pensions. The results showed that a higher ratio of immigrants leads to a decreased pressure on pension expenditure in centre-receiving countries, while for the periphery-sending countries, a great part of the emigrants consists of working people who leave their home countries and stop contributing to the pension system. The adult education level was found to have a similar effect on the expenditure on pensions in both clusters. The average wage had opposite effects for the two clusters: in the centre-receiving countries it has negative effects as a higher ratio of immigrants leads to a higher pressure on the labour market, whereas in the sending-periphery countries emigrants are mostly unemployed and, as a consequence, reduce the pressure on the labour market.

Introduction

The European population is ageing and this is a well-known and ever-increasing process. As a result, there is growing pressure on the pension systems of some European countries. Classical migration theories have long described migration in relation to youth and health. Lately, two kinds of mobility have been identified in relation to the pension systems: both youth and pensioners on the move. Usually, young people move from a low-income to a high-income country, while pensioners show different migration patterns.

Despite strong incentives, cross-border mobility of youngsters in Europe is still relatively low. The paper focuses on the cross-border mobility of young European people within the framework of the Horizon 2020 research project: MOVE "Mapping mobility – pathways, institutions and structural effects of youth mobility in Europe". The central questions of MOVE are how the mobility of young people can be favourable for both the socio-economic and the individual development of young people, and which are the factors that foster/hinder such beneficial mobility. The paper is based on a macro-economic analysis conducted in work package 2 of the MOVE project "Sampling and secondary analyses of macro data of youth mobility in Europe and the partner countries", which was presented in the final work package report (Hemming, Tillmann, Reißig 2016).

Concerning the dynamics and the changing patterns of mobility and youth mobility in EU28/EFTA countries we examine the clusters identified in the final work package report: EU/EFTA centre-receiving countries (Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, The Netherlands, Sweden, and the United Kingdom), EU/EFTA periphery-sending countries (Bulgaria, Croatia, Czech Republic, Estonia, Greece, Hungary, Latvia, Lithuania, Portugal, Poland, Romania, Slovakia, Slovenia, and Spain) and EU/EFTA outlier countries (Luxembourg and Norway). The clusters are in accordance with the centre and periphery model proposed by Wallerstein (1979, 1991). According to Manafi, Marinescu, Roman and Hemming (2017), when testing the stability of clusters over time, Spain switched the first cluster with the second one as a consequence of the economic crisis and the resulting increase in youth unemployment and reduction in GDP per capita (see also Éltető 2011). The results are also in line with Kahanec and Zimmermann (2010), proving that high rates of youth mobility could be explained by a set of push and pull factors. This paper aims to analyse the effects of migration and some socio-economic indicators on pension systems in Europe considering all countries in the first two clusters (excluding the outliers and small countries).

The novelty of the paper lies in testing the effects of migration and selected socio-economic indicators on the European pension systems in a dynamic approach covering the period 2004–2013.

The paper is structured as follows: We start with describing the state of the art in the theoretical approaches regarding the effects of (youth) mobility

on the pension systems. The following section presents the methods applied, the research hypotheses, the indicators and statistical procedures used. Descriptive statistics are presented, followed by the synthetized results and the conclusions in the last section.

Literature review

Due to the great economic diversity of the European Union countries, pensioners usually migrate to the south of Europe in search of countries where their standard of living would be higher due to augmented purchasing power (Toyota, Böcker, Guild 2006). Aubarell and Aragall (2005) proved that increased economic migration leads to an "asymmetry of social benefits", because a large and increasing number of active immigrants contributes disproportionately to funding pensions. In this context, differentials in the net benefits from public pensions, along with other policies (income taxes and public service provisions) could alter the payoff to migration in terms of influencing the international allocation of labour. Some countries may choose to tailor their fiscal policies by selecting immigrants with favourable attributes and encouraging emigration of households with unfavourable attributes (Wildasin 1999).

Razin and Yuen (1999) and Razin and Sadka (2000) proved the existence of an initial gain in pension affordability because of taxes paid when considering a one-off inflow of working-age migrants with children in a two-generation model. They found no effect in future years because the descendants of immigrants will cover the pension costs of their parents. When return migration of the descendants is considered, the opposite could happen (Krieger 2008). When public pension benefits are fixed and immigration therefore eases the tax payments on younger generations required to finance them, the conclusion is that immigration is likely to be favoured by the young, but not by the old (Scholten, Thum 1996). On the other hand, when contributions are fixed and immigration increases the pensions instead, we come to the opposite conclusion, namely that immigration will tend to be favoured by the old rather than the young (Razin, Sadka 2000; Kemnitz 2003). Krieger (2008) explores cases when pension benefits are flat or earlier-income related, concluding that this is less important from the migration perspective.

In a dynamic setting (Preston 2014), immigration may make public pension provision cheaper or, thinking in terms of individual budget constraints, make later consumption more attractive, which may motivate people to opt for higher-benefit pension schemes. More recently, Aubry and Crawford (2016) studied how public pension funding affects the choice of destination, concluding that while economic factors and the distance between locations are the primary drivers of migration, state pension funding also plays a role.

Hypothesis, methods and data

The central hypothesis that is tested in the paper is that pension systems are affected by international migration (measured as the crude rate of net migration) and, more specifically, that a high level of emigration leads to a higher pressure on the pension system.

The data basis for the panel analysis was compiled during the MOVE project in a Scientific Use File (SUF) named "Youth mobility macro data for Europe" (Hemming, Tillmann, Reißig 2016), consisting primarily of Eurostat (see Annex 1), OECD (2014) and World Bank (2016) data. The MOVE-SUF file included 31 country-cases (EU-28 and 3 EFTA countries: Switzerland, Iceland and Norway), covering a 10-year period (2004–2013).

For the panel analysis the most relevant indicators for the state, society and economy sectors were selected according to the heuristic macro-theoretical model on youth mobility (for a detailed description of the indicators see Annex 1):

- Economy: average wage;
- State: adult education level, Gini index;
- Society: HDI, urban population, infant mortality rate, median age, expenditure on pensions.

In addition, the "crude rate of net migration" indicator was included in the analysis. This indicator was not included in the MOVE-SUF File (see Annex 1 for more details).

The fixed-effects method was applied to the panel data (see also Hemming, Tillmann, Reißig 2016). When analysing the impact of changing variables over time a model should be used that explores the relationship between predictors and outcome variables within an entity. It is assumed that something within the individual may impact or bias the predictor or outcome variables, the rationale behind the assumption being that there is a correlation between an entity's error term and the predictor variables.

With the fixed-effects model, the effect of the time-invariant characteristics is eliminated, so one can assess the net effect of the predictors on the outcome variable. Another important assumption of the fixed-effects model is that the time-invariant characteristics are unique to the individual and should not be correlated with other individual characteristics. Each entity is different, therefore the entity's error term and the constant (which captures individual characteristics) should not be correlated with those of other individuals.

The following strategies were applied (see also Hemming, Tillmann, Reißig 2016):

- First, a correlation analysis was performed excluding all variables with strong correlation coefficients.
- The assumption for applying regression analysis is that normality can be assumed.

- Multicollinearity was tested with the variance inflation factor (VIF). In the final analysis for all indicators, VIF values were below 10.
- When interpreting the results, significance levels (p-values) of t-statistics were not considered because no random sample of the population was used, the total of all EU/EFTA countries being examined in the analysis instead.
- For two variables (expenditure on pensions and average wage) log-transformation of the data was applied. For these variables, the partial regression coefficients can be interpreted as being an "elasticity score".
- As the panel models were mainly affected by the within-country effects (as 10 datasets were included per country), the R^2 (expressing the total variance of the dependent variable explained by the independent variables included) is expected to be rather high and its explanatory power should be interpreted with caution.
- Missing data were not imputed, because the GRETL software can carry out the analysis without them.

The model (Figure 1) defines the log-transformation of the expenditure on pensions (as per cent of GDP) as the dependent variable. It also includes the potential influence of some other socio-economic variables on the dependent variable: infant mortality rate (a high infant mortality rate leads to higher expenditure on pensions as per cent of GDP); Human Development Index – HDI (it is more likely to find elderly people in a country with a higher HDI, thus the expenditure on pensions will be higher); the ratio of young people in the total

Figure 1: Background model for the effects of international migration
on the expenditure on pensions
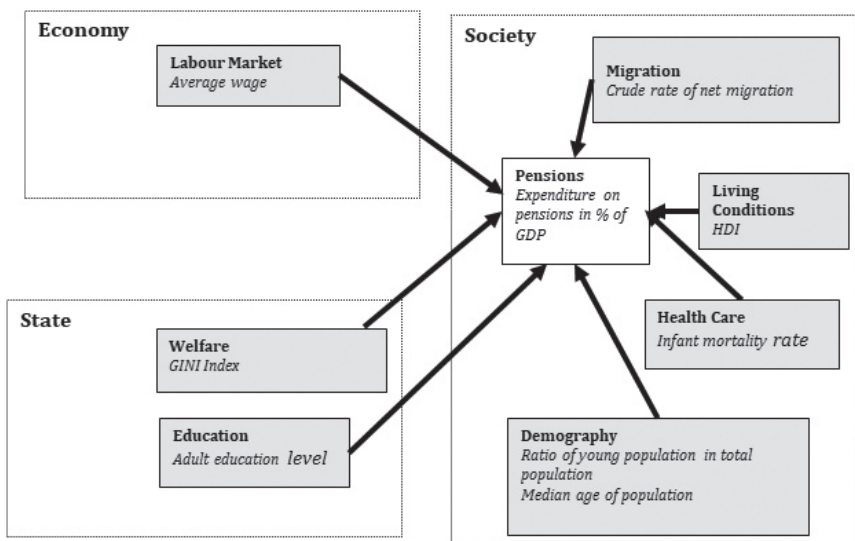
population (a large ratio of young people in the total population decreases the pressure on the pension system and also decreases the expenditure on pensions); median age of population (a lower median age means a bigger active population and a smaller number of old people, meaning a lower expenditure on pensions); average wage (a higher average wage might cause more old people to postpone their retirement, and thus the expenditure on pensions would decrease); Gini index (a higher value of this index could indicate a high number of old people and, therefore the expenditure on pensions could be higher); adult education level (with more people completing higher education without working, the contribution to pension funds is lower, meaning that the pressure on the pension system is higher; but then again, more educated people remain active for a longer period of their life, postponing their retirement; therefore, the expenditure on pensions decreases, except if the system includes NDC pensions). Finally, the model includes the crude rate of net migration (a higher rate of net migration could lead to a lower pressure on the expenditure on pensions).

Descriptive statistics

A summary of the descriptive statistics is presented in the Table 1.

The highest and the lowest HDI correspond to the same countries (Austria and Great Britain, respectively), in each year considered.

Regarding skewness values, average wage shows a normal distribution across the 23 countries for the whole 2004-2013 period. The highest increases in 2013/2004 were registered in Estonia (29%), Slovakia (25%) and Norway (25%) and the highest decreases were in Greece (by almost 17%), Great Britain (by almost 3%) and Portugal (by almost 3%).

During the period of 2007-2014, the infant mortality rate showed a downward trend in all EU countries, except for Denmark and Sweden, where the rate was close to zero. The highest ratios were found for Romania and Bulgaria and the lowest for Cyprus.

In 2013, the highest share of expenditure on pensions was observed in Greece (16.7) and Italy (16.5), whereas the lowest shares were found in Ireland (6.8) and Lithuania (7.2). In almost all countries analysed the trend was ascending, except for Germany and Poland, while in Hungary the share fluctuated over time.

Results of the panel analysis

To test the hypothesis of this study, panel data analysis using GRETL software was performed for the 2004-2013 period. The analysis was conducted for both

Table 1: Summary of descriptive statistics*

Variables	Mean in 2007	Mean in 2014	General trend	Countries with low ratios	Countries with high ratios
Adult education level	25.4***	31.1***	Increasing	Portugal, Italy	Luxembourg, Great Britain
Average wage (expressed per year)***	37222	38328**	Increasing	Czech Republic, Slovakia	Luxembourg
Crude rate of net migration	3.4	1.3	Varying	Cyprus, Lithuania	Luxembourg, Germany, Norway
Expenditure on pensions	9.32	10.95**	Increasing	Romania, Lithuania, Slovakia	Italy, Greece, Austria
Gini index	29.4	30.1	Small increase	Scandinavian countries, Belgium, Czech Republic	East European Countries and Spain
HDI	0.849	0.860**	Small increase	Romania, Spain, Slovakia, Great Britain	Austria, Belgium
Infant mortality rate	4.68	3.81**	Decreasing	Scandinavian countries	Romania, Bulgaria, Malta, Slovakia
Median age	39.29	41.25**	Increasing	Slovakia, Luxembourg, Norway	Italy, Denmark

* Switzerland and Iceland were excluded from the analysis because of missing data. ** Values registered in 2013. *** Missing data for 8 countries.

the total sample and the two clusters (EU/EFTA centre-receiving countries and EU/EFTA periphery-sending countries), excluding Switzerland, Cyprus, and Iceland. Switzerland and Iceland were excluded because of missing data. Cyprus was excluded according to the convention on macro-analyses in research on poverty, suggesting that countries with a small number of inhabitants should not be included (Sachs 2005).

This model studies the potential influence of net migration (as the crude rate of net migration plus adjustment) on the expenditure on pensions (as % of GDP), while adjusting for effects of selected socio-economic indicators such as the Gini index, average wage, adult education level, infant mortality rate, ratio of young people in total population, median age and HDI. The results of the panel analysis are summarised in Figure 2. The detailed results are presented in the Annex 2.

The summary of the results shows that the models for the total sample explain nearly 75% of the total variance, whereas those for the single clusters explain over 80% of the total variance for the centre-receiving countries and

almost 70% for the periphery-sending countries, reflecting the differentiation between the clusters and supporting the centre-periphery approach (Wallerstein 1979, 1991). Moreover, the crude rate of net migration has negative effects on the expenditure on pensions in both clusters. A higher ratio of immigrants leads to a lower pressure on pension expenditure in centre-receiving countries, while for the periphery-sending countries, a great part of the emigrants consists of working people leaving their home countries and stops contributing to the pension system. The hypothesis regarding the interaction is true – for both the periphery-sending and the centre-receiving countries.

Only the adult education level has a similar effect on the expenditure on pensions in both clusters. The average wage, however, causes opposite effects for the two clusters: for the centre-receiving countries it has negative effects, meaning that a higher ratio of immigrants leads to a higher pressure on the labour market, whereas in the periphery-sending countries the emigrants are in general unemployed, thus reducing the pressure on the labour market. On the total sample, the effects are positive. The infant mortality rate has positive effects on the expenditure on pensions in both clusters and for the total sample. There are two types of interaction for the two clusters: 1. an increasing ratio of the young population leads to a decreasing expenditure on pensions in the centre-receiving countries, while in the periphery-sending countries the same indicator goes up; 2. a higher Gini index is associated with lower expenditure on pensions in the centre-receiving countries, the effect being positive for the periphery-sending countries and for the total sample.

Figure 2: Panel analysis illustrating the effects of mobility and other indicators on expenditure on pensions (as % of GDP) for two clusters (EU/EFTA center-receiving countries are marked with white, EU/EFTA periphery-sending countries with light grey) and total sample (EU/EFTA total – marked with dark grey), cross-sectional data sets
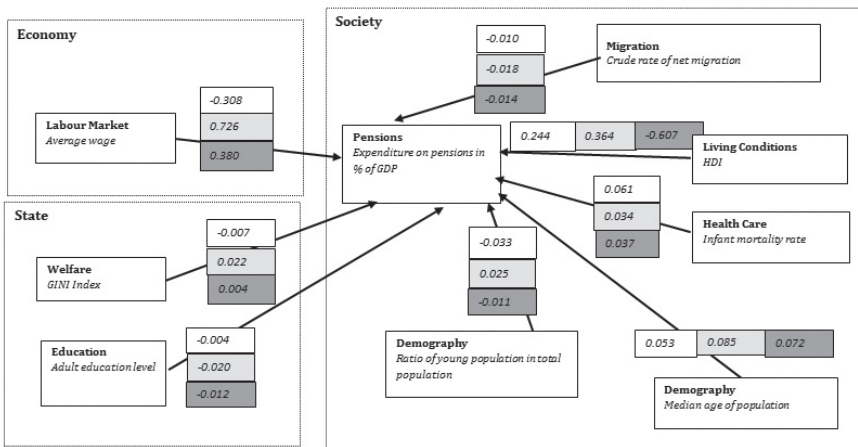
Conclusions

The International Migration Outlook (OECD 2014) reported that international migration increased in some European countries (Germany, Sweden, France and Finland) during 2011–2012. In other EU member states like Great Britain, Spain or Italy the trend was declining over those years. The most stable migration category was family migration, but its trend is slightly descending compared to the 2008–2011 period. Similar conclusions regarding the increasing number of migrants and the migrants' preferences for high income countries were drawn in an International Migration Report (UN 2016). Among the top twenty countries in the world hosting the largest number of international migrants, Germany occupied second place in 2015 (and third place in 2000), Great Britain fifth, France seventh, while Spain and Italy held the 10th and 11th place respectively. The migrants' median age has been slowly increasing, from 38 years in 2000 to 39 years in 2015, most of the international migrants being of working age. The same report shows that between 2000 and 2015, Romania and Poland saw a rapid growth in the size of their diaspora population (7.3% per annum for Romania and 5.1% per annum for Poland).

It is a well-known fact that international migration contributes to population dynamics both in origin and destination countries, easing or aggravating demographic problems. Regarding Europe, the increasing migration flows are not enough to compensate for the ageing population process and its negative consequences.

In this light, the crucial objective of the paper was to assess the potential influence of net migration and other socio-economic variables on the pension systems across Europe. The database for the entire analysis was compiled with several socio and macroeconomic indicators referring to a ten-year period (2004–2013). Using previous results clustering the European countries into centre-receiving and periphery-sending countries, the panel analysis was performed for each of the clusters and for the total group of countries. Of course, it is difficult to rigorously assess the relative importance of each of the independent variables, but, with some reservations, the results corroborate other research findings.

As stated above, most of the hypotheses have been confirmed. For the countries grouped into EU/EFTA centre-receiving countries, the infant mortality rate, HDI and the median age of population have a positive influence on the expenditure on pensions, while the ratio of young population to total population, the adult education level and the average wage have the opposite effect. Also, for these countries, the crude rate of net migration has a negative impact on the same dependent variable, meaning that the higher the rate of migration, the lower the expenditure on pensions (as % of GDP). This is not surprising if we look at the figures – the majority of the immigrants are of

working age and contribute to an increasing GDP in the destination countries, easing the pressure on the pension system.

The second cluster, EU/EFTA periphery-sending countries, exhibits a different pattern. For countries belonging to this cluster, the crude rate of migration is negative (for almost every year analysed), showing that more people left the respective country and moved to another country. With only one exception (the adult education level), all the independent variables exert a positive influence on the expenditure on pensions (as % of GDP), but each to a different extent.

On the total sample the average wage, Gini index, the median age of population and the infant mortality rate have positive effects on the expenditure on pensions, whereas the Human Development Index, the adult education level, the ratio of young people to the total population, and the crude rate of net migration have negative effects.

In this case mobility of people is "good" both for the socio-economic and the individual development, reducing the pressure on the expenditure on pensions.

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Annex 1. Information on the macro indicators included in alphabetical order

Variable Label	Source	Unit
Adult education level (tertiary, % of 25–64 years-olds)	OECD (https://data.oecd.org/eduatt/adult-education-level.htm)	%
Average wage (total, US dollars)	OECD (https://data.oecd.org/earnwage/average-wages.htm)	USD
Crude rate of net migration plus adjustments	EUROSTAT (http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&plugin=1&pcode=tsdde230&language=en)	%
Expenditure on pensions (% of GDP, current prices)	EUROSTAT (http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=tps00103&plugin=1)	%
Gini coefficient of equivalised disposable income	EUROSTAT (http://ec.europa.eu/eurostat/tgm/table.do?tab=table&plugin=0&language=en&pcode=tessi190)	–
Human Development Index Version 1 (status quo from 15th August 2015)	UN (http://hdr.undp.org/en/content/table-2-human-developmentindex-trends-1980-2013)	–
Infant mortality rate (ratio per 1000 live births)	EUROSTAT (http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=tps00027&plugin=1)	%
Median age of population	EUROSTAT (http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=demo_pjanind&lang=en)	%
Population by age group (15 to 29 years, % of total population)	EUROSTAT (http://ec.europa.eu/eurostat/data/database Population and social conditions-> Youth)	%
Population (total number)	EUROSTAT (http://ec.europa.eu/eurostat/tgm/table.do?tab=table&plugin=1&language= en&pcode=tps0000P)	persons

Annex 2: Results of the panel analysis for two clusters and total sample

Model	Dependent Variable: Expenditure on pensions (as % of GDP)					
Clusters	Independent Variables	Coefficient	p-value	VIF test	Other characteristics	
EU/EFTA	Human Development Index	0.244	0.0073	2.021	R²	0.812
centre-	Ratio of young people	-0.033	<0.0001	5.452	(adjusted)	
receiving	Infant mortality rate	0.061	<0.0001	1.690	Durbin–	0.068
countries	Median age of population	0.053	<0.0001	5.132	Watson	
	Gini index	-0.007	<0.0001	1.202	statistic	
	Adult education level	-0.004	<0.0001	2.786		
	Average wage	-0.308	<0.0001	2.985	RHO	0.966
	Crude rate of net migration	-0.011	<0.0001	1.283		
EU/EFTA	Human Development Index	0.364	0.0141	1.774	R²	0.756
periphery-	Ratio of young people	0.025	<0.0001	7.520	(adjusted)	
sending	Infant mortality rate	0.034	<0.0001	3.242	Durbin–	0.980
countries	Median age of population	0.085	<0.0001	8.148	Watson	
	Gini index	0.022	<0.0001	1.322	statistic	
	Adult education level	-0.020	<0.0001	1.356		
	Average wage	0.726	<0.0001	3.345	RHO	0.452
	Crude rate of net migration	-0.018	<0.0001	1.799		
Total	Human Development Index	-0.607	<0.0001	1.105	R²	0.695
	Ratio of young people	-0.011	0.0020	5.465	(adjusted)	
	Infant mortality rate	0.037	<0.0001	1.729	Durbin–	1.178
	Median age of population	0.072	<0.0001	3.889	Watson	
	Gini index	0.004	<0.0001	1.052	statistic	
	Adult education level	-0.012	<0.0001	1.713		
	Average wage	0.380	<0.0001	3.128	RHO	0.218
	Crude rate of net migration	-0.014	<0.0001	1.469		