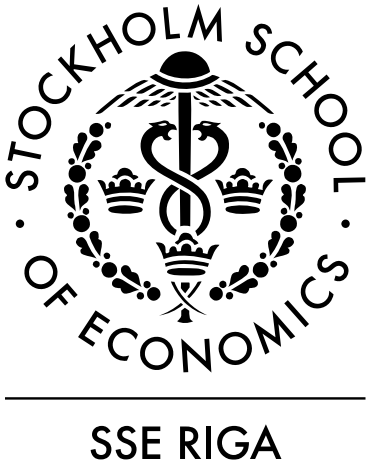

Bachelor Thesis

Population Age Structure in the EU-28: Implications for Gross Domestic Savings and Current Account

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Abstract

Demographic ageing has become an important issue as the baby-boom generation is getting older and the working age population does not keep increasing at the same pace. In this context, our research addresses the issue from the perspective of gross domestic savings and the current account of a country. The aim of this paper is to examine the impact of the population age structure of the EU countries on the gross domestic savings and current account balance trend. The analysis covers a period of 21 years (1995-2015) for 28 European Union countries. Gross domestic savings and the current account balance were estimated by applying panel data regressions, which is the most appropriate econometric model as suggested by previous empirical research. Other economic and financial factors that determine the gross domestic savings and current account balance of a country were analysed together with age-related variables. The study identified a negative impact of old age dependency ratio on savings, and a positive relation between age dependency ratios and the current account balance, the second relation being potentially explained by a larger negative impact on investments from the ageing population.

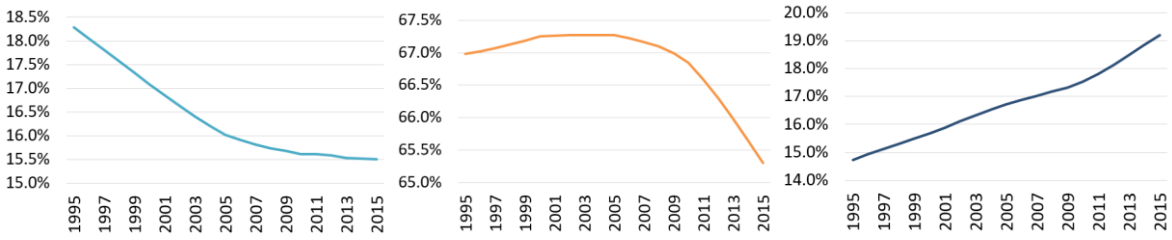
Keywords: *Gross domestic savings; Current account balance; Ageing; Demographics; Age dependency ratio; Panel regression.*

Table of Contents

1. Introduction

The ageing population has been a prevailing phenomenon in numerous countries around the world manifested by significant upward changes in the old dependency ratios due to the simultaneous ageing of the baby boom generation and a downward tendency in the young dependency ratio caused by lower fertility ratios (Brooks, 2003) (United Nations, 2015). World Bank (2017) dataset confirms that for most of the EU countries the birth rate has decreased over the last decades, while only a few of the EU countries experienced a low birth rate growth or a constant level. The share of the three age categories (0-14, 15-65, 65+) has changed significantly in the EU countries over the 21 years analysed. The weight of the 0-14 years old category dropped from 18.29% in 1995 to 15.5% in 2015 while the 15-64 age group shrank from 66.98% to 65.30% (see Figure 1A, 1B). The last age group, 65+, displayed an upward movement, increasing with almost 5 percentage points (from 14.73% in 1995 to 19.19% in 2015) (see Figure 1).

Figure 1. Evolvement of age groups in the EU-28 over 1995-2015.



A) Age group 0-14 / Total **B)** Age group 15-64 / Total **C)** Age group 65+ / Total

Source: Created by the authors using data from (World Bank, 2017)

Equally important, when looking at future trends and forecasts, Eurostat (2013) predicts that the EU will face a high old dependency ratio towards the end of the 21st century. Moreover, according to Długosz (2011), Germany and Italy will be the countries with the highest ratio of old population (over 65 years) to young population (under 15 years) by the middle 2050. Among the European countries that are expected to face the most rapid ageing process are Latvia and Estonia (Długosz, 2011).

Thus, the ageing population has become a topical problem for the healthcare system, pension system, taxation, and labour force structure, affecting many macroeconomic indicators. One of the most important economic effects of an ageing population is its influence on the total national savings. Hence, it is worth analysing how the rise in the

proportion of the elderly has affected savings, both public and private, as well as the current account balances since it equals to savings minus investments.

This topic is of interest, since savings are important for the future economic growth and welfare of a country, as proven by the neoclassical Solow growth model. Per this model, decreasing savings leads to a lower steady state level of capital, meaning that there will be less output and a lower GDP growth in the economy due to lower capital availability which is caused by poor investments (Solow, 1956). Empirical research on a large sample of countries using Solow growth model supported the fact that higher savings rate and lower population growth countries tend to be wealthier (Mankiw, Romer, & Weil, 1992). Economists have always been concerned with the determinants of welfare. Demographics have been vastly researched as being one of them because the age structure of the population has a direct impact on the savings rate. In the context of an ageing population in Europe and decreased savings as it was empirically proven by Gudmundsson and Zoega (2014), and Higgins (1998), it is likely that investments exceed savings, which would lead to a negative current account in future. A negative current account is not sustainable in the long run and it could create another problem for the European countries on top of reduced savings.

Novelty: Several research papers have been studied to come up with a general understanding of what has already been discovered in the ageing population - savings and current account framework and the gaps that are still to be covered (see Appendix A). We realised that there has been little research in the field of savings, current account, and ageing population relationship carried out in Europe in the recent years. Furthermore, we consider that this topic is imperative since ageing is a problem of great relevance for the public spending and savings of the EU. The aim of this paper is to fill this gap by researching the EU countries altogether and analyse how the ageing population has impacted savings and the changes their current accounts experienced throughout the period 1995 - 2015. We want to create an integrated work on the EU-28 and come up with results, conclusions, and recommendations for what should be done to alleviate the negative effects of ageing population on economic growth. Our results should be of interest to policy makers and governmental institutions. We aim to bring a contribution to the existent research and provide novel insights about the impact of the ageing population while intending to answer the following **research questions**:

RQ1: How have the gross domestic savings responded to the ageing population across the European Union countries in the period 1995-2015?

RQ2: How has the current account balance changed as a result of the ageing population across the European Union countries between 1995 and 2015?

This paper comprises eight sections. The next section summarises the previous empirical and theoretical findings on savings and current account estimation and presents their determinants and their economic importance. Section 3 reviews the selected methodology and makes the reader familiar with the dataset that was used. The obtained results are presented and discussed in section 4, while section 5 deals with robustness check. Section 6 presents the limitations of this research, section 7 provides policy suggestions and the last section concludes.

2. Literature Review

2.1 Motivation: Why are savings important for economic growth?

The ageing of population in the European Union countries has been an important trend in demographics over the past decades. What stays behind this trend are the increasing life expectancy at birth and decreased fertility and birth rates, which will affect the EU and world economy for the decades to come (Lee, 2003). For instance, in Latvia, the proportion of population aged 65+ increased from 13.7% in 1995 to 19.4% in 2015, but the highest rise was observed in Malta, where it went up from 10.76% to 19.25% in the same period (World Bank, 2017). Also, the European average of birth rates per 1000 people decreased from 11.18 in 1995 to 10.24 in 2014 (World Bank, 2017). Thus, both ageing and decreasing birth rates have been meaningful phenomena in European Union's demographic trends and will remain topical for the next periods.

The impact of demographics on savings is incontestable, being mostly reflected through the participation of the population in the labour market. The increase in the proportion of the elderly in a society leads to a higher old dependency rate, meaning that people involved in the labour market will need to ensure the consumption of the elderly, which is rather large because of the health care expenditure needs (Guest & McDonald, 2001). Moreover, Chinn and Prasad (2003) concluded that demographics affect the current account via savings - the higher the proportion of the elderly, the greater the pressure on the productive population and the lower the savings.

On a global perspective, savings and investments are equal, but this is generally not the case for individual countries. In the short run, a country's current account surplus is transferred to the country that has a deficit, the general expectation being that the capital outflow will become a capital inflow later or vice versa. In the current context of an ageing population in Europe, saving rates are dragged down, which is thought to lead to current account deficits that are not sustainable in the long run. For instance, the current account deficit that is persistent in the US for decades is worrisome to policymakers, because the deficit cannot be maintained for much longer and the situation should be reversed. Therefore, the burden of the deficit is expected to fall on households any time in the future and there

could be restrictions on imports which, again, would harm particular categories of people (Cline, 2007). The same negative effects of a current account deficit could very likely be attributed to European countries, thus, the persistence of a negative current account over a longer period should be avoided because it is not sustainable. In a long time framework, the imports and exports of a country are co-integrated at a coefficient of 1, hence, the current account balance should be in equilibrium (Hassan, Hoque & Rao, 2015).

Feldstein and Horioka (1980) brought evidence that a strong relationship between savings and investment exists even in the context of open economies and perfect world capital mobility. The authors analysed the international capital mobility considering the relationship between investments and savings in 16 OECD countries over the period between 1960 and 1974. Their research revealed that, in the short run, saving in a closed economy implied postponing consumption, whereas in an open economy it usually hinted at capital outflows. That is to say that, in the short run, savings and investments are not closely related and that investment can also happen on the account of a current account deficit. However, the statistical evidence presented by the authors proved that in the long run, because of institutional rigidities and regulations, the savings and investments of a country equalise. The capital flows naturally adjust so as to make investments approximately the same as savings.

All in all, even though the financial system is globalised and there is capital mobility, investments cannot be sustained from a current account deficit forever, it is savings that are supposed to determine investment in a long-term framework, hence, they are crucial for an organic economic growth.

2.2 Previous studies: methods and data

2.2.1 Impact of demographics on savings

To further proceed with the literature review, we summarised some of the most relevant findings on the topic of savings and current account - demographics relationship and presented the results of the previously conducted research. A brief review of the empirical findings is also provided in Appendix A.

Initially, we delved into research conducted on age dependency ratios and savings and spotted negative relationships between dependency ratios and savings in the papers written

by Lee, Mason, and Miller (2000), Athukorala and Tsai (2003), Taylor and Williamson (1994), Higgins (1998), Bloom, Canning, Mansfield, and Moore (2007), Kim and Lee (2008), and Uddin, Alam, and Gow (2016). This situation is very well explained by the consumption cycle theory which proposes the consumption - saving behaviour framework of people throughout their lifetime. In the early and later stage of their life people only consume, dissaving, whereas in the productive stage they consume and save for the retirement period, the saving rate going up as they advance in their professional life and their income increases. This theory implies that the private saving rate should go up when life expectancy has been increasing in the past decades, so as to accumulate more resources that are to be consumed when professionally inactive. Or, another response to the increase in the life expectancy would be to keep the savings rate constant and increase the retirement age instead.

One of the first attempts to analyse the effect of age dependency ratios was made by Leff (1969). The study examined a set of 74 countries including subgroups of countries with different levels of development. A multivariate regression analysis was applied for the year of 1964 employing two regression equations with two different dependent variables - the aggregate savings as a percentage of national income and the rate of savings per capita. The author tried to explain the variables using dependency ratios, income per capita, and income growth. The regressions' outcomes support the significant positive relation between the level of national income and savings rate, and a negative effect coming from dependency ratios. It was also remarked that the large coefficients for national income become lower when the regression accounts for demographics (Leff, 1969).

Lee et al. (2000) analysed the effect of demographic transition on savings in Taiwan under the pure life cycle saving and their analysis showed that the level of savings increased when the total dependency ratio decreased. This paper also revealed that the effect of increased life expectancy and decreased mortality rate is ambiguous since people live longer, but also work longer because of the raise in the retirement age, causing opposite effects on old age dependency ratio, and, consequently, on savings. Another study performed in Taiwan covered the period between 1952 and 1999 and obtained consistent results with the previous paper - a negative relation between savings and dependency ratios (Athukorala & Tsai, 2003). An additional research employed the life cycle model using the national aggregate savings rate, income growth rate and youth dependency rate and revealed a negative relationship

between the dependency rate and savings (Taylor & Williamson, 1994). The paper also communicated that because of the high dependency rates and low savings in the New World countries[1], which lead to a negative current account, there was a need for capital inflow for investments from the Old World[2]. High dependency ratio was associated with low savings in the work of Higgins (1998) as well. The author used time series analysis and fixed effects panel regression on a sample of 100 countries for the period between 1950 and 1989.

Bloom et al. (2007) studied whether the presence of a social security system had an impact on the savings rate and its intensity in the context of an increasing life expectancy for a panel of 57 countries analysed over the period 1960 - 2000. The authors reported that saving rate rises when life expectancy goes up, but the magnitude of the increase is highly dependent on the existence of a pension system and a retirement incentive (Bloom et al., 2007).

Grenade and Moore (2007), in their study on the Eastern Caribbean Currency Union, pointed out that an increase in public savings, dependency ratio, inflation, or real deposit rate causes a dip in private savings. Also, they made projections for the following 25 years and concluded that the increase in the dependency ratio will lead to an insignificant drop in private savings. On the other hand, the authors stated that the real GDP growth is what positively affects private savings and that should be a privileged focus for policy makers (Grenade & More, 2007).

Guest and McDonald (2001) calculated the optimal national savings for Japan and Australia for the period 1990-2050 using a Representative-agent model of a small open economy. The authors concluded that for a country that already encounters the issue of rapidly ageing population, as it is the case of Japan, savings decrease, whereas for Australia, where the ageing population is expected to happen but to a low or insignificant extent, the saving rate is supposed to follow an increasing trend.

A study conducted in Australia and Canada pointed out that increasing income was the most important determinant of increasing savings rate over the period 1871-1988 (Canada) and 1864-1988 (Australia), but an increase in the proportion of the working age population was also found to positively affect the savings rate in Canada, whereas the outcome for

[1] New World - Australia, the USA, Argentina, and Canada
[2] Old World - UK

Australia was ambiguous. The results were obtained by applying a co-integration econometric approach, the time frame being divided into four periods expressed by dummy variables (Wilson, 2000).

Another work on Australia applied three different econometric techniques: dynamic ordinary least squares (DOLS), fully modified ordinary least squares (FMOLS) and the vector error correction model (VECM) on the obtained data for 1971-2014 on dependency ratio, savings rate, and real GDP. Their work investigated the impact of dependency ratio and savings rate on real GDP - used to proxy the economic growth of the country. The authors pointed out the fact that the relationship between dependency ratio and savings is negative in Australia, the negative effect being stronger in the long run (Uddin et al., 2016).

Focusing on Europe, Hondroyiannis (2006) studied the determinants of private savings in 13 EU countries for the period between 1961-1998, taking as explanatory variables dependency ratios, real interest rate, liquidity, public finances, real disposable income growth, and inflation. He applied a panel co-integration approach employing fully modified ordinary least squares and revealed that private savings, contrary to the results for total savings, are positively linked to dependency ratios, government budget constraint, real disposable income growth, real interest rate, and inflation. A negative relation was found only for the liquidity constraint, coming from the fact that a relaxation of regulations in the capital markets decreases the level of private savings (Hondroyiannis, 2006).

Another study which included some European countries was conducted by Kim and Lee (2008), who analysed G-7 countries (the US, the UK, France, Germany, Italy, Canada and Japan) over the period 1979-2001. They modelled a sample composed of the G-7 countries to analyse the effect of the age structure on private and public savings separately. The authors discovered that the higher the dependency ratio - the lower the savings rate, the negative effect being more pronounced in the case of public savings rate because of the pension and healthcare expenditures incurred by the government (Kim & Lee, 2008).

Bearing in mind the empirical evidence on the relationship between the population age structure and savings rate, we propose a first hypothesis to be tested:

Hypothesis 1:

High dependency ratios are associated with low levels of gross domestic savings.

2.2.2 Impact of demographics on the current account balance

One of the benchmark works that modelled the current account balance is the research paper of Chinn and Prasad (2003) who studied the medium-term determinants of the current account. The authors analysed a dataset of 18 industrial countries and 71 developing countries for the period between 1971-1995. They used five-year averages for the data employed to avoid the short-term fluctuations as they were interested in medium-term determinants of current account balance. The variable set that they tested included age-related factors - old dependency ratio and young dependency ratio, macroeconomic variables: general government budget balance, average real GDP growth, standard deviation of GDP growth, and national savings as a ratio of GDP. For their study, the authors employed two econometric approaches - cross section and panel regressions. When implementing the panel approach, the authors repeated the regression while adjusting for the two groups of countries (industrial and developing), and also for geographical areas since their results significantly changed when they accounted for African countries. Chinn and Prasad (2003) found similar results for both methods: positive effect on the current account balance coming from government budget balance, the stock of net foreign assets (NFA), and financial deepening; and a significant negative effect of youth dependency ratio and openness to international trade. When performing the panel regression only on industrial countries, the openness to international trade showed a positive relation with the current account, which leads to the conclusion that the developing countries in the sample determined the negative relationship estimated initially.

Brooks (2003) used the overlapping generations model to analyse the impact of demographics on capital flows between world regions which assumed perfect capital mobility. The author pointed out that the generation of baby boomers in the European Union and North America contributed to creating savings that were transferred to Latin America, Africa and other developing regions that were having a budget deficit because of high youth dependency rate. But the forecast in this paper revealed that in 2010 the situation would reverse - the EU and North America would be the regions to import capital from the developing countries. Börsch-Supan, Ludwig, and Winter (2006) also forecasted the capital account situation of the EU countries and revealed that by 2020 these countries would be capital importers because of the increase in the senior age population.

Furthermore, Gudmundsson and Zoega (2014), after having had run a pooled OLS estimator regression and a fixed-effects estimator regression on a sample of 57 countries for the period 1980-2009, concluded that the higher the share of the young and old population the higher the current account deficit of the country is. Higgins (1998) came to the same conclusion, but he chose a panel method instead, a sample of 100 countries, and the period of 1950-1989. The research also proved the negative impact of demographic indicators on investments, savings, hence on the current account.

Ca'Zorzi, Chudik, and Dieppe (2012) conducted research on the current account imbalances contribution to the financial crisis of 2008. They accounted for 14 variables that were thought of as major determinants of the current account imbalances and revealed that oil balance, fiscal balance, and relative income were positively related to current account, whereas investment as % of GDP, real GDP growth, dependency ratios, population growth, civil liberties, trade integration, financial integration, relative income squared, and Asian crisis dummy had a negative coefficient. NFA variable showed an ambiguous result because countries with high debts typically aim at improving their long-term economic situation by increasing their current account balance, but, on the other hand, being already indebted makes it very difficult for them to enhance their current account balance. Finally, it was concluded that the effect of the imbalances on the crisis was rather small.

Kim and Lee (2008) not only analysed the effect of increasing dependency ratios on savings but also on the current account changes for the G-7 countries. The authors used a panel VAR model that comprised data on real GDP, national savings, real interest rate, dependency ratio, and current account and came to the same conclusion, namely that current account is negatively affected by an increase in the dependency ratio. Per this paper, the effect on current account balance comes as a result of the difference in the pace of changes in savings and investment.

Having had considered the existing literature in the field, we introduced a hypothesis referring to the demographics effect on the current account balance:

Hypothesis 2:

High dependency ratios are associated with larger current account deficits.

3. Methodology

For the analysis of the current account and gross domestic savings, we chose to perform panel data regressions. The selected model and the reasons for this preference are presented in this section. The benefits and the drawbacks are described in detail and the reasoning behind the choice of variables is also provided. At the end, the data gathering method is explained.

3.1 Motivation for the use of panel regression

The researchers who have previously analysed the determinants of savings including the ageing population employed various empirical models, one of them being the panel data regression, used by Higgins (1998), Hondroyiannis (2006), Bloom et al. (2007), and Taylor and Williamson (1994).

Having had considered the previously applied methods on this topic and the goal of this research, of analysing the EU-28 countries, we decided to apply panel data regressions. The panel data regression has several advantages, such as:

- It allows for a richer econometric analysis accounting for country-specific effects and observing a relation across more entities over various points in time (Stock & Watson, 2010).
- It shows a more complex understanding of the relationships and effects than the simple cross section and time series regressions because it enables to identify individual effects that are difficult to be otherwise estimated.
- Because of the possibility to have more observations while analysing several entities over a period, more degrees of freedom are obtained, thus one can perform the analysis which would otherwise be impossible in a time series framework (Brooks, 2014).

3.2 Estimation methods

3.2.1 Gross domestic savings

The general equation for the fixed effects panel data regression is presented below.

$$Y_{it} = \beta_0 + \beta X_{it} + \alpha_i + \varepsilon_{it} \quad (1)$$

where α_i represents the country specific effects. Y_{it} denotes the dependent variable, X_{it} is the vector of the explanatory variables, and ε_{it} stands for the error term. When including the macroeconomic variables W_{it} and demographic variables we obtain equation (2).

$$GDS_{it} = \beta_0 + \beta_1 OADR_{it} + \beta_2 YADR_{it} + \sum \beta W_{it} + \alpha_i + \varepsilon_{it} \quad (2)$$

where *i=1…28*, which represents the number of the country and *t=1995…2015,* which denotes the respective time periods. GDS_{it} is the dependent variable of the regression, representing the gross domestic savings of the country *i* at time *t.* Our model explains the dependent variables gross domestic savings as % of GDP by possible demographic and macroeconomic determinants such as age dependency ratios, GDP per capita- variables that are also employed in the research carried out by Bloom et al. (2007), Uddin et al. (2016), Kim and Lee (2008), Leff (1969), and Higgins (1998). When researching savings, the interest rate and inflation were previously used by Grenade and Moore (2007), and Hondroyiannis (2006) for their importance when deciding how much to save, thus, we included the government bond interest rate variable in our regression.

3.2.2 Current account balance

Former research on the impact of demographics on current account balance built cross-section regressions: Chinn and Prasad (2003); panel regressions: Higgins (1998), Chinn and Prasad (2003); overlapping generations model: Brooks (2003); pooled OLS estimator regression and fixed-effects estimator regression: Gudmundsson and Zoega (2014). Therefore, we followed the methodology of Chinn and Prasad (2003) and performed another panel regression to assess the relationship between current account and demographic structure:

$$CA_{it} = \beta_0 + \beta_1 OADR_{it} + \beta_2 YADR_{it} + \sum \beta W_{it} + \sum \beta_j Z_{it} + \alpha_i + \varepsilon_{it} \quad (3)$$

For estimating the current account an additional set of four variables Z_{it} was added together with the savings regressors W_{it}. Chinn and Prasad (2003) expressed financial deepening as a ratio of M2 to GDP, but in the context of this paper where the geographical area researched is the EU, in which 19 countries use the Euro, using this ratio is not reasonable. Hence, we chose domestic credit provided by the financial sector as an indicator of financial deepening. Furthermore, openness to trade is of great importance for the current

account balance because it shows how liberal trade is and the extent to which a country would be able to pay its external debt from export earnings, thus, we calculated it by following the approach of Chinn and Prasad (2003) and summed the imports as % of GDP and exports as % of GDP. Finally, two more financial indicators were used: net foreign assets, as suggested by the same authors, and foreign direct investments, variables meant to capture the effect of financial transactions and integration on the current account.

3.3 Panel regression implementation

Initially, an ordinary least square (OLS) estimation was performed. This approach is the most widely used and represents the fundamentals of econometric analysis, but one of the major pitfalls of this method consists in the fact that it does not account for specific effects, which is of relevance for the sample of countries analysed in this paper (Wooldridge, 2002). Taking this into account, the econometric model has been extended to random and fixed effects regressions. Individual-specific effects could be correlated with explanatory variables and panel regressions allow to control for fixed effects across entities (Hausman & Taylor, 1981). In equation (4) c_i represents the unobserved effect (Wooldridge, 2002).

$$Y_{it} = \beta x_{it} + c_i + u_{it} \quad (4)$$

The fixed effects method is applied when the individual effects are estimated, while the random effects regression considers c_i a random variable which is not correlated to the set of explanatory variables x_i. Thus, because the random effects model assumes that c_i is uncorrelated with x_i, this model basically treats c_i as a part of the error term. When c_i does not correlate with the error term the random effects model is unbiased and efficient. Fixed effects on the other hand allow for c_i to be correlated with the set of explanatory variables. Also in the fixed effects regression, the intercept changes across countries while the slope coefficient is unique for all of them. We expect that our model exhibits individual effects that are correlated with x_i (Wooldridge, 2002). Similarly, fixed effects regression was added as in the method applied by Higgins (1998) in his study on savings.

In order to determine whether to implement fixed effects or random effects, we performed the Hausman test. The test was introduced for the first time by Hausman (1978) and was aimed at dealing with orthogonality problem that arises when the $E(\varepsilon|X) = 0$

assumption is not fulfilled, meaning that there is more explanatory power in the vector X which could be identified, partly due to the individual-specific effects. Under the null hypothesis, the random effects are chosen because of higher efficiency, and when the null hypothesis is rejected fixed effects are prioritized since they are consistent (Hausman, 1978; Wooldridge, 2002).

Fixed or random effects panel regressions were chosen by the Hausman test as in Hausman (1978), while generally following a simplified version of the methodology of Bloom et al. (2007) in constructing the model (excluding the social security system factor). The panel regressions, econometric tests and data statistics presented in this paper were obtained by using the data analysis software STATA.

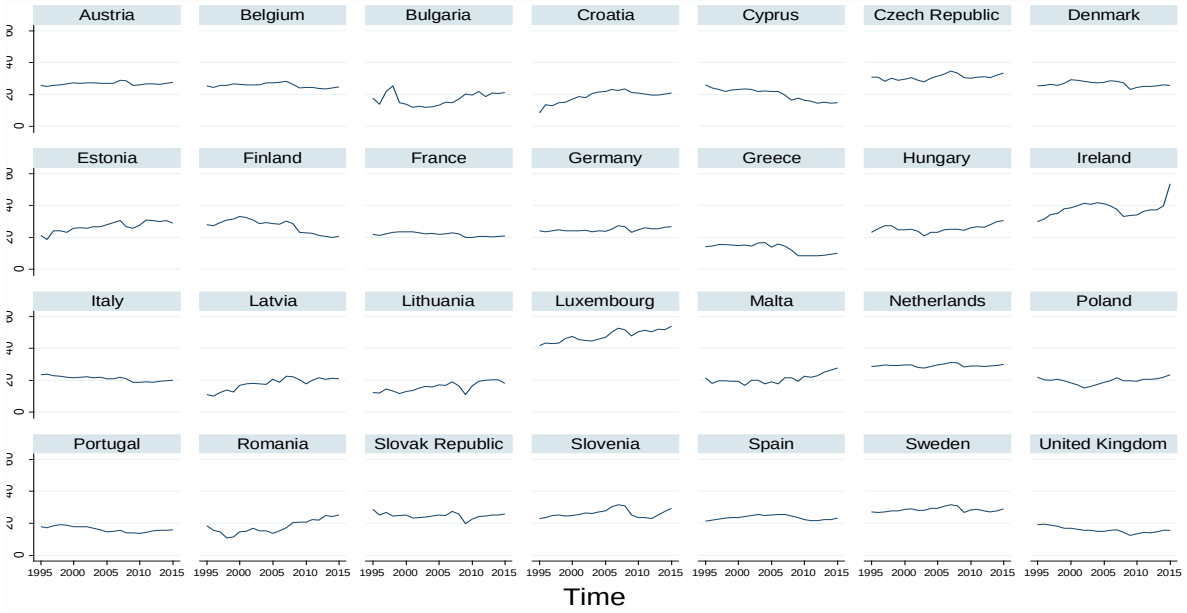
3.4 Data

External records of secondary data sources have been used to retrieve the needed data for the analysis. Because the availability of data varies across the sample countries, the selected research period is 1995-2015, with an annual observation frequency for the 28 EU countries[3]. Data for the following variables were collected from the World Bank Database, World Development Indicators (World Bank, 2017): gross domestic savings (% of GDP); current account balance (% of GDP); old age dependency ratio (% of working-age population); young age dependency ratio (% of working-age population); GDP per capita, PPP (constant 2011 international $); GDP per capita growth rate (annual %); foreign direct investment, net inflows (% of GDP); net foreign assets as % of GDP [calculated by us as NFA (current LCU)/ GDP (current LCU)]; inflation, consumer prices (annual %); domestic credit provided by financial sector (% of GDP); openness to international trade [calculated by us as Exports of goods and services as % of GDP + Imports of goods and services as % of GDP]. Government bond interest rates (% per annum) values were collected from the International Financial Statistics Database. Since there are missing observations for some entities and variables for some periods, the data is unbalanced (Grenade & Moore, 2007).

[3] Austria, Belgium, Bulgaria, Croatia, Republic of Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom

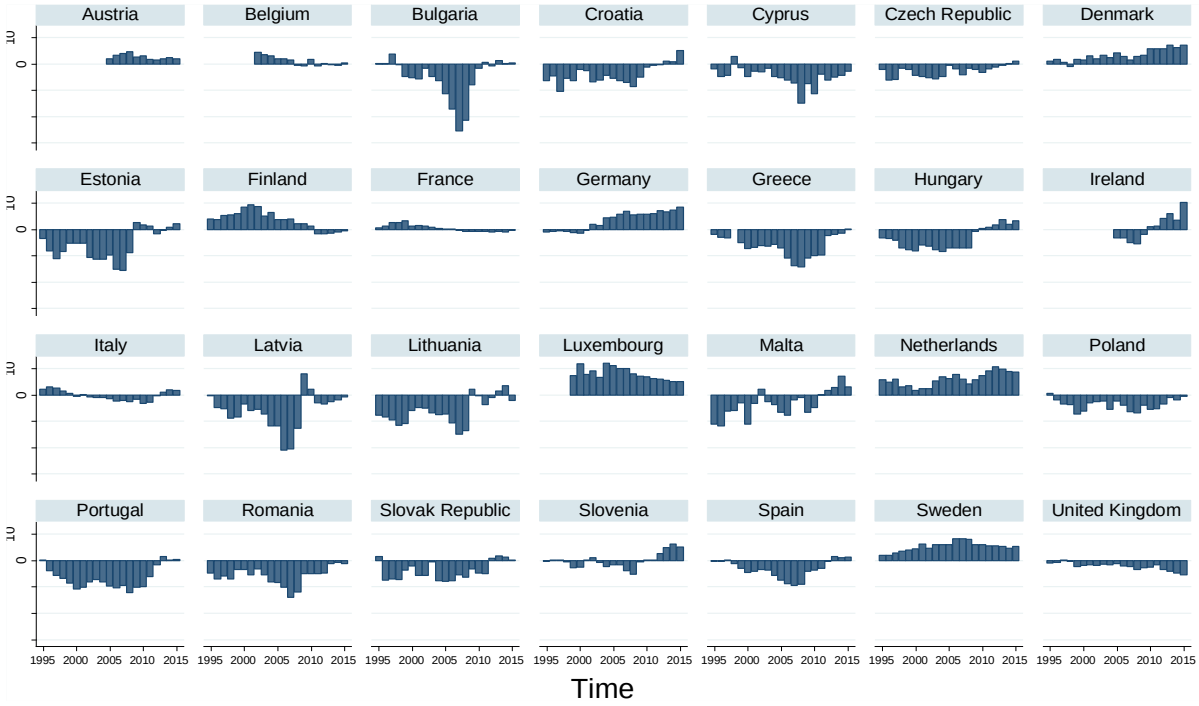
A more detailed description of the variables and their definitions can be found in Appendix B while the trends of gross domestic saving and current account for the EU countries are presented in Figures 2 and 3 respectively.

Figure 2. Gross domestic savings (% of GDP) trends over 11995-2015 in the EU countries



Source: Created by the authors using data from World Bank (2017)

Figure 3. Current account balance (% of GDP) trends over 1995-2015 in the EU countries



Source: Created by the authors using data from World Bank (2017)

As can be noticed on Figure 2, the European Union countries are quite diverse in their savings behaviour. Luxembourg saved the highest proportion of its GDP throughout the

whole period, whereas Ireland is the country that registered the steepest increase in savings in the past years. Cyprus, Finland, Greece, and the UK decreased their savings rate in the last 2 decades, with Greece reporting a savings rate of 8.33% in 2011, which was the lowest rate in the EU countries in the 21 years analysed. As for the Baltic states, an increase in savings can be noticed. Latvia and Lithuania saved approximately 20% of GDP in 2015, whereas Estonia – around 30%.

Figure 3 illustrates long-term positive current account balances for Denmark, Finland, Germany, Luxembourg, Netherlands, and Sweden. On the other hand, Bulgaria, Estonia, Greece, Latvia, Lithuania, Portugal, and Romania were net borrowers for many consecutive years. The highest current account deficit of -25.55% was spotted in Bulgaria in 2007, and the greatest current account surplus, of 12.06% - in Luxembourg for the year of 2004. In 2009, all 3 Baltic states registered a positive current account for the first time in the proposed time frame. In the years to follow, the balances of the Baltic states did not shift much in any of the two directions.

4. Analysis and discussion of the results

In this section, we present the results that we obtained when implementing our main model on the EU-28 gross domestic savings and current account. This part presents the economic discussion, interpretation of the results, and compares the obtained evidence with prior empirical findings.

4.1 Gross domestic savings

All the explanatory variables except for the government bonds interest rate and inflation rate were found significant at 1% level of significance in the first OLS regression. The next step in modelling demographic effects was running two regressions with the specifications of random and fixed effects respectively.

Table 1. The determinants of gross domestic savings

	OLS	Random effects	Fixed effects
Old age dependency ratio	-0.569***	-0.237***	-0.220***
	(0.000)	(0.000)	(0.000)
Young age dependency ratio	-0.242***	0.079	0.105
	(0.001)	(0.307)	(0.216)
GDP per capita, PPP	0.0004***	0.0004***	0.0004***
	(0.000)	(0.000)	(0.000)
GDP per capita annual growth (%)	0.416***	0.263***	0.259***
	(0.000)	(0.000)	(0.000)
Government bond interest rate	-0.0073	0.088	0.090
	(0.456)	(0.121)	(0.113)
Inflation (annual %)	0.097	-0.038	-0.041
	(0.245)	(0.374)	(0.349)
Constant	28.787***	14.695***	13.368***
	(0.000)	(0.000)	(0.000)
Obs.	491	491	491
R^2			
within		0.354	0.354
between		0.626	0.621
overall	0.677	0.640	0.635
F-statistics for country fixed effects	-	-	70.64***

p-values in parentheses * $p<0.10$, ** $p<0.05$, *** $p<0.01$

Source: created by the authors

After performing the Hausman test we obtained evidence for not rejecting the null hypothesis (see Table 2), meaning that the random effects model is unbiased and efficient,

but fixed effects regression is not consistent. Thus, this test indicates that the random effects regression will be the base regression for the future discussion.

Table 2. Test used for selection of the model for gross domestic savings in EU

Test	Hypothesis	Result
Hausman	H0: random effects H1: fixed effects	Prob > χ^2 = 0.5124 H_0 cannot be rejected, random effects are chosen

Source: created by the authors

For the old age dependency ratio used in the regression, we obtained a negative coefficient significant at 1% which is consistent with the empirical findings of Athukorala and Tsai (2003), Bloom et al. (2007), and Higgins (1998) who obtained the same inverse relationship. The relation is justified by the tendency of the country to decrease the savings rates as healthcare and pension related expenses increase when the number of the elderly keeps rising, this being the case of the European countries as revealed by our model. Also, the households incur higher dissaving when they age, indicating a trend of decreased savings as the share of the old population is rises.

The coefficient before young dependency ratio is positive, but not statistically significant, thus we can conclude that young dependency ratio has no impact on gross domestic savings for the studied sample. This result can be explained by two opposite tendencies: on one hand countries tend to save more because of their expectations of increased future spending on education and healthcare systems; on the other hand, a higher share of young people diminishes savings rate according to the life cycle theory. However, the empirical literature mostly supports the negative relation (Athukorala & Tsai, 2003; Gudmundsson & Zoega, 2014; Higgins, 1998), which can be due to differences in the set of countries and sample period.

When it comes to the relationship between GDP and its growth with savings, the former empirical research found significant positive relationships for both (Grenade & Moore, 2007; Hondroyiannis, 2006; Leff, 1969), which is also the case in our paper. These relationships are natural since when a country has more income to save from or there is a positive GDP growth the population and the government will save more, and overall the state will have an increase in its savings.

Another effect that was analysed is that of the government bond interest rate, for which an insignificant coefficient was obtained. Hondroyiannis (2006) wrote that the private savings level should increase with interest rates since people choose now to save their money and to use them for future consumption, however our regression did not find any significant relation for the given set of countries.

The last economic determinant analysed was inflation. Its coefficient displayed a negative insignificant sign. Past empirical evidence on private savings revealed both positive and negative significant signs (Grenade & Moore, 2007; Hondroyiannis, 2006). The explanation for such an ambiguous relationship is that the change in savings caused by an increased inflation depends very much on the initial level of inflation. High level of inflation will most probably cause stronger negative changes in household savings and the corresponding measures of the government could only partly offset this effect, resulting in an unclear overall effect in the economy.

The overall model disclosed consistent or slightly different results comparing to the previous empirical evidence. Regarding demographic variables, the old age dependency ratio has a negative significant effect on the gross domestic savings while the young age dependency ratio yielded an insignificant result. Therefore, Hypothesis 1 is being accepted and it reveals the fact that gross domestic savings have been consistently negatively affected by the increasing share of the old population across European countries.

4.2 Current account balance

Afterwards, we moved on to modelling the impact of the age structure on the current account and firstly performed a simple OLS regression. The current account regression required an extended number of explanatory variables, as it is also driven by investment affecting factors, hence, some new regressors were added. After having had run a simple OLS regression, it was noticed that all the variables had significant coefficients at 5% significance level, besides foreign direct investment, which was insignificant. The sign of young age dependency and old age dependency ratio did not correspond with the ones revealed in the research carried out previously. This could be justified on the grounds of the effect age dependency has had on investment, which is touched upon on the pages to follow.

Table 3. The determinants of current account balance (% of GDP)

	OLS	Random effects	Fixed effects
Old age dependency ratio	0.289***	0.564***	0.581***
	(0.000)	(0.000)	(0.000)
Young age dependency ratio	0.270***	0.515***	0.556***
	(0.001)	(0.000)	(0.000)
GDP per capita, PPP	0.0004***	0.0003***	0.0001
	(0.000)	(0.000)	(0.206)
GDP per capita annual growth (%)	-0.209***	-0.131**	-0.144**
	(0.001)	(0.020)	(0.010)
Government bond interest rate	0.394***	0.619***	0.604***
	(0.000)	(0.000)	(0.000)
Inflation (annual %)	-0.385***	-0.498***	-0.462***
	(0.000)	(0.000)	(0.000)
Domestic credit provided by financial sector	-0.032***	-0.024***	-0.022***
	(0.000)	(0.000)	(0.000)
Net foreign assets (% of GDP)	-2.171***	-0.932*	1.680*
	(0.000)	(0.061)	(0.076)
Foreign direct investment (% of GDP)	-0.010*	-0.010**	-0.007
	(0.085)	(0.027)	(0.149)
Openness to international trade	0.025***	0.030***	0.057***
	(0.000)	(0.000)	(0.000)
Constant	-25.996***	-37.498***	-37.903***
	(0.000)	(0.000)	(0.000)
Obs.	438	438	438
R^2			
within		0.318	0.343
between		0.566	0.300
overall	0.506	0.454	0.263
F-statistics for country fixed effects	-	-	12.83***

p-values in parentheses * $p<0.10$, ** $p<0.05$, *** $p<0.01$

Source: created by the authors

Furthermore, we ran the random effects and fixed effects regressions based on equation (3) and noticed that the signs of the coefficients, besides for the net foreign assets as % of GDP variable, coincided with the ones of the OLS regression, but their significance levels differed (see Table 3). For the fixed effects regression, we obtained insignificant results for GDP per capita PPP and foreign direct investment. Significant results at the 1% level were obtained for all other exogenous variables besides net foreign assets as % of GDP, which is

significant at a level of 10%. Later on, we performed the Hausman test for the current account model as well and the test indicated that fixed effects were to be chosen, the null hypothesis being rejected at 1% significance level (see Table 4).

Table 4. Test used for selection of the model for current account balance in EU

Test	Hypothesis	Result
Hausman	H0: random effects H1: fixed effects	Prob > χ^2= 0.0000 H_0 is rejected, fixed effects are chosen

Source: created by the authors

First, let us discuss the effect of non-demographic (control) variables on the current account. The negative coefficient for GDP growth coincides with the empirical evidence provided by Ca'Zorzi et al. (2012), who pointed out that GDP growth might have a negative relationship with current account since people consume more and save less in the current period having a hope of greater revenue in the future because of increasing GDP growth. Chinn and Prasad (2003) however, concluded that a high GDP growth rate leads to a positive current account balance in developed countries and to a negative one in developing countries, but the impact of this variable on the CA is relatively small. Grenade and Moore (2007) and Leff (1969) claimed that increasing GDP and GDP growth leads to a rise in savings, from which we can infer that GDP growth is expected to have a positive impact on the current account balance as well. All in all, even if there are shared opinions on the effect of GDP growth on the current account, our results prove that there is a negative relation between the two, which aligns with the conclusions of Ca'Zorzi et al. (2012).

Positive signs were obtained for government bond interest rate (used as a proxy for the deposit rates), net foreign assets (% of GDP), and openness to international trade. When the deposit rate increases, savings are expected to go up as well, positively affecting the current account, an opinion that is expressed by Hondroyiannis (2006) too. What concerns the NFA as % of GDP, its positive impact is explained by the fact that high NFA might create more income for the country, which would have a positive reflection on its current account balance in the future (Phillips et al., 2013). This finding is in accordance with the evidence of Chinn and Prasad (2003), but partially contradicts the one of Ca'Zorzi et al. (2012), who claimed that the effect of NFA is ambiguous because high NFA might create difficulties for growth

and negatively impact the current account. Openness to international trade was found to have a positive effect on the current account balance, because the more open a country is, the higher its ability to export and to attract investment is. Chinn and Prasad (2003) came to the same conclusion when researching the industrial countries, but their results proved an opposite effect in the developing countries.

As shown in Table 3, inflation (annual %) and domestic credit provided by financial sector have a negative impact on the current account balance. A rise in the inflation rate makes people consume more in the current period and save less for the future because the resources are more valuable in the present than they will be in the time ahead, which, again, exerts a negative influence on the current account, claim that is supported by the empirical research of Grenade and Moore (2007) as well. Still, sometimes inflation is thought of as an ambiguous determinant of the current account balance since it might lead to a positive impact on the current account via savings, as pointed out by Hondroyiannis (2006), or negative – as proved by Grenade and Moore (2007). The initial point of inflation is to be considered when analysing its further impact on the current account. As for financial deepening, expressed by the domestic credit provided by the financial sector, the underlying reasoning behind its negative coefficient consists in the fact that an increase in credit leads to higher investment, dragging the current account down. Yet, Chinn and Prasad (2003) asserted that financial deepening had a positive impact, but they expressed it as M2 over GDP, which explains our contradictory results.

Unlike the empirical evidence of Gudmundsson and Zoega (2014), Higgins (1998), Kim and Lee (2008), and Brooks (2003), we obtained positive coefficients for the age dependency ratios. The results are not consistent with the previous research that found that higher dependency ratios decrease savings and, thus, the current account as well. We already proved the negative effect of old dependency ratio on gross domestic savings in the EU-28 (and neutral effect of young dependency ratio). Therefore, the only possibility to obtain a positive sign before demographic variables in the current account regression is the negative impact of dependency ratios on investment. A recent paper by Wongboonsin and Phiromswad (2017) reported that an increase in the share of the old age population leads to a decrease in investment as a share of GDP, which, in turn, is expected to counteract the negative effect coming from savings on the current account. The same authors found that a

diminished GDP growth and a reduction in the quality of institutions come hand in hand with the drop in investment. Furthermore, the simulation performed by Börsch-Supan, Ludwig, and Winter (2006) proved that transferring investments from the countries where the age dependency is high to the ones which have a "younger" population would lead to a higher return, hence, this is a strong argument behind decreasing investment when age dependency increases. Dekle (2000) stated that an increase in the dependency ratio leads to a decrease in GDP per capita and a drop in labour force growth. Because of a smaller number of workers, the equipment requirements would go down, hence, there would be less investment needed. In the empirical evidence brought by Kim and Lee (2008), savings dropped more than investment did, hence current account decreased as well but less than savings. However, in our research, it appeared that investment decreased more than savings because of the rise of age dependency. In order to verify this theory, we performed an additional regression on investment which proved that when accounting for investment, the effect of age dependency on the current account is negative. We included the same set of variables as for the current account balance regression and performed the fixed effects regression, chosen in accordance with the results of the Hausman test.

Table 5. Investment (% of GDP) relation with age dependency ratios (for full regressions see Appendix C)

	EU coefficients
Old age dependency ratio	-0.717***
	(0.000)
Young age dependency ratio	-0.245**
	(0.020)

p-values in parentheses * $p<0.10$, ** $p<0.05$, *** $p<0.01$

Source: created by the authors

Table 5 shows that old age dependency has a negative effect on investment as % of GDP at 1% significance level and young age dependency ratio has a negative coefficient significant at a 5% level. The effect coming from old age dependency is considerably greater than the one coming from the young age dependency. From these results, it can be inferred that not only has age dependency a negative impact on savings but also on investment, thus, depending on the magnitude of these two effects, the current account can be positively or negatively affected. Therefore, we conclude that investment was affected more than savings.

All results considered, we reject Hypothesis 2, since our regressions suggest that current account is positively impacted by high young and old age dependency ratios. This outcome contradicts the empirical evidence, but the underlying cause is the higher impact age dependency has on investment than it has on savings.

5. Robustness check

To verify the validity of our results, we repeated our analysis on a different set of countries: OECD countries[4] and performed the regressions for the EU dataset with both time and country fixed effects.

5.1 OECD estimates

The OECD countries create a suitable dataset for robustness check because it includes a group of higher income level countries where the wealth is more homogeneously distributed, which makes it a comparable dataset for validating the obtained results. The new dataset covers a larger geographical area of the world (35 countries) and the same period as the main dataset: 1995 – 2015 (see summary statistics in Appendix D). The data was retrieved from the same databases (World Bank, 2017; IMF, 2017).

Gross domestic savings

For the OECD dataset, we performed again the OLS, random effects, and fixed effects regressions, and afterwards performed the Hausman test on the saved results. For the OECD dataset we obtained the same result for Hausman test and implemented random effects model (see Appendix E), therefore, we display only the results of the random effects regressions in Table 6. For all three regressions on OECD see Appendix F.1.

Table 6. Baseline panel regressions for gross domestic savings (% of GDP)

	Random effects EU	Random effects OECD
Old age dependency ratio	-0.237***	-0.426***
	(0.000)	(0.000)
Young age dependency ratio	0.079	-0.047
	(0.111)	(0.390)
GDP per capita, PPP	0.0004***	0.0003***
	(0.000)	(0.000)
GDP per capita annual growth (%)	0.263***	0.243***
	(0.000)	(0.000)

[4] Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom, and United States

Government bond interest rate	0.088	0.069
	(0.121)	(0.122)
Inflation (annual %)	-0.038	-0.008
	(0.374)	(0.846)
Constant	14.695***	23.594***
	(0.000)	(0.000)
Obs.	491	624
R^2		
within	0.354	0.407
between	0.626	0.531
overall	0.640	0.542
F-statistics for country fixed effects	-	-

p-values in parentheses * $p<0.10$, ** $p<0.05$, *** $p<0.01$

Source: created by the authors

The robustness check shows consistent estimates for the young dependency ratio, inflation rate, and government bond interest rate, as we obtained again insignificant results for this variable. When comparing the magnitude of the effects, the old age dependency had a much larger negative effect in the OECD countries than in the EU. In the random effects regression for OECD, GDP per capita and GDP per capita growth had both revealed the same positive signs as in the EU countries dataset, being both significant at 1% significance level.

To sum up, the robustness check helped us identify the same strong effects for old age dependency ratio, GDP, and GDP growth, and similar insignificant results for the rest of the variables in the OECD countries and assess our main results as being solid.

Current account balance

Table 7 was created to combine the outcomes of the fixed effects current account regressions for the EU and OECD datasets. It can be noticed on it that the coefficient signs for the two regressions coincide for all variables. The fixed effects regression was chosen when the Hausman test was performed and the null hypothesis was rejected at 1% significance level (see Appendix E, F.2).

Table 7. Baseline panel regressions for current account balance (% of GDP)

	Fixed effects	
	EU	OECD
Old age dependency ratio	0.581***	0.189***
	(0.000)	(0.008)
Young age dependency ratio	0.556***	0.207**

	(0.000)	(0.048)
GDP per capita, PPP	0.0001	0.0001**
	(0.206)	(0.025)
GDP per capita annual growth (%)	-0.144**	-0.207***
	(0.010)	(0.000)
Government bond interest rate	0.604***	0.364***
	(0.000)	(0.000)
Inflation (annual %)	-0.462***	-0.507***
	(0.000)	(0.000)
Domestic credit provided by financial sector (% of GDP)	-0.022***	-0.028***
	(0.000)	(0.000)
Net foreign assets (% of GDP)	1.680*	2.610***
	(0.076)	(0.002)
Foreign direct investment (% of GDP)	-0.007	-0.003
	(0.149)	(0.753)
Openness to international trade	0.057***	0.075***
	(0.000)	(0.000)
Constant	-37.903***	-18.913***
	(0.000)	(0.000)
Obs.	438	555
R^2		
within	0.343	0.278
between	0.300	0.170
overall	0.263	0.151
F-statistics for country fixed effects	12.83***	27.93***

p-values in parentheses * $p<0.10$, ** $p<0.05$, *** $p<0.01$

Source: created by the authors

Old age dependency and young age dependency have positive signs in both cases. The coefficients for age dependency are more than twice greater for the EU than for OECD, which might be determined by the different savings and investment policies of the countries that make up the two datasets.

GDP per capita coefficient is positive and significant at a 10% level for OECD, but insignificant for the EU. The government bond interest rate, NFA, and openness to international trade show a positive significant effect on current account in both regressions as well. The coefficient for interest rate is higher for the EU, whereas for NFA and openness to international trade a greater effect can be noticed for the OECD dataset.

GDP growth, inflation, and domestic credit provided by financial sector negatively impacted the current account of both sets of countries. The negative effect is stronger in the case of the EU for all three explanatory variables.

Given these points, it can be concluded that the results for the two datasets are consistent, validating the robustness of our results. There are only some discrepancies, which might have arisen because of the differences in the countries that make up the samples. Some distinctions consist in the fact that in the US the ageing effect is not as strong as in the EU, unlike Japan, which is by far one of the oldest countries in the world with the most rapidly ageing population.

5.2 Time fixed effects regression

For the second robustness check, we performed regressions with time fixed effects in order to identify whether there are common factors that similarly affected all the EU countries. The general equation is the same as (1), with the additional parameter δ_t denoting the time fixed effects.

$$Y_{it} = \beta_0 + \beta X_{it} + \alpha_i + \delta_t + \varepsilon_{it} \quad (5)$$

The tests for time fixed effects for the current account and savings regressions rejected the null hypothesis that time effects are jointly equal to zero (see Appendix G). Thus, we estimated both country and time fixed effects regressions using the same sets of explanatory variables as in the baseline models. The new estimation for savings revealed negative significant coefficients for most of the years, capturing most of the ageing population effect on savings, thus the old age dependency ratio coefficient became insignificant (see Appendix H). This may signal that the overall demographic trends in the EU matter the most (note that coefficients before year dummies become more negative over time), while the country-specific demographic tendencies are of secondary importance for gross domestic savings. The current account estimates are consistent with our baseline model. The time coefficients are insignificant, thus, controlling for time fixed effects did not change our previous results, and confirmed the robustness of the obtained coefficients (see Appendix H).

6. Policy Recommendations

Population ageing is a phenomenon affecting many regions of the world and the states should adapt and follow the new trends and realities. A recent paper by Gagnon, Johannsen, and Lopez-Salido (2016) described ageing effects as reaching a "new normal", affirming that "low interest rates, low output growth, and low investment rates are here to stay" (p. 28). This could be the reality of the EU countries and policymakers are now faced with new challenges. In the early 1990's the first EU summit put emphasis on the importance of increasing employment among elderly. The main three goals pursued by the Stockholm European Council already in 2001 included achieving low public debt levels, increasing employment and productivity and restructuring the pension, healthcare and long-term care systems (Chłoń-Domińczak, Kotowska, Kurkiewicz, Abramowska-Kmon, & Stonawski, 2014). The European Commission (2006) came up with the most important objectives that were to be achieved by implementing new policies such as demographic renewal, increased employment, improved productivity and performance, migration policies, fiscal sustainability measures.

We have analysed the existing policies and some that are yet to be implemented in Europe and other regions and, considering the results of our study as well, came up with some policy recommendations, which are meant to mitigate the negative effect of the ageing phenomenon on the gross domestic savings, current account balance, and the labour market.

Migration has contributed to reducing the scarcity of workforce in some regions, and it remains an important mechanism with great potential to positively impact the labour force distribution in the future as well. The underlying reason behind labour mobility is to increase the world economic growth in aggregate. Długosz (2011) suggested that one of the solutions for maintaining the level of the dependency ratio in ageing countries would be "replacement migration", a phenomenon which is topical nowadays in the context of the European migration crisis. For instance, Germany, which has one of the most rapidly ageing population trends has already implemented some policies that sustain migration. Even though in the short run massive migration could create additional issues, we put it forward since in time it could positively impact the economic growth, as well as the demographic situation of the EU countries.

Hondroyiannis (2006) claimed that in order to keep up with the ageing population, Continental Europe should implement reforms in the pension allocation system and ***reorganise their social security systems***. He added that financial integration is yet another key factor which determines the future evolvement of the savings level. At the same time, the ease of investing and a good access to capital markets were considered a favourable aspect as well, that might increase the savings rate. Looking at the fiscal sustainability aspect, we suggest the social security system restructuring via various measures for the pension system, healthcare and education.

One suggested measure by the European commission in 2006 was ***raising the retirement age*** together with ensuring that older people have enough work opportunities (Kok et al., 2003). Several EU countries have already increased their retirement age during the past years, including Belgium, Czech Republic, and the Baltic countries. Other countries such as Austria, Denmark, Germany, Malta, and the United Kingdom opted for a gradual increase of the retirement age which takes place every year and will be finished in the 2030s. Additionally, postponed retirement is highly encouraged and early retirement is penalised in some EU countries as a measure for achieving a sustainable pension system for the future (Eichhorst et al., 2011). For favouring a faster change across the EU, we suggest that all the countries increase their retirement age if not done so far. Moreover, ***ensuring working opportunities for the elderly population*** together with ***discouraging early retirement*** should be promoted in the EU countries with the goal of increasing gross domestic savings and improving the current account balance.

In the early 2000s, Germany introduced a series of reforms in the labour market, known as the Hartz reforms. These were meant to ***reduce unemployment*** and in order to achieve this goal they facilitated the job search process, minimised the unemployment benefits, and induced more employment flexibility (Engbom, Detragiache & Raei, 2015). Following the example of Germany, which managed to have the lowest unemployment rate in the EU in 2014, of only 5%, and working towards reducing unemployment, particularly for the young, represents a recommendation on how to alleviate the negative impact coming from the aged workforce. There are several countries where unemployment is rather high: Greece 26.5%, Spain 24.4%, Croatia 17.3, Cyprus 16.1%, thus an involvement of more people in the labour market would increase GDP, which is also

expected to have a positive reflection on savings and the current account balance (World Bank, 2017). Simonazzi, Ginzburg, and Nocella (2013) researched the trade flows between Germany and southern Eurozone countries and revealed that Germany had a current account surplus for many consecutive years on the account of Spain, Portugal, Italy, Greece, France. Most of these countries face the issue of high unemployment, thus, increasing employment and stimulating internal production and exports, a reorganization of the domestic companies so as to locally produce what used to be imported, would create more homogeneity between the current account balances of the EU countries and would contribute to ensuring a long-term sustainable growth.

An issue brought on to the labour market by ageing population is the ageing workforce and reduced productivity. Although more experienced, the senior workers' skills might not align with the demands of the highly technologically innovative world, thus, productivity is dragged down (Aiyar & Ebeke, 2016). Aiyar and Ebeke (2016) projected that Greece, Hungary, Italy, Portugal, and Spain would be the most affected countries by workforce ageing by 2035. The same authors presented an estimation of the negative effect workforce ageing in Europe would have on total factor productivity and potential policies that could diminish this detrimental impact. They suggested that enabling a better access to healthcare services, enhancing the quality of the training programs for the workers, boosting innovation, and adjusting the tax system would attenuate the issue of reduced productivity. Hence, one of our recommendations to employers and policy makers is to prepare the grounds for ***developing a high productivity level*** for the upcoming aged workforce, so as to keep the pace with the quickly changing job requirements.

To sum up, in order to attenuate the issues brought up by the ageing population in Europe, we recommend that labour mobility is facilitated, unemployment between the young people is reduced, pension system restructured and the retirement age – increased. Also, working towards ensuring a higher productivity of the workforce to come and developing skills that align with the upcoming job requirements are worth being considered too.

7. Limitations of the study

In this section, we would like to present some possible limitations of our research and to suggest potential solutions for them.

One of our main concerns is that there might be ***cross-country dependency***, which is one of the major drawbacks of macro panel data. This issue implies that countries depend on each other and that there is a spillover effect on economic and financial indicators coming from one country to another. This might be the case in our research since countries that trade a lot with each other such as France and Germany, the Baltic states might have their internal savings, and their current account closely related to foreign figures. Some econometrics papers have developed advanced tests and methods to deal with cross-country dependency, such as the nonlinear instrumental variable unit root test proposed by Chang (2002) or have revealed models that allow for cross country dependency (Baltagi, 2008).

More than that, the chosen set of countries might be ***heterogeneous***, meaning that countries exhibit very different trends and economic progress, which could lead to biased estimates. One suggested solution for the issue of heterogeneity would the pooled mean group approach proposed by Pesaran, Shin, and Smith (1999), however, we were not able to implement it due to a low number of observations and because our panel is unbalanced. As for our model, it is fairly reasonable to assume that the EU countries exhibit a homogenous effect from demographics.

Another possible problem is ***endogeneity***, meaning that some of the variables are also correlated or determined by the error term, therefore it is difficult to establish the direction of causality. However, for our models we considered reasonable to expect that the demographic variables are exogenous, as it was previously done in the empirical study by Aksoy, Basso, Smith, and Grasl (2015), where the authors explained that the fact that baby-boom generation appeared 50 years ago should not be affected by current level of GDP, its growth and other factors. Another solution to this issue would be to include instrumental variables as their utilisation makes the results of the regression model consistent even when there is a correlation between explanatory variables and the error term (Cameron & Trivedi, 2005).

The ***omitted variable bias*** could be present since there might be some important variables that we have not accounted. Consequently, the obtained coefficients could be overestimated or underestimated. Part of the omitted variable bias was already reduced when controlling for entity fixed effects. Interaction terms could have potentially reduced the bias and add valuable insights to our findings. However, due to the limited amount of available observations, and a lot of possible interaction terms we did not include it in our model, but it could be a relevant addition for larger datasets. Also, it might be the case that our dataset comprises too few countries and that the time frame chosen is too short to capture the demographic changes that typically happen over more decades. Some possible omitted variables could include other demographic variables such as life expectancy, mortality rates, fertility rate, and the birth rate for a more complex analysis of demographic trends.

Considering the above-mentioned restraints of our study, we acknowledge the fact that there is place for improvement in further research of this topic which is of great relevance nowadays. But, throughout this study, we have tackled the most important aspects of these limitations and our results suggest a high degree of accuracy.

8. Conclusion

The purpose of this research was to analyse the impact age dependency had on the savings and current account of the European Union countries over the period 1995-2015. Panel econometric regressions were employed to determine the relation between demographics, savings, and the current account.

Our research showed that old age dependency has had a negative effect on savings explained by increased consumption and dissaving both privately and publicly. The young age dependency had a neutral effect in our study, explained by two opposite effects: saving for increased future spending on education and reduced savings as inferred from the life-cycle theory. As for the current account, both demographic variables had positive coefficients, which did not align with the empirical evidence. The reason for this inconsistency was found to be the negative effect dependency ratios exerted on investment, which was stronger than the one on savings. The underlying causes behind this negative effect might be the diminished equipment requirements due to the decrease in the workforce and the preference for more investment in the regions where the population is "younger".

In order to corroborate our findings, we performed our first robustness check on another dataset, comprised of the OECD countries. Our results for OECD were consistent with the findings on the EU, hence, our research was substantiated. The second robustness check was performed by testing and adding time fixed effects, which also confirmed our main estimates.

This paper provides statistical proof that is meant to attract attention to the relevance of the issue of increasing age dependency ratios to governments, policymakers and EU representatives, which should implement measures to expand the share of the labour-active population by undertaking a course of actions to reduce unemployment, revise the retirement age and pension system, work towards increasing the productivity of the workforce that is ageing, and facilitate the labour mobility in the European Union.

9. References

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10. Appendices

Appendix A. Literature review table.

Author	Sample, period	Method	Variables	Empirical results
Athukorala and Tsai (2003)	Sample: Taiwan Period: 1952-1999	Life cycle model	**(1)** Rate of growth of per capita income, **(2)** level of disposable income (=wealth), **(3)** age structure of population: aged dependence and young dependence, **(4)** real interest rate, **(5)** unemployment, **(6)** social security payments, **(7)** availability of institutional credit to households, **(8)** dummy for recent financial market liberalization reforms.	The researchers outlined that the higher the young and aged dependence the lower the household savings are, the effect from the aged dependence being greater than the effect of the young dependence. Also, it was stated that the availability of institutional credit to households drags the savings rate even more down than where it already is in the context of an ageing population.
**Bloom *et al.* (2007)	Sample: 57 countries Period: 1960-2000	Panel data regression	Social security system proxied by 4 variables: **(1)** 2 dummies: universal coverage, retirement incentive, **(2)** measure of fully funded social security systems, **(3)** measure of pay-as-you-go systems; **(4)** annual wage, **(5)** life expectancy, **(6)** wage growth, **(7)** wage growth/birth rate, **(8)** ratio of old to working age, **(9)** ratio of young to working age, **(10)** log labour participation rate.	The authors started their research with an ordinary-least-squares regression and tested for fixed effects afterwards. The Wald test proved that the fixed effects regression was more efficient. The research revealed that the higher the life expectancy is the larger are the national savings when there are universal coverage and retirement test. Also, a large old-age dependency rate is associated with a lower amount of savings. The paper concludes that behaviour associated with higher longevity is also important in determining the savings level.
*Brooks (2003)	Sample: EU, Japan, North America, Former Soviet Union, Latin America, China, Africa, Rest of the World Period: 1910 – 2070	Overlapping Generations (OLG) Model	**(1)** GDP per capita, **(2)** productivity (TFP), **(3)** current account balance as % of GDP, **(4)** age dependency ratio.	The paper describes the impact of demographics on capital flows between regions. The author points out that the generation of the baby boomers in the European Union and North America contributed to creating savings that were transferred to Latin America, Africa and other developing countries that were having a budget deficit because of high youth dependency rate. But the forecast made in this paper revealed that in 2010 the situation would change, the EU and North America being the regions to import capital from the developing countries now.
*Ca'Zorzi et al. (2012)	Sample: 34 - 99 countries (depending on the model) Period: 1996 – 2000	Various models	**(1)** NFA, **(2)** oil balance, **(3)** investment as % of GDP, **(4)** real GDP growth, **(5)** fiscal balance, **(6)** relative income, **(7)** old dependency ratio, **(8)** young dependency ratio, **(9)** population growth, **(10)** civil liberties, **(11)** trade integration, **(12)** financial integration, **(13)** relative income squared, **(14)** Asian crisis dummy.	The authors studied the effect of current account imbalances on the financial crisis of 2008. They analysed 14 variables as major determinants of the current account and revealed that oil balance, fiscal balance, and relative income had positive signs, but investment as % of GDP, real GDP growth, old dependency ratio, young dependency ratio, population growth, civil liberties, trade integration, financial integration, relative income squared, Asian crisis dummy had negative signs. NFA showed ambiguous results.

*Chinn and Prasad (2003)	Sample: 18 industrial countries, 71 developing countries Period: 1971-1995	Cross-section and panel data regression	Dependent variable: current account balance as ratio to GDP; Explanatory variables: **(1)** general government budget balance, ratio to GDP, **(2)** stock of net foreign assets, ratio to GDP, **(3)** relative per capita income, adjusted by PPP exchange rates, **(4)** youth dependency ratio (relative to mean across all countries), **(5)** old dependency ratio (relative to mean across all countries), **(6)** average real GDP growth, **(7)** standard deviation of GDP growth, **(8)** standard deviation of terms of trade, **(9)** logarithm of trade-weighted real exchange rate, **(10)** openness indicator: ratio of exports plus imports of goods and non-factor services to GDP, **(11)** financial deepening, ratio of M2 to GDP, **(12)** capital controls on current account transactions, **(13)** national saving, ratio to GDP.	The cross-sectional OLS regression results show that the government budget balance, stock of net foreign assets, relative income, and indicators of financial deepening have a positive relationship with current account balance, while youth dependency ratio and indicators of openness to international trade negatively impact it. After performing the panel regression and studying the effects achieved over time, the authors obtained results that show that government budget balance, the stock of net foreign assets, and financial deepening also positively affect the current account balance, whereas a negative effect came from the young dependency ratio and openness to international trade. But, when performed only in industrial countries, the panel regression results proved a positive relationship between openness to international trade and the current account balance. Average GDP growth was proven to have a small influence on the current account balance.
Feldstein and Horioka (1980)	Sample: 16 OECD countries Period: 1960 - 1974 (annual observation frequency)	Extended Life Cycle Model	**(1)** Private saving rate, **(2)** growth rate of total private income, **(3)** ratio of the number of retirees over the age of 65 to the pop. aged 20-65, **(4)** ratio of the number of younger dependents to the working age pop., **(5)** benefit-earnings replacement ratio or the social-security programme, **(6)** labour force participation rate of older men, **(7)** average per capita income, **(8)** presence of a retirement test as a condition for receiving benefits, **(9)** government saving, **(10)** corporate saving.	In the short run savings and investments are not closely related. Investments can happen whether from accumulated savings or on the account of a current account deficit. But, in the long run, because of institutional rigidities and regulations, the savings and investments of a country equalise. Therefore, a sustainable growth should happen on the account of savings rather than capital inflow from other countries.
Grenade and Moore (2007)	Sample: Eastern Caribbean Currency Union (8 countries); Period: 1980 - 2005, (annual)	Heterogeneous (unbalanced) panel error correction	**(1)** dependency ratio, **(2)** public saving, **(3)** real GDP growth, **(4)** real interest rate, **(5)** inflation, **(6)** changes in the terms of trade, **(7)** GDP/capita.	Inflation, dependency ratio, public savings, terms of trade shocks and real deposit rate showed negative coefficients, whereas GDP growth showed a positive impact on private savings. It was projected that by 2040 the proportion of the dependent population would be more than 2 times greater, which would have a negative reflection on private savings and external current account.
*Gudmundsson and Zoega (2014)	Sample: 57 countries Period: 1980-2009	Pooled OLS estimator and fixed-effects estimator regression.	**(1)** population aged 0–24 **(2)** population aged 25–64, and **(3)** population aged 65 and over.	The correlation between age groups and current account revealed that the higher the share of the young and old population the higher the current account deficit of the country is. After having had performed regressions, the authors obtained consistent results with the correlation ones.

Guest and McDonald (2001)	Sample: Australia and Japan. Period: the middle 1990s to 2050	Representative-agent model of a small open economy	**(1)** The planning horizon (years) **(2)** the partial elasticity of output with respect to capital, **(3)** the reciprocal of the elasticity of intertemporal substitution, **(4)** the reciprocal of the elasticity of substitution between wealth and consumption **(5)** the depreciation rate, **(6)** the proportion of debt to be repaid in each year, **(7)** the interest rate, **(8)** the rate of technical progress, **(9)** the rate of time preference.	In the case of Australia, the authors suggest that the optimal saving rate has an increasing trend since in the previous periods there was low or no ageing population, On the other hand, as Japan already faces increasing ageing population, the savings rate has a decreasing tendency.
*Higgins (1998)	Sample: 100 countries Period:1950-1989 (5-year averages)	Panel data regression	**(1)** Population age distribution (a vector of demographic variables), **(2)** growth rate of output per worker, **(3)** relative price of investment goods.	Rising old and young age dependency ratios are associated with lower savings. Moreover, it is proved that demographics have a direct effect on savings and investments - thus influencing the current account balance of the country.
Hondroyiannis (2006)	Sample: 13 European states Period: 1961 - 1998 (annual)	Panel co-integration	**(1)** Dependency ratio, **(2)** old dependency ratio, **(3)** liquidity constraint, **(4)** government deficit as % of GDP, **(5)** real disposable income growth, **(6)** real interest rate, and **(7)** inflation.	A positive impact on private savings was exerted by dependency ratio, government budget constraint, real interest rate, inflation, the growth of real disposable income, whereas a negative impact was seen from the liquidity constraint.
*Kim and Lee (2008)	Sample: G7 countries Period: 1979 - 2001 (annual data)	Panel VAR model	**(1)** Real GDP per capita, **(2)** national savings, **(3)** real interest rate, **(4)** elderly dependency rate, **(5)** youth dependency rate, and **(6)** current account.	The higher the dependency rate the lower the savings rate, the negative effect being more pronounced in the case of public savings rate (because of the pension, healthcare expenditures incurred by the government). The current account balance is also negatively impacted by a high dependency rate. This situation is believed to lead to a transfer of capital between developed and developing countries, where the ageing population is not a pronounced trend yet.
Lee *et al.* (2000)	Sample: Taiwan Period: simulation starts in 1800, results presented for 1900-2050, or 1950-2050	Dynamic simulation model	**(1)** Population growth rate, **(2)** life expectancy at birth, **(3)** total fertility rate, **(4)** number of children surviving to age of 20, **(5)** retirement years/working years, **(6)** proportion of population of age under 20, **(7)** proportion of adult population over age 50, **(8)** wealth/income per year, **(9)** savings/income per year, **(10)** productivity growth, **(11)** interest rates.	The simulated results of this research show that as the ageing trend became a reality, savings rate increased after the 1960s, reaching its peak in the 2010s. Also, the mortality rate decreased and the life expectancy increased, hence, the effect on savings is unclear, being low or negligible, since people live longer but also work longer.
Leff (1969)	Sample: 74 countries Period: 1964	Multivariate regression analysis	Dependent variables: **(1)** aggregate domestic savings ratio, **(2)** level of per capita savings; Explanatory variables: **(1)** income per capita, **(2)** growth rate of income, **(3)** percentage of total population aged under 15, **(4)** percentage of total	This paper revealed a negative relationship between the analysed dependency ratios and savings. This result holds for multiple regressions and for different sets of countries. On the other hand, savings are positively related to income.

			population aged 65 or more, **(5) -** the sum of **(3)** & **(4)**.	
Taylor and Williamson (1994)	Sample: Old World - UK; New World - Australia, the USA, Argentina, and Canada Period: 1850 – 1989	Life-cycle model and panel data	**(1)** National aggregate savings rate, **(2)** real income/capita growth rate, **(3)** level of real income per capita and **(4)** youth dependency rate.	The paper reveals a negative relationship between the dependency rate and savings. The high dependency rate in the New World countries at the end of the 19th century - beginning of the 20th century was reflected on their low savings, hence, there was a need of inflow of resources from the Old World, which was perceived as an intergenerational transfer by the authors of this research paper.
Uddin *et al.* (2016)	Sample: Australia Period: 1971-2014	Dynamic and fully modified ordinary least squares (DOLS, FMOLS), and vector error correction model (VECM)	**(1)** Log GDP per capita (dependent variable), **(2)** savings rate, and **(3)** dependency ratio (**(2)** and **(3)** - independent variables).	The authors pointed out that the age dependency ratio has a negative impact on GDP per capita, revealing that a high proportion of working age population is associated with higher GDP per capita. Moreover, the authors claimed that the negative effect from the ageing population would be stronger in the long run than in the short run.
Wilson (2000)	Sample: Australia and Canada Period: 1871-1988 (Canada), 1864-1988 (Australia)	Co-integration approach	**(1)** Real income, **(2)** population aged between 0-14, **(3)** population aged 15-24, **(4)** population aged 25-44, **(5)** population aged 45-64, **(6)** population aged 65 or older; 4 dummy variables: **(1)** Period before 1897, **(2)** First World War, **(3)** Great Depression (1930-1935), **(4)** Second World War.	The author revealed that in the short run an increase in working age population positively impacts the savings rate in Canada. Additionally, the paper showed that for both Canada and Australia the increasing income is associated with rising saving rates.

* Marks the research papers that analysed the impact of ageing population on current account.
** Marks the base paper for our research.

Source: Created by the authors

Appendix B. Definitions and sources of variables

Variable	Definition	Database
Gross domestic savings	Gross domestic savings are calculated as GDP less final consumption expenditure (total consumption).	WDI
Current account balance	Current account balance is the sum of net exports of goods and services, net primary income, and net secondary income.	WDI
Old age dependency ratio	It is the ratio of older dependents--people older than 64--to the working-age--those ages 15-64, shown as the proportion of dependents per 100 working-age population.	WDI
Young age dependency ratio	It is the ratio of people younger than 15--to the working-age--those aged 15-64, shown as the proportion of dependents per 100 working-age population.	WDI
Gross domestic product per capita	PPP GDP is gross domestic product converted to constant 2011 international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GDP as the U.S. dollar has in the United States. GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources.	WDI
GDP per capita annual growth	Annual percentage growth rate of GDP per capita based on constant local currency. Aggregates are based on constant 2010 U.S. dollars. GDP per capita is gross domestic product divided by midyear population.	WDI
Bond rates	Interest rates on government bonds and securities, expressed in % per annum.	IFS
Foreign direct investment	Foreign direct investment is the net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. This series shows net inflows the reporting economy from foreign investors and is divided by GDP.	WDI
Net foreign assets	Net foreign assets (% of GDP) are the sum of foreign assets held by monetary authorities and deposit money banks, less their foreign liabilities. Data are in current local currency and divided by GDP current local currency by the authors	WDI
Inflation	Inflation, as measured by the consumer price index, reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly.	WDI
Domestic credit provided by financial sector (% of GDP)	Domestic credit provided by the financial sector includes all credit to various sectors on a gross basis, with the exception of credit to the central government, which is net. The financial sector includes monetary authorities and deposit money banks, as well as other financial corporations where data are available (including corporations that do not accept transferable deposits but do incur such liabilities as time and savings deposits).	WDI
Openness to trade (Exports + imports as % of GDP)	Calculated by the authors as the sum of imports and exports as a share of GDP. Exports/ Imports of goods and services represent the value of all goods and other market services provided to/ received from the rest of the world. They include the value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services. They exclude compensation of employees and investment income (formerly called factor services) and transfer payments.	WDI

*WDI stands for Word Development Indicators database from (World Bank, 2017),
**IFS stands for International Financial Statistics database from (IMF, 2017).

Source: Created by the authors using the exact definitions provided by the databases

Appendix C. Investment (% of GDP) regression for the EU-28

	OLS	Random effects	Fixed effects
Old age dependency ratio	-0.334***	-0.612***	-0.717***
	(0.000)	(0.000)	(0.000)
Young age dependency ratio	-0.332***	-0.398***	-0.245**
	(0.000)	(0.000)	(0.020)
GDP per capita, PPP	0.00004	0.00005	0.0002***
	(0.154)	(0.271)	(0.002)
GDP per capita annual growth (%)	0.280***	0.280***	0.276***
	(0.000)	(0.000)	(0.000)
Government bond interest rate	-0.604***	-0.684***	-0.629***
	(0.000)	(0.000)	(0.000)
Inflation (annual %)	0.559***	0.543***	0.488***
	(0.000)	(0.000)	(0.000)
Domestic credit provided by financial sector	-0.018***	-0.003	0.001
	(0.000)	(0.538)	(0.742)
Net foreign assets (% of GDP)	-0.628**	0.499	1.711**
	(0.030)	(0.304)	(0.014)
Foreign direct investment	-0.001	-0.0001	0.0002
	(0.807)	(0.959)	(0.951)
Openness to trade	-0.006	-0.033***	-0.041***
	(0.167)	(0.000)	(0.000)
Constant	41.616***	51.098***	45.126***
	(0.000)	(0.000)	(0.000)
Obs.	452	452	452
R^2			
within		0.527	0.541
between		0.103	0.045
overall	0.440	0.313	0.043
F-statistics for country fixed effects	-	-	19.92***

p-values in parentheses * $p<0.10$, ** $p<0.05$, *** $p<0.01$

Source: Created by the authors

Appendix D. Summary statistics for the OECD dataset

Variable	Obs.	Mean	Std. Deviation	Min	Max
Gross domestic savings	733	25.212	7.183	8.331	53.955
Current account balance	697	-0.352	5.672	-23.670	16.187
Old age dependency ratio	735	21.667	5.679	7.820	43.324
Young age dependency ratio	735	28.036	7.405	19.200	61.144

GDP per capita	735	33769.5	14215.3	8271.2	95577.9
GDP per capita growth	732	2.084	3.224	-14.560	25.637
Domestic credit provided by financial sector	735	112.361	69.184	0.000	357.319
Government bonds interest rate	627	4.954	3.420	-0.040	51.743
Inflation	734	3.950	8.157	-4.480	88.108
Net foreign assets	694	0.253	1.032	-0.983	8.107
Foreign direct investment	720	5.111	12.939	-58.978	255.423
Openness to trade	733	88.234	52.359	16.679	391.497

Source: Created by the authors

Appendix E. Hausman tests for OECD

Test	Hypothesis	Result
Hausman	H_0: random effects H_1: fixed effects	Gross domestic savings: Prob > χ^2= 0.5414 Current account: Prob > χ^2= 0.0000 H_0 is accepted for gross domestic savings, random effects are chosen H_0 is rejected for current account, fixed effects are chosen

Source: Created by the authors

Appendix F. OECD regressions for gross domestic savings and current account

Table F.1. Gross domestic savings (% of GDP) regressions for OECD

	OLS	Random effects	Fixed effects
Old age dependency ratio	-0.633*** (0.000)	-0.426*** (0.000)	-0.424*** (0.000)
Young age dependency ratio	-0.351*** (0.000)	-0.047 (0.390)	-0.016 (0.791)
GDP per capita, PPP	0.0004*** (0.000)	0.0003*** (0.000)	0.0003*** (0.000)
GDP per capita growth/year (%)	0.439*** (0.000)	0.243*** (0.000)	0.237*** (0.000)
Government bond interest rate	0.162* (0.070)	0.068 (0.122)	0.058 (0.196)
Inflation (annual %)	-0.032 (0.745)	-0.008 (0.846)	-0.007 (0.862)
Constant	33.440*** (0.000)	23.594*** (0.000)	22.496*** (0.000)
Obs.	624	624	624

R^2			
within		0.407	0.407
between		0.531	0.519
overall	0.582	0.542	0.532
F-statistics for country fixed effects	-	-	123.10***

p-values in parentheses * $p<0.10$, ** $p<0.05$, *** $p<0.01$

Source: Created by the authors

Table F.2. Current account balance (% of GDP) regressions for OECD

	OLS	Random effects	Fixed effects
Old age dependency ratio	0.090*	0.284***	0.189***
	(0.079)	(0.000)	(0.008)
Young age dependency ratio	0.113**	0.211***	0.207**
	(0.016)	(0.008)	(0.048)
GDP per capita, PPP	0.0003***	0.0002***	0.0001**
	(0.000)	(0.000)	(0.025)
GDP per capita growth/year (%)	-0.141**	-0.172***	-0.207***
	(0.038)	(0.000)	(0.000)
Government bond interest rate	0.381***	0.378***	0.364***
	(0.000)	(0.000)	(0.000)
Inflation (annual %)	-0.715***	-0.555***	-0.507***
	(0.000)	(0.000)	(0.000)
Domestic credit provided by financial sector	-0.015***	-0.026***	-0.028***
	(0.000)	(0.000)	(0.000)
Net foreign assets (% of GDP)	-1.264***	0.020	2.610***
	(0.000)	(0.971)	(0.002)
Foreign direct investment	-0.027*	-0.011	-0.003
	(0.084)	(0.279)	(0.753)
Openness to trade	0.019***	0.039***	0.075***
	(0.002)	(0.000)	(0.000)
Constant	-14.973***	-19.982***	-18.913***
	(0.000)	(0.000)	(0.000)
Obs.	555	555	555
R^2			
within		0.252	0.278
between		0.333	0.170
overall	0.418	0.298	0.151
F-statistics for country fixed effects	-	-	27.93***

p-values in parentheses * $p<0.10$, ** $p<0.05$, *** $p<0.01$

Source: Created by the authors

Appendix G. Time fixed effects test for the EU countries

Gross domestic savings regression	Current account regression
(1) 1996.year = 0	(1) 1996.year = 0
(2) 1997.year = 0	(2) 1997.year = 0
(3) 1998.year = 0	(3) 1998.year = 0
(4) 1999.year = 0	(4) 1999.year = 0
(5) 2000.year = 0	(5) 2000.year = 0
(6) 2001.year = 0	(6) 2001.year = 0
(7) 2002.year = 0	(7) 2002.year = 0
(8) 2003.year = 0	(8) 2003.year = 0
(9) 2004.year = 0	(9) 2004.year = 0
(10) 2005.year = 0	(10) 2005.year = 0
(11) 2006.year = 0	(11) 2006.year = 0
(12) 2007.year = 0	(12) 2007.year = 0
(13) 2008.year = 0	(13) 2008.year = 0
(14) 2009.year = 0	(14) 2009.year = 0
(15) 2010.year = 0	(15) 2010.year = 0
(16) 2011.year = 0	(16) 2011.year = 0
(17) 2012.year = 0	(17) 2012.year = 0
(18) 2013.year = 0	(18) 2013.year = 0
(19) 2014.year = 0	(19) 2014.year = 0
(20) 2015.year = 0	(20) 2015.year = 0
F (20, 436) = 5.32	F (20, 379) = 3.90
Probability > F = 0.000	Probability > F = 0.000

Source: Created by the authors

Appendix H. Time and country fixed effects regressions for the EU

	Time and country fixed effects	
	Gross domestic savings	Current account balance
Old age dependency ratio	0.032	0.142
Young age dependency ratio	-0.056	0.443***
GDP per capita, PPP	0.0006***	0.0003***
Government bond interest rate	0.027	0.653***
Inflation (annual %)	-0.013	-0.419***
Domestic credit provided by financial sector	-	-0.017**
Net foreign assets (% of GDP)	-	2.980***
Foreign direct investment	-	-0.001
Openness to trade	-	0.039***
1996	-0.261	0.192
1997	-0.397	1.034
1998	-0.444	0.844
1999	-1.465**	-0.727
2000	-2.107***	0.706

2001	-2.547***	0.119
2002	-3.089***	0.801
2003	-3.754***	0.854
2004	-4.151***	0.276
2005	-4.399***	0.077
2006	-5.017***	-1.667
2007	-5.808***	-2.901
2008	-5.187***	-2.725
2009	-5.121***	-1.368
2010	-6.161***	0.698
2011	-5.720***	0.356
2012	-5.404***	1.119
2013	-5.002***	2.240
2014	-5.184***	2.190
2015	-4.939***	2.497
Constant	8.698**	-31.751***
Obs.	491	438
R^2		
within	0.480	0.455
between	0.543	0.408
overall	0.567	0.327
F-statistics for time fixed effects	82.07***	12.03***

p-values are denoted as * $p<0.10$, ** $p<0.05$, *** $p<0.01$

Source: Created by the authors