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Demographic Dividend, Economic Growth and Domestic investment decision: Empirical Evidence from Europe

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Abstract: Demographic dividend can open up new opportunities. A country needs coherent strategy on how to promote private investment, contribution to sustainable development, inclusive growth and job creation. All these factors can reduce poverty. Aging population decreases the economic growth and increases the poverty. I investigated the effect of aging population on economic growth in 40 European Countries between 1995 and 2017. I also examined the interaction effect of aging and domestic investment on economic growth. To this end, I estimated the model of this study using OLS, panel fixed effects, and system GMM methods. The results reveal that the effect of aging on economic growth is negative and significant. The interaction coefficient is positive and significant, suggesting that the adverse effect of aging on growth can be mitigated by raising domestic investment. The results are robust to an alternative measure of aging.

Keywords: Aging Population; Domestic Investment; Economic Growth; European Countries

1. Introduction

The issues of population and economic growth have attracted considerable attention over the years (Dasgupta, 1995; Bucci, 2008; Headey and Hodge, 2009; Huang and Xie, 2013; Azomahou et al., 2014; Bucci et al., 2018). Nonetheless, one thing is clear, and it is the fact that these studies have not been able to provide clear-cut evidence on the direction of the effect of population increase on economic growth. Huang and Xie (2013) find that the impact of population growth on GDP differs between short-run and long-run. More specifically, the short-run effect is negative and significant, but there is no effect in the long-run. The paper of Bucci, Eraydin, and Muller (2018) provide evidence which contradicts the findings of Huag and Xie (2013). They find a positive impact of rising population on growth but up to a certain point after which the effect becomes negative.

One possible reason for the observed mixed results is that the effect of rising population on the economy could be positive or negative. On the one hand, high population increases the level of poverty and slows growth through the positive impact on the unemployment rate. On the other hand, it increases output through the division of labour and specialization. Prskawtz et al. (2007) further attribute the mixed results to the fact that the definition of the population includes both people within and outside the workforce. As a result, population-growth nexus can be better examined by looking into demographic aspects of the population. This explains why recent studies explore how economic growth is affected by labor force (Tsani et al., 2013; Chen et al., 2016) and aging population (Ehrlich and Yin, 2013; Van Der Gaaj and De Beer, 2015).

A look at data reveals there has been a continuous increase in the population of the elderly over the years across different regions, as can be seen in Figure 1. Though several studies have investigated the issue, there are still rooms for improvements in some ways.

First, the literature shows abundance of studies that investigate the problem aging population and economic growth across different regions (Groezen et al., 2005; Bloom et al., 2010; Hashimoto and Tabata, 2010; Ehrlich and Yin, 2013; Prettner, 2013; Cuarema et al., 2014; Van Der Gaaj and De Beer, 2015). However, most of these studies are theoretical; they do not test their theoretical findings empirically using real-world data nor predict the future path of economic growth. Also, there is a lack of consensus with regards to the direction of the impact of increasing population of elderly on economic growth.

Second, concerning Europe which is the focus of this study, there is a dearth of studies on the issue. The work of Adamchak (1989) is theoretical and investigates how economic development impacts the elderly population, which is the exact opposite of what I examine in this study.

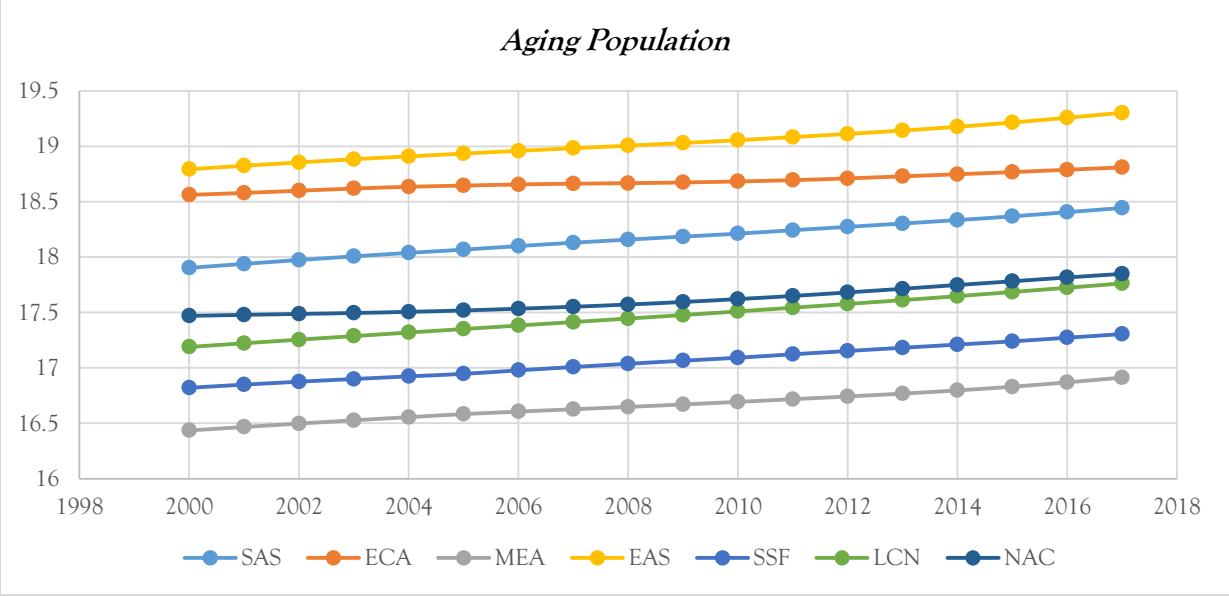

Figure 1: Rising Aging Population in different Regions between 2000 and 2017

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Third, some empirical studies have shown that rising population of elders has a declining effect on economic growth. Also, increase in national investment creates employment opportunities for the younger population, thereby increasing productivity. Since the increase in investment raises productivity through the positive effect on employment, it makes sense to think that the effect of aging on economic growth depends on the interaction with domestic investment. This study is, therefore, the first to attempt analyzing the relationship between aging population, economic growth, and investment. Thus, I examine how an aging population affects economic growth in Europe. I also investigate how elderly population interacts with investment to affect economic growth.

2. Review of Literature

I briefly discuss some empirical studies that examine how aging population affects economic growth.

Cuaresma et al. (2014) constructed different indicators of aging population and examined how well they could explain economic growth in Europe. They provided evidence that these indicators negatively and significantly explain economic growth in the region. They also found, 'the effect of aging is more pronounced for poorer European countries'. Van Der Gaag and De Beer (2015) found that the increasing population of elderly in Europe reduced economic growth, but that raising employment level helps to improve the declining effect.

The study of Bloom et al. (2010) revealed similar results. Their results suggested that introducing a policy that raised the retirement age would have a bolstering effect on productivity. These results were, however, at variance with the results of Futagami and Nakajima (2001). They found that introducing a policy of postponing the age of retirement was terrible because it slowed economic growth.

On the contrary, a few studies have identified a positive association between aging and productivity. Groezen et al. (2005) argued that the direction of the impact of aging on economic growth depends on the transmission mechanism. They showed that old age raises capital accumulation through an increase in saving so that the aftermath is increased growth. On the other hand, there was a shift in demand from capital-intensive services to labor-intensive and this resulted in a reduction in productivity level.

A similar study by Prettner (2013) yielded evidence that supported the results of Groezen et al. (2005). They showed that an increase in the population of elders increased economic growth in the long-run. They also revealed, 'falling mortality and fertility rate positively and negatively explain economic growth in the long-run respectively'. The positive effect of aging on growth depends on how changes in fertility rate compare with changes in mortality.

Empirical evidence also supports that aging impacts economic growth nonlinearly. Gomez and Cos (2008) verified whether or not old age affects economic growth for OECD countries using General Method of Moments (GMM). They found the effect to be positive but only up to an optimum point beyond which growth starts to slow down. Hu (2016) examined both the micro and macro impact of aging on the productivity of China. His study provided evidence that the effect is nonlinear. The mechanism through which it takes place is the accumulated experience of the elderly population. This brings to light the fact that

older people have gathered a great deal of knowledge which helps to boost productivity. However, this positive effect does not continue indefinitely, beyond a certain age, they become incapable of contributing to output.

3. Concept of Demographic Dividend

Toward the end of the twentieth century, economists started to discuss the effect of changes in population age structure on the economy, particularly on the economic growth and poverty. There is a significant relationship between economic growth and poverty. In reality, they started to see the growth and economic development, not only through the prism of natural growth or population size, but also by examining changes in the demographic structure by age. They noted the impact of demographic transitions on economic growth and poverty. Concept of the demographic dividend was created in 1998 by D E. Bloom and G. Williamson.

A demographic dividend is the quickened economic growth that can result from improved conceptive wellbeing, a fast decrease in fertility, and the subsequent shift in population age structure. "The concept of the 'demographic dividend' (Bloom, Canning et al. 2001; Bloom, Canning et al. 2003) elucidates the economic benefits that a country can gain if it experiences a decline in fertility. The decline in fertility reduces population growth, and increases the capital-labor ratio. At the same time, the shift in fertility increases the ratio of working-age to total population; compounding this is the positive behavioral response of female labor force participation, which further increases labor supply per capita. Using a simulation model, our parameter estimates suggest that the effects of fertility reduction on income levels can be large – more than doubling the steady-state level of output per capita." (Bloom D. E. et. al., 2007)

According to the United Nations Department of Economic and Social Affairs the window of opportunity appears, "when the proportion of children and youth under 15 years falls below 30 per cent and the proportion of people 65 years and older is still below 15 per cent". According to D. E. Bloom, D. Canning and J. Sevilla the most important are: labor supply, savings, and human capital.

At the beginning of the twenty first century A. Mason and R. Lee developed further the concept of the demographic dividend. Their study is known as the concept of second demographic dividend. Meanwhile the concept from the end of twenty century is called now the first demographic dividend.

A. Mason (2007) defined the first demographic dividend saying: "Given fixed output per worker, labour force participation rates, and unemployment rates, a rise in the share of the working-age population will lead, as a matter of simple algebra, to an increase in output per capita"5. He mentioned too, that after all "the first dividend will turn negative as population growth outstrips growth in the labour force. Eventually, the share of the population in the working ages may be no greater than before the dividend period began. The same demographic forces that produce an end to the first dividend, however, may lead to a second demographic dividend"

The second demographic dividend means the effect on the economy by capital made because of saving for the purpose of utilization in retirement age notwithstanding: changing demographics, declining portion of family support and inadequate state aid for mature age. The capital in this way framed and thus invested by which changes in the level of the economy, and the second dividend may emerge and develop.

A. Mason and R. Lee (2006) pointed also that the second demographic dividend in contrast to the first one occurs almost automatically. According to them only accumulating assets and not the accumulating transfer wealth can realize the second demographic dividend. The second demographic dividend in contrast to the first one occurs almost automatically.

The indicator activity rate is defined as the percentage of the population in a given age group who are economically active. It is related to demographic dividend. According to EUROSTAT, "The economically active population (also called labour force) is the sum of employed and unemployed persons. Inactive persons are those who, during the reference week, were neither employed nor unemployed. The indicator is based on the EU Labour Force Survey".

The pyramid graph helps us to explore the current state of active population. I used Eurostat data of 2018 and 2019 to get a comparative idea of these two years. According to figure 2, we can see that the activity rates of some countries are very high whereas the activity rates of some countries are less.

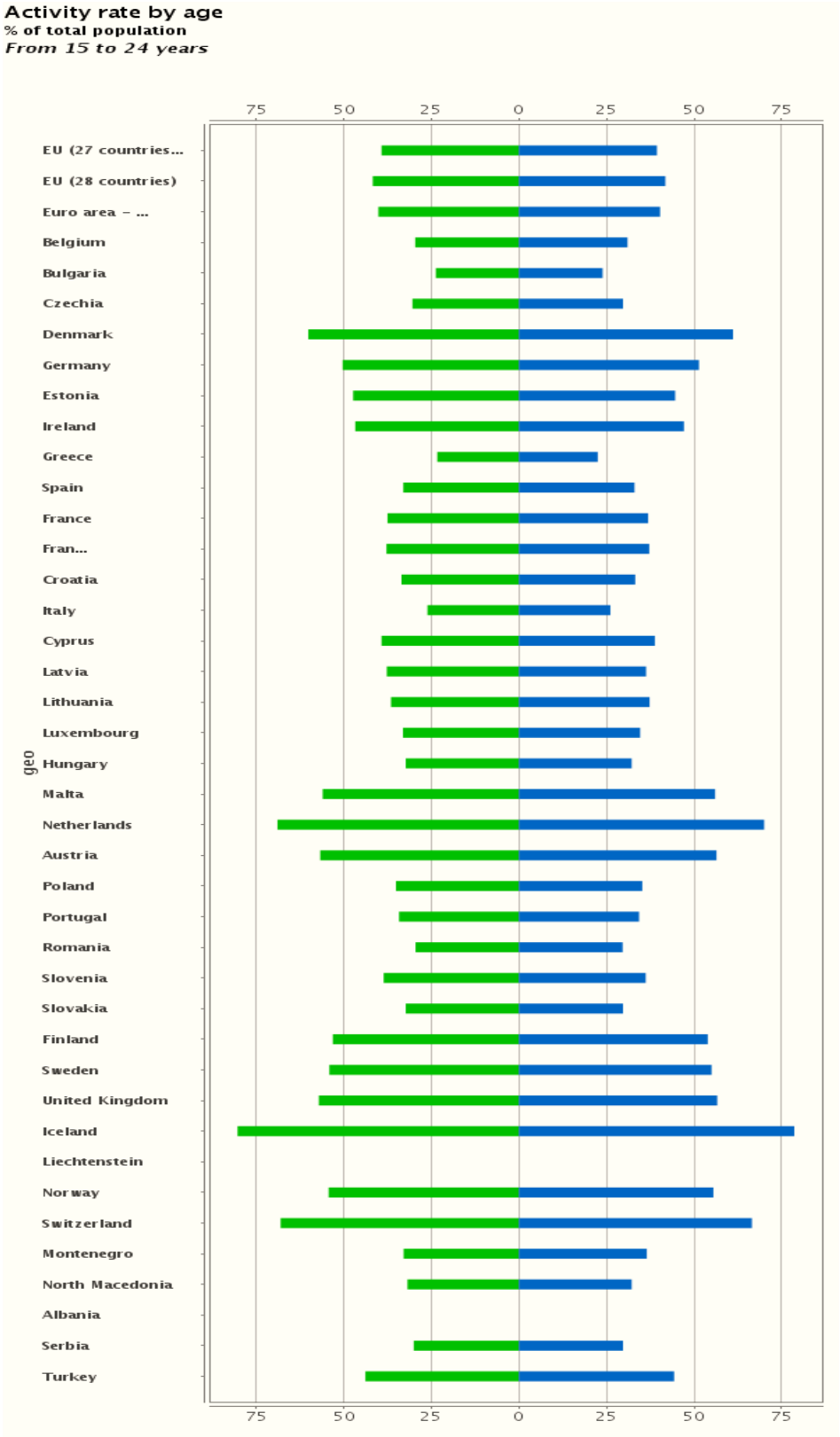

Figure 2: Activity rate by age, (% of total population) Source: EUROSTAT, 2020

4. Model Specification

The model that I used to examine the relationship between aging population, investment, and economic growth is specified below

$$Z_{i,t} = \delta_1 + \delta_2 \ln(aging_{i,t}) + \delta_3 \ln(aging_{i,t}) \times inv_{i,t} + \delta X_{i,t} + \omega_i + \theta_t + \mu_{i,t} \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where $Z_{i,t}$ is the dependent variable and it represents the annual growth rate of GDP. $aging_{i,t}$ is the measure of aging population, $aging_{i,t} \times inv_{i,t}$ captures the interaction effect of aging population and domestic investment, $X_{i,t}$ is a vector of country characteristics, ω_i and θ_t are controls for country and year fixed effects respectively. $\mu_{i,t}$ is the disturbance term and i and t represent country and time respectively.

I followed the literature and used the annual GDP growth rate as a measure of economic growth (Marjanovic et al., 2016; Williams et al., 2017). The aging population is the population of ages 65 years and above. Though some studies have used the population of ages 60 years and beyond, I could not obtain the data for European countries which make up the sample. Also, the percentage of working population ages 80 years and beyond is used as an alternative measure of the aging population. This serves as a means of checking the robustness of my findings.

I added an interaction of aging population, and domestic investment in the model to check whether or not increasing domestic investment would mitigate the declining effect of aging on economic growth. If the coefficient estimates turn out to be positive, it means that raising investment can reduce the adverse impact of growing elderly population on economic growth. The vector of control variables which are country characteristic includes inflation rate, trade openness, foreign direct investment, labor force, democracy, and exchange rate. Summary statistics for all the variables are in Table 1 below.

Table 1: Summary Statistics

Variable	*Obs.*	*Min.*	*Mean.*	*Max.*	*S.D.*
GDP Growth Rate	920	-36.7	5.30	150	8.71
Aging	920	20020	757000	4957000	1005651
Investment	920	2.66	22	115.1	11.41
Inflation	920	-35.84	7.26	83.33	9.32
Openness	920	0.21	0.71	5.32	0.48
FDI	920	-8.59	3.94	161.8	9.7
Labour Force	920	176800	7983000	55790000	9266993
Democracy	920	-7	1.88	10	5.29
Exchange Rate	920	0	518.8	5081	711.52
Aging × Investment	920	222700	15580000	110300000	19955552

5. Estimation Method and Data

Estimating the above model with Ordinary Least Squares (OLS) method will yield bias estimates because it does not control for country-specific factors that are time invariant. This leads me to consider estimating the model with either random or fixed effects method. The study Hausman (1978) is followed to determine that the panel fixed effects model will perform better than a random effects model.

It has not been shown in the literature that economic growth can in anyway influence the age of people. This means there is the absence of reverse causality in the model. However, one can argue that a reduction in economic growth increases the level of poverty and death due to malnutrition, thereby influencing the number of persons that fall within the aging population. This is why the model is further estimated using the Generalized Method of Moments (GMM) method. The System GMM is preferred to instrumental variable (IV) regressions because it is always difficult to obtain instruments that are strong and exogenous (Bazzi and Clemens, 2013).

This study made use of 40 European countries. I dropped the remaining countries because I could not find data for them. I was unable to cover all the European nations because data availability determined the states included in the sample. In other words, countries and years with missing observations were omitted from the sample. The data for all the variable came from the Website of World Bank (World Bank, 2017), except for data on democracy which come from Our World in Data (Our World in Data, 2017), and they covered the period from 1995 to 2017.

6. Empirical Results

Table 2 presents the regression results. I first estimated the model using OLS. The result in column one confirms that rising aging population reduces economic growth in Europe, but the estimate is not significant. The interaction of aging and investment is also not significant, but the coefficient is positive.

However, this estimation is likely to be biased because it does not control for country and time-invariant variables. This is why I controlled for country fixed effects in column two, year fixed effects in column three, and both country and year fixed effects in column four. The magnitude and significance of the coefficient of aging which is the first coefficient of interest seem to be fluctuating. Though it is consistently negative across different estimations, the magnitude is smaller in column one and three.

Table 2: Aging Population, Investment and Economic Growth in Europe

Variable	*OLS*	*FE*	*FE*	*FE*	*GMM*
Aging	-0.017	-10.69***	-0.073	-10.11*	-13.648**
	(0.457)	(2.621)	(0.452)	(5.827)	(6.802)
Aging × Investment	0.004	0.007*	0.0066*	0.0079*	0.0060*
	(0.003)	(0.004)	(0.0034)	(0.0044)	(0.0035)
Inflation	0.027	-0.040	-0.0046	-0.052	-0.062
	(0.034)	(0.038)	(0.0374)	(0.0416)	(0.038)
Openness	9.100***	13.71***	8.824***	13.82***	7.565***
	(1.089)	(1.508)	(1.090)	(1.517)	(1.232)
FDI	0.010	-0.136***	0.0043	-0.144***	0.070
	(0.048)	(0.051)	(0.048)	(0.051)	(0.060)
Labour Force	9.65e-08*	3.458e-07*	1.230e-07**	3.440e-07*	7.54e-07**
	(5.68e-08)	(1.933e-07)	(5.672e-08)	(1.986e-07)	(3.34e-07)
Democracy	-0.102*	0.279**	-0.0452	0.2795**	0.258***
	(0.059)	(0.125)	(0.0608)	(0.1280)	(0.089)
Exchange Rate	0.00098**	-0.0002	0.0012***	0.000034	-0.005***
	(0.00054)	(0.001)	(0.0004)	(0.00105)	(0.001)
Intercept	-3.238				
	(5.705)				
Adjusted R^2	0.274	0.367	0.289	0.371	
AR (2) p-value	-	-	-	-	0.341
Hansen p-value	-	-	-	-	0.219

Notes: Column one presents OLS results, column two includes only country fixed effects, column three includes only year fixed effects and column three includes both country and year fixed effects.*, ** and *** represent significance at 10%, 5% and 1% respectively. Standard errors are in parenthesis.

It is expected that the results of column four are the best among the first four columns since it controls for both country and year fixed effects. The result shows that an increase in the aging population by 1% is associated with a significant decrease of 10.11% in economic growth. This result is in line with the previous studies (Van Der Gaag and De Beer, 2015; Choi and Shin, 2015; Teixeira et al., 2016; Loser et al., 2018). Also, the coefficient of interaction is positive and significant at the 10% level. This means that conditional on domestic investment, increase in aging population will raise economic growth.

As pointed out before, economic growth cannot influence age, but it can determine the number of persons that fall within a given age bracket. This means that economic growth and aging population are jointly determined. As a result, I estimated the model using the system GMM; the results are shown in column five of Table 2. The two key variables still maintain their signs and significance.

Inflation is negative in column four and five, suggesting that higher fluctuation in general price reduces economic growth. The coefficient of trade openness remains consistent regarding sign and significant across all estimations. This means that there are huge benefits associated with opening up to international trade. These benefits can only be realized if exports are always more than imports.

It is expected that an increase in foreign direct investment will boost economic growth if the inflows are channeled effectively to productive use. The coefficient changes across different estimation but remains positive in column 4 and GMM results. It is not significant, and this could be because FDI flowing into European countries are not well used. The coefficient of labor force is positive and significant as expected. Democracy is positive and significant in column 4 and 5, suggesting that economic growth increases as European countries become more democratic (Gerring et al., 2005; Doucouliagos and Mehmet, 2008; Siroufy and Inkeles, 2017).

The GMM results suggest that the effect of exchange rate on economic growth is negative and significant. This means that a decrease in the exchange rate is associated with an increase in economic growth. This makes sense because decline in exchange rate, also known as devaluation, increases export volume. And since GDP is a function of net export, the overall effect will be increase in economic growth.

Table 3: Aging Population, Investment and Economic Growth in Europe (Robustness)

Variable	*OLS*	*FE*	*FE*	*FE*	*GMM*
Aging	-4.619	-4.096*	-4.878***	-3.331	-7.685*
	(1.116)	(2.122)	(1.385)	(2.155)	(4.182)
Aging × Investment	0.082***	0.006	0.105**	0.111*	0.079**
	(0.050)	(0.064)	(0.051)	(0.066)	(0.036)
Inflation	0.003	-1.418	-0.019	-0.048	0.071***
	(0.033)	(0.037)	(0.037)	(0.041)	(0.026)
Openness	9.641***	10.4477***	9.330***	13.59***	19.844***
	(1.110)	(1.602)	(1.123)	(1.641)	(0.796)
FDI	-0.035	-0.140***	-0.033	-0.147***	-0.485***
	(0.047)	(0.051)	(0.048)	(0.051)	(0.027)
Labour Force	9.35e-08***	-3.089e-08	1.137e-07***	3.178e-07	1.73e-07
	(3.46e-08)	(1.673e-07)	(3.536e-08)	(2.002e-07)	(1.86e-07)
Democracy	-0.090	0.200	-0.050	0.290**	0.124**
	(0.058)	(0.124)	(0.060)	(0.128)	(0.058)
Exchange Rate	0.00034	-0.0009	0.0005	0.000006	-0.007***
	(0.00046)	(0.001)	(0.0004)	(0.00105)	(0.001)
Intercept	3.238				
	(1.116)				
Adjusted R^2	0.297	0.352	0.306	0.369	
AR (2) p-value	-	-	-	-	0.426
Hansen p-value	-	-	-	-	0.882

Notes: Column one presents OLS results, column two includes only country fixed effects, column three includes only year fixed effects and column three includes both country and year fixed effects.*, ** and *** represent significance at 10%, 5% and 1% respectively. Standard errors are in parenthesis.

[1]Initial aging variable include ages from 65 years and above but the alternative measure includes only ages from 80 years and above.

It is critical to ensure that I did not just gather data on a bunch of variables and feed software to run and produce results. To provide the robustness of my results, I estimated the regression model again with a different measure of aging. The percentage of the working population ages from 80 years above are added and used as the key explanatory variable. The model is re-estimated using the method of OLS, panel fixed effects, and GMM. The results are in Table 3 of the appendix. The variables still maintain their signs and significance, except for aging which is not significant in column four. One possible reason for the observed insignificance is because the alternative measure of aging contains fewer observations compared to the initial aging variable[1].

7. Prerequisite of demographic dividend in Europe

Economic theories disclose to us that land, labor, capital, entrepreneurs, science and technology, health, environment must be utilized appropriately for the most extreme returns for economic development. Extensive investment is the main key point to get the benefits of demographic dividend. To mitigate the effect of aging population and to achieve the demographic dividend, following prerequisites have to be fulfilled:

Firstly, Capital formation gives the energy to a viable and proficient combination of factors of production to guarantee maintainable economic development.

Secondly, Capital accumulation plays significant role to provide labor with tools and implements of production. It is important enough to make a noteworthy level of specialization conceivable.

Thirdly, Entrepreneurs play a vital role in economic growth and development. They are key contributors to technological innovation and new job growth. Proper policy and incentives can boost up investment as well as entrepreneurship.

These all factors are related to investment. If investment can be increased, then there will be a positive impact on economic growth.

8. Conclusion

The rising population of people that fall within retirement age is a serious issue that needs immediate attention all over the world. Not only does this reduce productivity through the adverse effect on labor force participation, it also leads to overdependence on the working population. It is necessary that the government of various European countries come up with reasonable policy measures that will help reduce the adverse outcome.

In this study, I estimated the effect of aging on economic growth of 40 European countries between the period of 1995 and 2017. I also examined if raising domestic investment could help mitigate the adverse effect of aging on economic growth. OLS, panel fixed effects, and GMM methods were used to estimate

the model of this study. The results suggest that aging is significantly and negatively associated with economic growth in Europe. They also support that increasing domestic investment could be very useful in alleviating the adverse effect of the growing population of elders. These results are significantly robust to the use of another measure of aging population.

The results have some policy implications for Europe. That aging affects economic growth through productivity is not something that is within human control. However, the effects on output can be reduced through various measures. One way of achieving that, which have identified in this study is by increasing domestic investment, both private and public. But this requires a lot of actions on the part of the government. Since investment creates employment opportunities, the government should boost domestic investment in any way possible.

Investment comes from savings, so savings should be encouraged using monetary policy tools. The saving rate should be raised to a reasonable level by commercial banks. Also, these banks should be able to access cheap loans from central banks as it will enable them to offer low-interest loans to investors. Again, it is essential to understand that investment can only take place in a stable environment without the problem of political instability, wars, and terrorism. It is the job of the government to create an enabling environment that investment will take place. The government can also partner with private investors through Public Private Partnership (PPP). These will all create employment, which will increase productivity.

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Appendix

Table 3.2: List of Countries in the Sample

Russia	Germany	United Kingdom	France	Italy
Spain	Ukraine	Poland	Romania	Netherlands
Belgium	Czechia	Greece	Portugal	Sweden
Hungary	Belarus	Austria	Serbia	Switzerland
Bulgaria	Denmark	Finland	Slovakia	Norway
Ireland	Croatia	Moldova	Albania	Lithuania
Slovenia	Latvia	North Macedonia	Estonia	Montenegro
Luxembourg	Malta	Iceland	Andorra	Monaco

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