Universidade do Minho
Escola de Economia e Gestão

Miguel José Lima de Oliveira

Demographic Dividend: Evidence from Portugal at a regional level

abril de 2022

Demographic Dividend
Evidence from Portugal at a regional level
Miguel Oliveirar
UMinho | 2022

Universidade do Minho
Escola de Economia e Gestão

Miguel José Lima de Oliveira

Demographic Dividend: Evidence from Portugal at a regional level

Dissertação de Mestrado
Mestrado em Economia

Trabalho efetuado sob a orientação do
Professor Doutor João Cerejeira

abril de 2022

DIREITOS DE AUTOR E CONDIÇÕES DE UTILIZAÇÃO DO TRABALHO POR TERCEIROS

Este é um trabalho académico que pode ser utilizado por terceiros desde que respeitadas as regras e boas práticas internacionalmente aceites, no que concerne aos direitos de autor e direitos conexos.

Assim, o presente trabalho pode ser utilizado nos termos previstos na licença abaixo indicada.

Caso o utilizador necessite de permissão para poder fazer um uso do trabalho em condições não previstas no licenciamento indicado, deverá contactar o autor, através do RepositóriUM da Universidade do Minho.

Licença concedida aos utilizadores deste trabalho

Atribuição

CC BY

https://creativecommons.org/licenses/by/4.0/

ACKNOWLEDGMENTS

Firstly, I would like to thank my supervisor, Prof. Doctor João Carlos Cerejeira da Silva, for its great guidance and dedication during the development of this work. Your expertise and feedback helped me to successfully complete my dissertation.

I would also like to thank my colleagues for their support and motivation throughout the development of the master thesis.

Finally, I would like to thank my parents for their unconditional support, empathy and encouragement. This work would have not been possible without any of them.

STATEMENT OF INTEGRITY

I hereby declare having conducted this academic work with integrity and I confirm that I have not used plagiarism or any form of undue use of information or falsification of results along the process leading to its elaboration.

I further declare that I have fully acknowledged the Code of Ethical Conduct of the University of Minho.

RESUMO

Com as recentes diminuições das taxas de natalidade e mortalidade, o mundo vive agora um novo fenómeno, ainda que em ritmos e momentos diferentes, conhecido como dividendo demográfico, em que a economia recebe os benefícios de um impulso devido às mudanças na estrutura etária da população e rácios de dependência. Este dividendo foi nomeado por David Bloom e David Canning para explicar o impulso originado por mudanças na estrutura etária da população de um país e que influencia o seu crescimento económico no curto e longo prazo.

Apesar de este tema ser relativamente recente, há um grande debate sobre como este dividendo afeta o crescimento económico de um país ou região, e quais são os principais fatores que influenciam a existência e a significância desse mesmo dividendo. Enquanto alguns autores consideram que o dividendo demográfico é puramente um efeito contábil, outros consideram que a educação tem um grande papel nesse impulso económico.

Assim, neste artigo, eu estudo o impacto do dividendo demográfico em Portugal e também a nível regional, de forma a não só avaliar o seu estado atual e quais as variáveis que têm maior impacto, mas também comparar possíveis diferenças entre as regiões. Para isso, foi construído um conjunto de dados em painel com dados do INE e dos censos portugueses de 2001 e 2011, seguindo uma divisão territorial NUTS III de 2002. Foram estabelecidas múltiplas regressões, onde a variável dependente é o Produto Interno Bruto (PIB) português per capita por localização geográfica (NUTS III), de forma a tentar explicar a ligação entre o dividendo demográfico e outras variáveis demográficas com os níveis de rendimento em Portugal. Adicionalmente, variáveis dummy para cada região foram adicionadas a um modelo final e interagirdas com o correspondente efeito do dividendo demográfico, para tentar captar possíveis diferenças entre as regiões portuguesas.

Os resultados finais parecem sugerir uma relação positiva entre dividendo demográfico e crescimento económico e também uma possível tendência para áreas mais costeiras do país. No entanto, o período deste estudo é relativamente curto, portanto, trabalhos futuros podem ser realizados assim que mais dados estiverem disponíveis para serem adicionados ao âmbito desta análise.

Palavras-Chave: Dividendo Demográfico, Estrutura Etária, Portugal

ABSTRACT

With the recent decreases of the birth and death rates, the world has now experienced a new phenomenon, even if at different paces and moments, known as demographic dividend, in which the economy receives the benefits of a boost due to changes in the population's age structure and dependency ratios. This dividend was named by David Bloom and David Canning to explain the boost originated by changes in a country's population age structure and that influences its economic growth in the short and long run.

Despite this topic being relatively recent, there is a lot of debate related to how this dividend affects the economic growth of a country or region, and which are the main factors that influence the existence and significance of this dividend. While some authors consider that the demographic dividend is purely an accounting effect, others consider that the education has a big role in this economic boost.

Thus, in this paper, I study the impact of demographic dividend in Portugal and also at a regional level, in order to not only assess its current state and what variables have the biggest impact but also compare possible differences between regions. For it, a panel data set was constructed with data from INE and the portuguese census of 2001 and 2011, following a NUTS III territorial divison from 2002. Multiple regressions were set, where the dependent variable is the Portuguese Gross Domestic Product (GDP) per capita by geographic location (NUTS III), in order to attempt to explain the link between demographic dividend and other demographic variables with the income levels in Portugal. Additionally, dummy variables for each region were added to a final model and interacted to the correspondent demographic dividend effect, to try to capture possible differences between Portuguese regions.

The final results seem to suggest a positive relationship between demographic dividend and economic growth and also a possible trend for more coastal areas of the country. Nevertheless, the period in this study is relatively short, so future work can be done once more data is available to be added to the scope of this analysis.

Key Words: Demographic Dividend, Age Structure, Portugal

INDEX

Resumo v

Abstract vi

List of Abbreviations viii

Figures Index ix

Tables Index x

1. Introduction 11

2. Literature Review 12

2.1. Concepts and Background 12

2.2. The Population Ageing Consequences 14

2.3. The Influence of Fertility and Education 16

2.4. A Regional Level Analysis 18

3. Portuguese Demography 19

4. Methodology 22

5. Main Findings 24

5.1. Baseline Regression Results 24

5.2. Region-Specific Regression Results 25

6. Discussion 29

7. Conclusions and Further Work 30

7.1. Policy Recommendations 31

8. References 32

LIST OF ABBREVIATIONS

GDP – Gross Domestic Product

INE – National Institute for Statistics or "Instituto Nacional de Estatística"

LSDV – Least Square Dummy Variable

NUTS – Nomenclature of Territorial Units for Statistics

WAP – Working Age Population

FIGURES INDEX

Figure 1 – Portuguese population by age sections and gender (1991 and 2020 respectively) 19
Figure 2 – Potential Sustainability Index in Portugal 20
Figure 3 – General Fertility Rate in Portugal 21
Figure 4 – Crude Birth Rate in Portugal 21
Figure 5 – Crude Death Rate in Portugal 22

TABLES INDEX

Table 1 – Descriptive Statistics of Main Variables 23

Table 2 – Baseline Regression Results 25

Table 3 – Regression Results by NUTS III Regions 26

Table 4 – Regression Results by NUTS II Regions 28

1. Introduction

The increasing influence and intensity of demographic changes is becoming one of the most important factors that affect the direction of socio-economic development of the 21st century. The recent trends of decreasing birth and death rates led to a situation that we haven't experienced before, leading to a crossroad between two new phenomena: demographic dividend and population ageing. In the Portuguese case, with its first demographic dividend exhausted, the country currently experiences a population ageing phase, hence why I considered this topic relevant.

The demographic dividend was named by David Bloom and David Canning to explain the boost in the economic growth resulting from changes in a country's population age structure. As fertility rates decrease, a country's working-age population will grow in comparison to the dependent population. This creates an opportunity window for fast economic growth, if social and economic policies and investments are correctly implemented.

However, this drop in fertility does not happen immediately. This lag leads to a generational population "bulge", where, for a certain period of time, it originates a burden to the society due to higher dependency ratios. Over time, as fertility rates continue to fall and older generations have longer life expectancies, it originates a shift in the population age structure, resulting in the arise of demographic dividend, which, consequently, will benefit economic growth due to a higher ratio of working age population, available to work, in opposition to decreasing dependency ratios.

This demographic dividend can benefit the economy in different ways (Ross 2004). Not only the economy is able to take in and productively employ more workers, but also personal and national savings grow, as working-age adults tend to earn and save more than the very young. As fertility rates decrease, having fewer children improves the health of women and so they will look for jobs outside home, leading to an increase in their labour force participation. Additionally, parents are able to invest more in the education of each child, which originates better educational outcomes.

Despite this dividend being very important to the achievement of economic growth, it is definitely not enough, as it only allows the country's economy to have the labour force needed, while there must still be concern for their quality, and so the demographic dividend will only reach its full potential if there is a substantial investment in education quality, heath systems, and social and political rights, but also appropriate job opportunities and attracting infrastructures for possible investors.

Thus, due to the recent ageing process existing in Portugal, that inevitably followed the main demographic dividend period few decades ago, it can be quite interesting to analyse the spectrum of these changes at a more regional level, to understand the timing of these effects in different parts of the country. Therefore, the goal of this paper is to study the characteristics and impact of the demographic dividend not only in Portugal but also at a regional level and discuss what it can be done to protect future generations. This paper is divided in the following sections: the second chapter will do a resume of the existent literature review; the third chapter showcases the Portuguese demography as it currently stands; the fourth chapter addresses the methodology (the data and variables used); the fifth chapter provides the results for my multiple regressions; and finally the sixth and seventh chapter discuss and conclude the final insights of my work.

2. Literature Review

2.1. Concepts and Background

During the 19th and 20th centuries, there were opposite views related to the impact of demographics on economic growth. Some authors argued that population growth is adverse to economic growth: authors like Malthus defended that, due to the existence of diminishing returns to labour, it would imply that an increasing number of workers would not be followed by an increase on growth rate of output at same pace, and so leading to a decreasing output per capita. Additionally, another argument that defends this point of view can be found in the Solow Growth Model, where a high population growth tends to reduce capital per worker and so reducing as well economic growth. However, other authors like Keynes argued that population growth is an important source of economic growth, which is able to create growing demand and investment incentives: a shrinking population would generate smaller investment incentives and so the economy would stagnate.

Nevertheless, the introduction and debate of the demographic dividend concept changed the nature of this discussion. Like mentioned in the introduction, demographic dividend is the economic growth potential that can result from the change in a population's age structure, which happens mainly when the share of the working-age population is larger than the share of non-working-age population. However, this term can be interpreted from different points of view. From a demographic point of view, the demographic dividend is the state of a population's age structure when, due to a decreasing birth rate, the share of able-bodied population tends to a maximum and the share of dependency groups to a minimum. From an economic point of view, the demographic

dividend corresponds to a boost in economy during a certain period, where, due to an increasing share of working-age people, consumption rates increase, savings decrease, and the weight on state budget and pension funds reduces. Lastly, from a social point of view, the implementation of the demographic dividend is inevitably followed by a change of social structures and the ageing of the population in a near future.

However, the entry into the stage of implementation of this demographic dividend does not necessarily guarantee that the economy will obtain dividends from this situation, because there should be initial starting socioeconomic conditions to take an effective advantage of this boost. Therefore, if the country is not ready for the benefits resulted from the population's age structural changes, it might lead to negative consequences in its economy, such as unemployment growth for example. Additionally, the period of implementation of the demographic dividend can differ between countries and their level of development. Developed countries experienced population ageing much earlier and so the opportunities for the implementation of demographic dividend and reforms to neutralize its ageing consequences were wider than in modern developing countries, that were experiencing age structure changes more intensively. This means that an effective implementation of the demographic dividend phenomenon generates favorable conditions to the further transition into the stage of ageing population and then neutralize its consequences.

Barsukov (2019) studies the characteristics and patterns of the transition of the world population, from the stage of the implementation of the demographic dividend to the stage of ageing, and concludes that countries are conditionally divided into three main groups: the red group, that contains the countries that finished the demographic dividend implementation and already entered into the stage of population ageing; the yellow group, composed by countries that are experiencing demographic dividend; and the green group, with countries that did not start the implementation of demographic dividend. The author shows that developing countries (mainly on yellow group) experience significantly more intense demographic dividends than developed countries that already moved on from that stage (the red group). However, the benefits from this enormous demographic dividend experienced by the yellow group countries has a major consequence, which is an inevitable population ageing and its potential consequences: the author argues that the width of the demographic dividend window is directly proportional to the scale of potential population ageing consequences.

Later on, Barsukov and Kalachikova (2020) study the reasons and mechanisms that lead to the emergence of demographic dividend. According to the authors, they consider that the changes in the position of older generations were mainly affected by revolutionary civilizational breakthroughs, such as the industrial revolution for example, and qualitative changes of the demographic system. In particular, the authors note that the stage of the implementation of demographic dividends occurred as the rise of social states in developed countries were succeeding, where the share of the dependent groups were at very low levels. This allowed the creation of a foundation for the protectionist social security systems for older citizens. Additionally, the authors conclude that societies restructure the concept of "old age" throughout time, due to the increasing life expectancy and also the awareness of the role of older generations that influence the sustainable rates of socio-economic development of the country.

2.2. The Population Ageing Consequences

Like mentioned during this section, the demographic dividend phenomenon is inevitably followed by a transition into population ageing, as the significant share of working-age people get older and move on to the elderly share of the population structure. According to Albuquerque (2015), the population ageing influences economic growth through three main ways: labour supply, savings and investment, and productivity.

The effect of ageing originated by labour supply on economic growth results from an accounting effect due to the faster growth in the quantity of workers: the initial stages of population ageing creates a demographic dividend resultant from the decrease of the overall dependency ratio and increase of the share of working-age population, which influences the economy positively, since the labour market is able to absorb this supply increase (Bloom et al. 2003). Due to factors such as reduction in mortality and decrease of fertility rates, this leads to an increase in older cohorts of people and so increases the proportion to younger cohorts. However, this ageing will eventually originate a decrease in the proportion of working-age people, as more people will be leaving the labour force to retirement due to ageing.

The effect of ageing originated by savings and investment on economic growth can be perceived by opposite perspectives. From one side, authors such as Coale and Hoover (1958) have positive views about the influence of this factor in the economy, as long as savings are efficiently invested:

they argued that higher population growth combined with an increase in the number of children decreases the ability to save and therefore the growth of output and so, in the case of an ageing society, families are expected to have a higher ability to save. On the other hand, authors such as Friedman (1957) defend a more pessimist view: according to the permanent income hypothesis, individuals present different savings behaviours throughout their life, where people that experience higher earnings tend to save to fund consumption in periods of lower earnings. Therefore, this would mean that younger and older people would save less than middle-age people. Additionally, savings would only suffer when the effect of more people entering retirement dominates the effect of the decrease in the proportion of the younger generations.

Lastly, the effect of ageing originated by productivity on economic growth results from the fact that different age cohorts, more or less abundant, usually present different productivity performance levels, affecting the overall productivity of labour in the end. Nevertheless, there are skills such as management, experience and work planning that improve with age. Thus, when the value of these skills outweighs skills that tend to decline with age, job performance and productivity will increase with age.

As we know, population is an essential factor that affects economic development, so as people's life expectancy increases, the age of retirement naturally can increase too. In this period, the elderly become more dependent, and so it is important to understand this effect in the economy and how to improve this group's welfare. Yenilmez (2015) analyses the changes in certain variables such as the pension system and the retirement age, but also refers policy options that are supposed to benefit the world's rapidly increasing number of old people. Transfers from working people to the retired are important, but these can also harm the elderly economic well-being in many different ways, plus many younger people often become responsible for their older parents. Thus, the author suggests that legal and cultural changes are needed to face this problem, like the end of age discrimination or the encouragement of prolonging the older people workforce participation.

Finally, it is also worth to mention that population aging, and its consequent demographic decline, will tend to increase the demand for certain services, such as health, social security and the care of dependent groups. Consequently, some regions will face bigger challenges related to the finance of these services, while other regions, where population is considerably younger, won't struggle as much with this kind of financial constraints (Carbonaro et al. 2018).

2.3. The Influence of Fertility and Education

As address earlier, one of the most influential factors related to the demographic dividend is fertility: lower fertility rates lead to a decrease of the share of young age cohorts, originating smaller dependency ratios and increasing the proportion of working-age people to the previous ones. From a theorical perspective, fertility can be influenced negative or positively by an economic downturn. A bad economy can reduce fertility due to increased levels of job security, which could worsen the economic situation of couples and so making the cost of having a baby higher. Therefore, the economic stress associated might lead couples to postpone the decision of having a baby, or not even consider it at all (Adsera 2005). However, the opportunity cost of having a baby is significantly lower when the labour market does not offer much to potential parents and so women could trade lower wages and prospects in the labour market for the possibility of having a baby and providing their own childcare. If this is the situation, we can then find a positive relationship between fertility and economic downturn.

Ayllón (2019) studies the relationship between fertility and the Great Recession in Europe and uses data for 31 European countries from the European Union Labour Force Survey (EU-LFS) and the European Union - Statistics on Income and Living Conditions (EU-SILC) for the period 2004–2015. According to this paper, from the various indicators used to analyse this relationship, unemployment, long-term unemployment and the impossibility of finding a full-time job are the three indicators that have a negative relationship with the probability of having a baby. However, these results differ by age, gender and country clusters, which shows the existing institutional differences for childbearing across European countries. Additionally, the results also show a social gradient when it comes to the chance of having a baby and that depends of the socio-economic background, being the low-income households and those of non-EU immigrant origin that suffered the biggest impact on their fertility decisions.

Nevertheless, the debate on the relationship between fertility and economic development is long and its evidence is relatively weak and mixed. This happens because population growth changes happen endogenously while a country develops, and so other factors that influence population dynamics, such as institutional and cultural changes for example, often affect economic development, which, in turn, are usually poorly observed. Additionally, fertility changes affect economic growth across a long period of time. Overall, these issues hamper the way we can study the direct effects of population growth and differentiate them from other relevant factors. Therefore,

Ashraf et al. (2013) attempt to quantify the economic effects of fertility reductions in a developing country where with high fertility rates, using Nigeria as the relevant case-study. In the end, the authors conclude that a reduction in fertility does raise income per capita by an economically significant amount, but this effect is relatively small when we compare it to the existing income gaps between developed and developing countries.

The effect of changes in population's age structure on economic growth has been widely studied in the demography and population economics literature but, more recently, a growing amount of researchers has been trying to determine if the demographic dividend extends beyond a pure accounting effect. As we know, this phenomenon can raise income per capita through an accounting effect due to a bigger share of people in the working-age population than non-workers. However, these researchers claim the existence of a second demographic dividend, that accounts for most of the effects originated by the demographic dividend.

Cuaresma et al. (2014), by building on prior literature related to the effects of the demographic dividend, tries to study the existence and differences between the productivity effect and the translations effect, in order to measure their separate contributions to economic growth, without taking into account the labour force participation changes that originate the initial demographic dividend event. Using an improved data set and a global panel of countries, the authors find results that show that the labour productivity effects can be explained through changes in the educational attainment level and that the remaining effect of changes in the population's age structure is very small and it is related to a standard translation effect originated by changes in dependency rations during the demographic dividend. Thus, according to the authors, this demographic dividend phenomena needs to be understood in the context of the education effects and not only through age structure changes.

In general, we can observe a significant debate related to the relationship between population changes and economic growth. From an early focus on the role of population growth, provided by the initial work of Thomas Malthus (1798), this focus has shifted to the changes in population age structures (since the 1980s) to a more recent attention on the educational attainment and age structures (since the 2000s), where theories such as the unified growth theory establish the human capital as a trigger of demographic transition and economic growth.

Lutz et al. (2019) study the importance of the role of increasing human capital on economic growth for a panel of 165 countries between 1980 and 2015 and their results appear to show a clear

dominance of improving education over age structure: exogenously induced declines in fertility, which is a key factor to an increase of working-age population, seem to not originate economic growth by themselves. Additionally, declining youth dependency ratios show negative effects on income growth in cases of low education attainment levels. Thus, according to the authors, improvements in the educational attainment structures of populations are a key driver of economic growth, and, as variations in education levels can also be denoted demographic changes, they conclude that investments in human capital bring the true demographic dividend.

However, Kotschy et al. (2020) argue that the demographic dividend is more than an education dividend, being actually the result of a complex interplay between changes in the population´s age structure and education composition and level. By reassessing the relevance of shifts in age distribution on development for a panel of 159 countries between 1950 and 2015, based on a more flexible model of age-structured human capital endowments, the authors conclude that an increase in human capital has a positive effect on demographic dividend only if combined with a favorable age structure: a minimum level of education is then essential for economic growth but it needs to sync with a sufficiently large working-age share. Thus, according to Kotschy et al. (2020), it is important to not focus too much on the relevance of education, otherwise the consequent policies will lead to suboptimal results.

2.4. A Regional Level Analysis

Finally, an analysis at a regional level, instead of using international data, can be very useful: not only institutions and exogenous shocks, which have a big impact on economic growth, are more homogeneous across regions of a country than across countries, but also there is much more consistency on data at a regional level, which helps avoiding unnecessary measurement errors for this study. Baerlocher et al. (2019) and Fu et al. (2020) follow this type of analysis, by analysing the case of regions in Brazil and China, respectively.

Baerlocher et al. (2019) analyses heterogeneity across Brazilian micro-regions between 1970 and 2000, in order to study if there is a demographic dividend that extends beyond a pure accounting effect. Following the work of Cuaresma et al. (2014) and by using a System Generalized Method of Moments (Sys-GMM), the authors are able to find evidence of a pure accounting effect but only after controlling for human capital, which would mean that, for the Brazilian case at least, there is

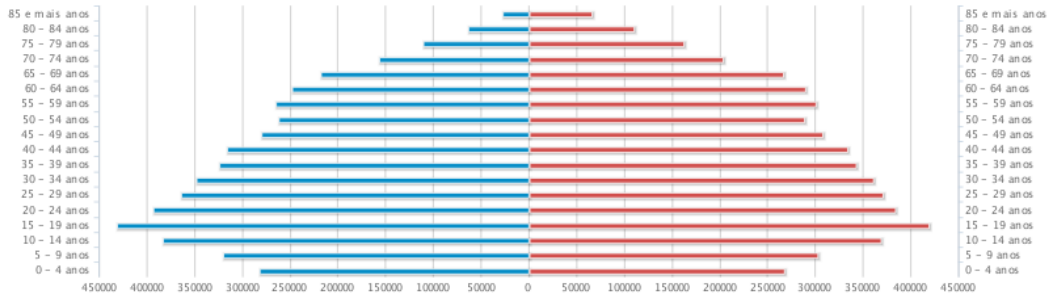
a second demographic dividend related to education. Additionally, the authors also show that this effect is more relevant than the accounting effect, where the latter is only responsible for about 10% of the income gap between the poorest and richest regions in Brazil.

Fu et al. (2020) set as a goal to study the relationship between the changes of population's age structure and labour productivity in China. By using provincial panel data between 2006 and 2015, this paper aimed to analyse the overall impact of age structure changes on labour productivity and further carry out regional division and triple test for provinces across the country. The authors present evidence that shows that these changes in the age structure of China, along with increases in total dependency ratio and child dependency ratio, originate negative effects on provincial labour productivity. Thus, according to the authors, the increase of labour input and the improvement of human capital appear to be general ideas to challenge the ageing of the Chinese population.

Additionally, Jafrin et al. (2021) attempts to study the relationship between demographic dividend and GDP growth rate by utilising panel data from 1990 to 2017 for five South Asia Association for Regional Cooperation (SAARC) countries (Bangladesh, India, Pakistan, Nepal and Sri Lanka). In this paper, the authors not only find a significant positive relationship between demographic dividend and economic growth, but also include a region-specific analysis that seems to follow the same trend, despite the existing differences on the impact of each emerging country in the economic growth.

3. Portuguese Demography

Before we move on to the methodology section of this study, it is important to describe a brief picture of the existent demography in Portugal, to showcase the current situation that the country is going through and also understand what are the main problems and what it can be done to solve them.



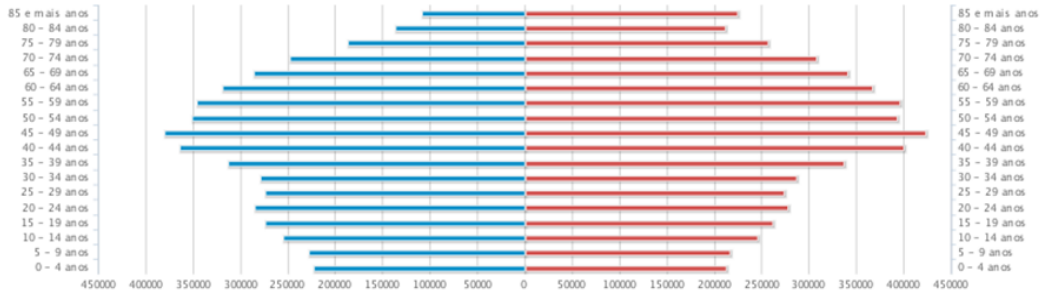


Figure 1 – Portuguese population by age sections and gender (1991 and 2020 respectively)

Source - PORDATA

The following figure (Fig. 1) shows the Portuguese population divided by age groups and sex (blue represents men and red represents women) for 1991 and 2020. We can easily observe significant changes between the two points in time: in 1991, Portugal presented a large share of people in working age while the share of old people was considerably low, and so a relatively young population when compared to 2020, where we can see a significant increase in the elderly sections and a decrease in younger sections. Even though this period is quite short for an analysis of this type, this figure can already give us insights of the consequent ageing of the Portuguese population in recent decades.

The next figure (Fig. 2) confirms the idea mentioned above: with the recent ageing of the population, the potential sustainability index (the ratio between the working-age population and elderly population) decreased substantially, which can lead to difficulties in experiencing higher economic growth rates due to the increasing significance of dependent groups such as the elderly. This is a serious issue in our current society, as the higher dependency ratios end up hindering the sustainability of pension systems and, in turn, the portuguese economy and its development.

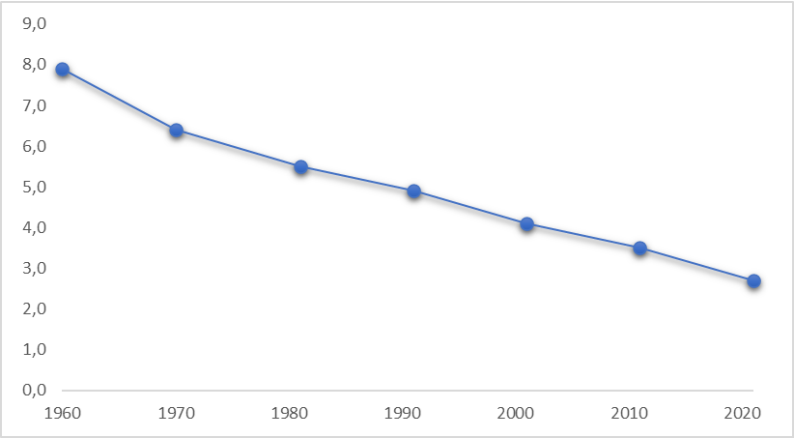


Figure 2 – Potential Sustainability Index in Portugal

Source – INE/PORDATA

Another relevant factor for the analysis of demographic dividend is the fertility. As shown in this figure (Fig. 3), the general fertility rate (the ratio between the number of live births per 1000 women of child-bearing age) experienced a huge decrease, especially in the 1980s and 90s, which could be a factor that affected the decrease of younger groups of the Portuguese population, as observed in this section already. Additionally, this reduction could also affect the women participation in the labour force, as it was addressed earlier.

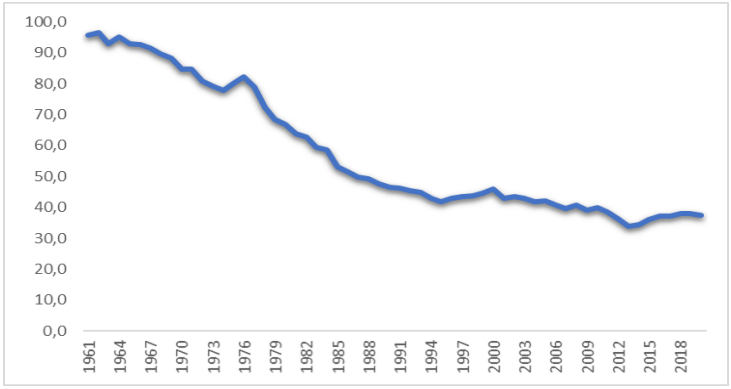


Figure 3 – General Fertility Rate in Portugal

Source – INE/PORDATA

Finally, the crude birth and death rate (how many people were born and died per 1000 residents) are also very important in the study of the effects of demographic dividend. In the Portuguese case, the following figures (Fig 4 & 5) showcase these variables: while we can observe a relative stagnation of the death rate in recent decades, the same does not happen with the birth rate, where the latter suffers a significant reduction. This situation hinders the Portuguese population age structure and leads to the population ageing phenomenon that we currently experience.

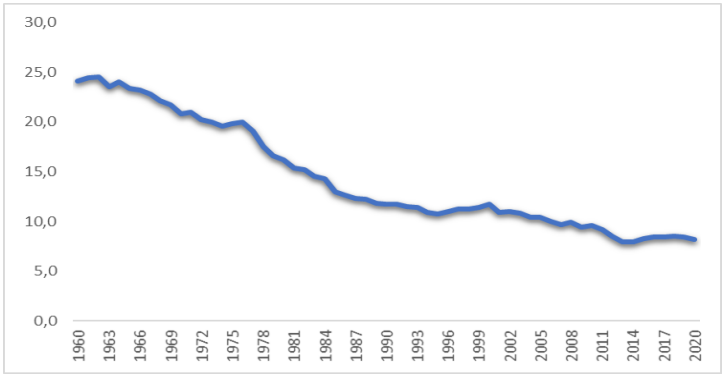


Figure 4 – Crude Birth Rate in Portugal

Source – INE/PORDATA

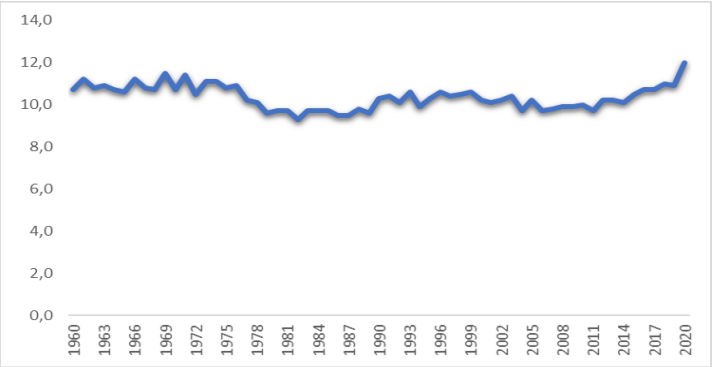


Figure 5 – Crude Death Rate in Portugal

Source – INE/PORDATA

Considering that the first demographic dividend is already exhausted and we now experience the effects of the consequent aged population, it is important to guarantee the existence of an evironment that allows Portugal to obtain benefits from a possible future second dividend. Thus, in this next section, I will further explain the goal of this study and which data and methods were used in order to apply the models that I consider relevant for the scope of this analysis.

4. Methodology

In order to analyse the impact of the demographic dividend in Portugal and also across different Portuguese regions, it is important to start by set the scope of this analysis and then describe the data and relevant variables to be studied in this article. This regional study will be conducted by following a NUTS (Nomenclature of Territorial Units for Statistics or "Nomenclatura das Unidades Territoriais para Fins Estatísticos") classification. This type of subdivision was developed and implemented by Eurostat in 1998 to help dividing the economic territory and conduct socio-economic analysis of regions. In this article, I apply a NUTS III (sub-regional) territorial division from 2002 and the data used in this research was retrieved from INE (National Institute for Statistics or "Instituto Nacional de Estatística") in order to capture important data for the analysis of the relevant variables used in my models. The regressions of this study are based in a panel data set, with data from the portuguese census of 2001 and 2011. The period of this study is relatively short due to the lack of data for certain variables, as some of them were not available for the territorial division that I've considered or simply did not present data for the 2021 census at the moment of this study (the most recent one).

Additionally, it is important to remind the relevance of a regional analysis: like mentioned in the previous literature review, institutional and exogenous shocks are more homogeneous across regions of a country than across countries, plus there is far more consistency on data at a regional level, which will help avoiding unnecessary measurement errors in further estimations.

In this study, I firstly considered the impact of the demographic dividend on economic growth, by expressing economic growth as a function of demographic dividend:

$$Economic\ Growth = f(Demographic\ Dividend)$$

This initial equation was then extended to include other variables I considered relevant to this analysis and so I've estimated multiple regressions in order to attempt to determine a linear relationship between economic growth and demographic dividend. For the estimations of this article, the dependent variable is the Portuguese Gross Domestic Product (GDP) per capita by geographic location (NUTS III) and the independent variables are the working age population ratio (which represents the demographic dividend), the year of the data, the crude birth rate, the crude death rate and the synthetic fertility index. It is noteworthy that the final model is with fixed effects, following a Least Square Dummy Variables method on its estimation.

$$GDPpc_{it} = \alpha + \beta_1 WAP_{it} + \beta_2 Year + \beta_3 RtBirth_{it} + \beta_4 RtDeath_{it} + \beta_5 FertIndex_{it} + \gamma Region_i + \varepsilon_{it}$$

where i denotes the NUTS III region and t denotes the time period. The main independent variable, the working age population, is defined as the total population in the age range between 15 and 64 and expressed as a percentage of the total population.

Variables	Observations	Mean	Standard Deviation	Minimum	Maximum
GDPpc	58	12.344	3.608	5.664	27.494
WAP	58	0.648	0.035	0.561	0.705
RtBirth	58	0.090	0.019	0.050	0.129
RtDeath	58	0.115	0.028	0.070	0.180
FertIndex	58	1.329	0.147	0.990	1.670

Table 1 – Descriptive Statistics of Main Variables

Table 1 presents a brief picture of the main variables of this study. As we can observe, all variables have 58 observations and do not present missing values. For Portugal, on average and between 2001 and 2011, the GDP per capita is 12344€, the working age population corresponds to 64.8% of the total population, there is a 9% birth rate and 11.5% death rate, and the syntethic fertility index is 1.329.

Furthermore, to avoid a potential bias originated from omitted heterogeneity, I also considered dummy variables for each Portuguese region of NUTS II and NUTS III, which it will be equal to 1 if the observation relates to the specific region and 0 otherwise, allowing a comparison between macro and micro regions. In this final model, each dummy variable is connected with the correspondent demographic dividend variable, originating an interaction variable that shows the impact of each region.

$$GDPpc_{it} = \alpha + \beta_1 WAP_{it} * Region\ Dummy + \gamma X_{it} + \varepsilon_{it}$$

where WAP_{it}*Region Dummy is the interaction variable for each region dummy (NUTS II or III, depending on each model) and X_{it} is the set of the previous variables in the model.

5. Main Findings

5.1. Baseline Regression Results

Table 2 showcases the baseline regression results for the specified models in the previous section. Despite the small number of observations that was adressed earlier, we can still observe some interesting results. Most of the variables seem to be statistically significant in the different models and positively related to the dependent variable (GDP per capita). This means that an increase in the value of these variables leads to an increase as well of the economic growth of the country. All models seem to be statistically signifcant at a 95% confidence level as well.

If we focus now in each variable, we can also retrieve more information. The working age population, or the demographic dividend, appears to be always positively related to the GDP, which follows the idea that a bigger proportion of population in working age will generate an economic boost that will benefit the country. However, by looking at the death rate variable, we can observe that it loses its statistical significance and even changes signal when combined with the fertility index in the same model. The same happens when we look at the birth rate variable, even though the signal remains the same but the coefficient suffers a considerable reduction. Additionally, the

fertility index variable, negatively related to the independent variable as well, seems to not be statistically significant in the last model. These results could be related to the lack of data in a short period of time that I've previously addressed or a possible relationship between the variables that affects the model, but, nevertheless, this last model is much more robust due to the application of fixed effects for the NUTS III Portuguese regions.

Table 2: Baseline Regression Results

	Model 1	Model 2	Model 3	Model 4
WAP	27.352**	36.850***	52.439	16.895
	(13.3177)	(11.5193)	(34.4521)	(16.8419)
Year		0.376***	0.590***	0.413***
		(0.0797)	(0.1042)	(0.0594)
Birth Rate			101.019***	83.089*
			(35.8945)	(42.2136)
Death Rate			70.619*	-20.333
			(40.9665)	(38.9103)
Fertility Index				-5.772
				(3.9657)
Dummy Regions				YES
Observations	58	58	58	58
R-squared	0.070	0.338	0.439	0.981
F statistic	4.218	14.015	10.364	36.706

Notes: Standard error in parenthesis. Significance Levels: *, 10%; **, 5%; ***, 1%.

The dependent variable is GDP per capita.

Source: INE

5.2. Region-Specific Regression Results

Table 3 presents the regression results of the final model, that includes the interaction variables for the region-specific dummy variables at a NUTS III territorial divison. At first sight, we can immediately observe a considerable increase of the R-squared, when compared to most of the previous models. This means that the independent variables in this model are able to explain the

variance of the dependent variable far better in a region-specific analysis than in the initial baseline models, which follows the initial assumption mentioned earlier in the methodology. Additionally, by looking at the common variables of both type of analysis, we can observe the same lack of statistical significance and signals affecting the dependent variable.

However, when we observe the region-specific interaction variables, the demographic dividend seem to impact the GDP of the different regions at varying level of significance and signal impact. This result may be due to existing differences between the portuguese regions when it comes to natural resources, educational level, geographical conditions and what not, and so, if these differences exist, the income levels that can be achieved will also be different (Bloom et al. 1999). Aditionally, regions closer to the coast of Portugal, especially Lisbon area, seem to have a more positive impact on the GDP of the region, which could be a sign of a trend, maybe due to the existence of a higher working age population ratio and better life conditions in coastal areas.

Table 3: Regression Results by NUTS III Regions

	Model 5
WAP Minho Lima	-7.062***
	(1.7316)
WAP Cávado	-9.496***
	(2.4327)
WAP Ave	-8.086***
	(2.2830)
WAP Grande Porto	-2.377
	(1.8247)
WAP Tâmega	-12.989***
	(2.2173)
WAP Douro Vouga	-6.382***
	(2.1009)
WAP Douro	-6.992***
	(1.7195)
WAP Trás os Montes	-5.271**
	(2.4306)
WAP Baixo Vouga	-3.045*
	(1.5309)
WAP Baixo Mondego	-1.184
	(1.5025)
WAP Pinhal Litoral	-1.160
	(1.6095)
WAP Pinhal Norte	-6.119**
	(2.7566)
WAP Dão Lafões	-5.696***
	(1.4557)
WAP Pinhal Sul	-3.316

	(5.2884)
WAP Serra Estrela	-8.874**
	(3.4320)
WAP Beira Norte	-4.775
	(2.9473)
WAP Beira Sul	1.789
	(3.6125)
WAP Cova Beira	-6.874***
	(2.0128)
WAP Oeste	-4.037***
	(1.3839)
WAP Médio Tejo	-1.988
	(1.7690)
WAP Grande Lisboa	12.596***
	(1.5614)
WAP Península Setúbal	-6.662***
	(1.5505)
WAP Alto Alentejo	-1.759
	(3.6973)
WAP Alentejo Central	-0.619
	(1.7424)
WAP Baixo Alentejo	0.618
	(3.3213)
WAP Lezíria Tejo	-1.833
	(1.5376)
WAP Açores	-4.300***
	(1.4543)
WAP Madeira	-3.191**
	(1.4373)
Year	0.364***
	(0.0467)
Birth Rate	70.022
	(44.3165)
Death Rate	-38.788
	(39.1885)
Fertility Index	-5.617
	(4.0879)
Observations	58
R-squared	0.977
F statistic	33.905

Notes: Standard error in parenthesis. Significance Levels: *, 10%; **, 5%; ***, 1%.

The dependent variable is GDP per capita.

Source: INE

However, if we run the same model once again but, this time, we only apply the Portuguese NUTS II regions, we obtain different results (Table 4): now most of the regions become statistically

insignificant and their coefficients seem to be smaller in general as well. The next chapter of this article will then discuss the results from this section and give possible explanations for them.

Table 4: Regression Results by NUTS II Regions

	Model 6
WAP Norte	-5.807*
	(3.2545)
WAP Centro	-2.625
	(3.0870)
WAP Lisboa	3.100
	(3.7474)
WAP Alentejo	-0.780
	(3.4997)
WAP Algarve	0.112
	(4.2127)
WAP Açores	-4.201
	(4.4766)
WAP Madeira	-2.295
	(4.2623)
Year	0.403***
	(0.1210)
RtBirth	49.209
	(110.0805)
RtDeath	-31.829
	(37.9410)
FertIndex	-0.359
	(10.4838)
Observations	58
R-squared	0.566
F statistic	5.443

Notes: Standard error in parenthesis. Significance Levels: *, 10%; **, 5%; ***, 1%.
The dependent variable is GDP per capita.
Source: INE

6. Discussion

There's no doubt that the changing patterns of age and other demographic factors such as fertility and mortality have a huge impact in the economy of a country. If we consider that the first demographic dividend in Portugal is already exhausted and that we are now experiencing a consequent population ageing, the study of the relationship between the demographic dividend and economic growth is even more important, especially if we asume that a second demographic dividend might be possible in a near future, as previous literature states.

By analysing the results of the baseline and region-specific regressions, it is possible to observe, in fact, a significant relationship between the demographic dividend and economic growth: this dividend is positively related to the GDP in general and then assumes different impacts and levels of significance when we apply a further analysis by region.

When we focus our analysis on Portuguese regions, some curious results arise as well. If we look at NUTS III regions, we can observe the existence of differences which may be related to different levels of natural resources, educational levels, geographical conditions and other relevant factors. However, if we apply the same model to NUTS II regions, these become mostly statistically insignifcant, which can suggest that the differences on the effects from demographic dividend are stronger between micro regions (NUTS III) than between macro regions (NUTS II).

When it comes to the rest of the demographic variables included in the models, there are mixed results: variables such as birth rate and death rate appear to assume different signals and significance levels across different models of this study, while the fertility index remains insignificant. This might be related to the existing problem of the lack of data available for the latest Portuguese census (2021), as this additional data would have allowed a further analysis with more variables and across a slighty larger period.

Nevertheless, this study was still able to provide some relevant insights in an area that is not very extensive at the moment, especially when the scope of the current analysis is limited to one country only, and to the consequent comparison of its different regions.

Additionally, the use of fixed effects, following a Least Square Dummy Variable (LSDV) method, on Model 4 also allowed us to obtain more robust results and that are controlled for the Portuguese regions.

7. Conclusions and Further Work

The recent impact of demographic changes in the world has become one of the most important challenges of our century. Recent trends of decreasing birth and death rates have led us to a crossroad between population ageing and a more recent phenomenon known as demographic dividend. This mechanism is responsible for an economic boost originated by increasing shares of working-age people and so decreasing shares of dependency ratios: due to a bigger share of working-age people than non-workers, this dividend can raise income per capita through an accounting effect. Moreover, recent research claims the existence of a second demographic dividend and that which was often connected to education.

Therefore, the goal of this study is to assess the existence of the demographic dividend in Portugal and across Portuguese regions, analyse the timing and impact of it in its economic growth and also conduct a brief comparative analysis between regions, in order to obtain important insights in a topic that was not very explored so far in our enviornment. The data used in this study was retrieved from INE and the portuguese census for 2001 and 2011 and applied in a panel data set, in order to conduct analysis throughout time and different regions.

The previous literature review tells us that there is still a debate in the field of demographic dividend and its relationship with economic growth. Certain factors such as fertility, for example, seem to have different impacts in the economy, while, more recently, there has a been a shift in the focus of this area to also include the effects of education levels into this demographic dividend and, consequently, the economic growth.

Thus, by setting multiple regressions where the dependent variable is the Portuguese Gross Domestic Product (GDP) per capita by geographic location (NUTS III) and the independent variables are the working age population ratio (which represents the demographic dividend), the year of the data, the crude birth rate, the crude death rate and the synthetic fertility index, but also by conducting a further analysis where dummy variables for each region were included to compare possible differences between them, it allows to draft some possible findings. Firstly, the relationship between demographic dividend and economic growth, besides the previous limitations adressed, seems to be significant and positive in general. This would mean that an increase in the share of population in working age would positively affect the portuguese GDP. Furthermore, a deeper analysis at a region-specific level also tells us that there are considerable differences between micro regions (NUTS III), which can be due to different levels of natural resources, education and other

economic and social factors, while the same does not happen between macro regions (NUTS II). Additionally, a possible trend between coastal areas and their demographic dividend might be possible to arise once more data is available for a larger scope of analysis.

Nevertheless, as I've mentioned earlier, further work would benefit the quality of the findings from this initial study. As of date, I was only able to include data from 2001 and 2011 and that was divided by the NUTS III territorial division, while data for 2021 was lacking in some categories and ranges, which wouldn't allow a full analysis for this period. Therefore, once this data is available to use, a deeper analysis, not only from the current variables but also from additional ones, woud be possible and interesting to follow in the near future, as more hypotheses related to economic, social and demographic factors could be studied and lead to better and wider insights of the Portuguese society.

7.1. Policy Recommendations

As mentioned previously, the impact of the demographic dividend on economic growth, by itself, is insufficient to benefit from the full potential of this economic boost generated by a larger share of working age population in comparison with dependent groups: it would only allow the existence of the labour force needed for an economic expansion, with little or no concern for their quality. So, the following conditions could benefit a future demographic dividend and the consequent window of opportunity.

First, it is essential to provide fair and good employment opportunities in order to fully take advantage of a larger cohort of people in working age. This would depend on the local governments' strategies and precautions to promote a better match between workers and jobs, otherwise the increase of youth unemployment could arise and, consequently, negatively impact the economic development.

Second, the investment in education quality is also fundamental to create a young skilled force that could benefit the labour market. If not, the education expenditure would still be high but without having a full impact on the young population cohort. Additionally, the existence of good infrastructures would attract more investors, which, in the end, could originate more jobs and investment in the country's economy, and, so, benefit the demographic dividend at its full potential.

Even though smaller populations might originate a reduction of consumption levels and save natural resources, the consequences of low fertility rates can also be negative, as a population with smaller young cohorts and larger old cohorts could affect the sustainability of social welfare systems like pensions and healthcare. Therefore, certain policies could be helpful to increase these levels of fertility. For instance, family-oriented measures such as financial support and tax breaks for parents with children may be benefitial to the economic and social well-being of families.

Part-time is also a helpful option for working mothers, allowing women to avoid picking between a full-time job or having children. Other measures like flexible working hours and short leaves are also very important for parents. Additionally, affordable housing can encourage young people to move from their parents' home and form couples to create their own families.

Finally, the population ageing phenomenon is a huge issue in our society, that needs attention and development of policies. Rural/remote areas often experience a more significant population ageing than coastal/urban areas, leading to a higher share of old peopne in those regions, which we can actually observe as well in Portugal. This low population density and dispersion across Portuguese regions causes more problems to create and sustain an effective service infrastructure as present in urban areas, reducing the access of these groups to health and social services. Because of this disadvantage, older people might face higher risks of health care deficits and social isolation. Therefore, the creation and establishment of new and sustainable solutions to help the elderly cohort living at home independently is essential for both demographic changes and financial constraints that the country miay face.

Ageism, the stereotyping and discrimination against people based on their age, is also a relevant problem, as many older workers struggle to find work and training opportunities, which often force them to retire early in situations of economic recession. Thus, to fight against ageism in our society, we need to not only address this discrimintion but also encourage more age-diverse workplaces that equally benefit all generations.

8. References

Adsera, A. (2005). Vanishing children: from high unemployment to low fertility in developed countries. American Economic Review, 95(2), 189–193

Albuquerque, P. C. (2015). Demographics and the Portuguese economic growth.

Ashraf, Q. H., Weil, D. N., & Wilde, J. (2013). The effect of fertility reduction on economic growth. Population and development review, 39(1), 97-130.

Ayllón, S. (2019). Job insecurity and fertility in Europe. Review of Economics of the Household, 17(4), 1321-1347.

Baerlocher, D., Parente, S. L., & Rios-Neto, E. (2019). Economic effects of demographic dividend in Brazilian regions. *The Journal of the Economics of Ageing*, *14*, 100198.

Barsukov, V. N. (2019). From the Demographic Dividend to Population Ageing: World Trends in the System-Wide Transition. Economic and Social Changes: Facts, Trends, Forecast, 12(4), 167-182.

Barsukov, V. N., & Kalachikova, O. G. N. (2020). The Evolution of Demographic and Social Construction of the Age of" Old Age". *Ekonomicheskie i Sotsialnye Peremeny*, *13*(1), 34-55.

Bloom, D., Canning, D., & Malaney, P. N. (1999). Demographic change and economic growth in Asia. *CID Working Paper Series*.

Bloom, D., Canning, D., & Sevilla, J. (2003). *The Demographic Dividend: A New Perspective on the Economic Consequences of Population Change*. Santa Monica, CA; Arlington, VA; Pittsburgh, PA: RAND Corporation. Retrieved from http://www.jstor.org/stable/10.7249/mr1274wfhf-dlpf-rf-unpf

Carbonaro, G., Leanza, E., McCann, P., & Medda, F. (2018). Demographic decline, population aging, and modern financial approaches to urban policy. *International Regional Science Review*, *41*(2), 210-232.

Coale A. and E. Hoover, 1958, Population Growth and Economic Development in Low-Income Countries: A Case Study of India's Prospects, Princeton: Princeton University Press.

Cuaresma, J. C., Lutz, W., & Sanderson, W. (2014). Is the demographic dividend an education dividend?. Demography, 51(1), 299-315.

Friedman M., 1957, A Theory of the Consumption Function, Princeton: Princeton University Press

Fu, L., Wang, Y., & He, L. (2020). Age composition change and inter-provincial labor productivity: a study from the perspective of population dividend and population urbanization. *Journal of Applied Economics*, *23*(1), 183-198.

Ince Yenilmez, M. (2015). Economic and social consequences of population aging the dilemmas and opportunities in the twenty-first century. *Applied Research in Quality of Life*, *10*(4), 735-752.

Jafrin, N., Mahi, M., Masud, M. M., & Ghosh, D. (2021). Demographic dividend and economic growth in emerging economies: fresh evidence from the SAARC countries. *International Journal of Social Economics*.

Kotschy, R., Urtaza, P. S., & Sunde, U. (2020). The demographic dividend is more than an education dividend. Proceedings of the National Academy of Sciences, 117(42), 25982-25984.

Lutz, W., Cuaresma, J. C., Kebede, E., Prskawetz, A., Sanderson, W. C., & Striessnig, E. (2019). Education rather than age structure brings demographic dividend. Proceedings of the National Academy of Sciences, 116(26), 12798-12803.

Ross, J. (2004). Understanding the demographic dividend. *POLICY Project Note*.

T. R. Malthus, An Essay on the Principle of Population (J. Johnson, London, UK, 1798).