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VIABLE HEALTH FUNDING IN TIME OF DEMOGRAPHIC AGING

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Abstract

In the past several decades, a new challenge has arisen. It refers to the rapid demographic aging of the population in developed and developing countries, quite the opposite of the previous understanding of an overpopulated planet. An increase in the older population brings implications for different segments of society and the national health system, and its funding is one of them. This paper aims to analyse if there is a relationship between government health expenditure and the increase in the older population in fourteen countries in the European Union experiencing the most intense process of demographic aging. The relationship between health expenditure and population aging is a highly debatable issue. There is significant research supporting both hypotheses, the former being that aging influences the health expenditures and the latter i.e., the opposite one that the demographic aging of the population does not drive the health expenditures. More than twenty years ago, this conundrum was addressed as a "Red Herring"; however, the debate continues up to nowadays. This paper aims to determine whether aging is a significant factor when it comes to health expenditure. Accordingly, possible further recommendations will follow – should policymakers look at the aging population or other possible determinants to prevent the potential rise in health expenditure such as government social spending. The model also includes gross domestic product per capita and a dummy variable to estimate the effect of the global recession on health expenditure.

Keywords: demographic aging, health expenditure, Panel Regression Model

JEL classification: J11, I18, C33

Introduction

One of the main challenges that many national economies face today is population aging. There is no nation in the developed world that is not facing this issue. At the 2019 World Artificial Intelligence Conference, two billionaire entrepreneurs, Tesla CEO Elon Musk and Alibaba founder Jack Ma agreed that the biggest problem that the world will face in the future is population decline. They also call it "accelerating population collapse" (Clifford, 2019).

Population aging is a demographic, social, and economic phenomenon. Two demographic trends are responsible for population aging, increased life span, and decreased birth rates. Wan Ahmad et al. (2015) see that population ageing is a by-product of demographic transition and state that demographic transition and population ageing are two inseparable concepts. Declining birth and mortality rates and the increase in life expectancy mainly contribute to the population's ageing.

Societal aging changes how people work, function as a family, decide to start or delay their retirement, and even improve their digital literacy and well-being.

Economic implications of population aging reach all segments of the economic system. Bloom and Luca (2016) define population aging as the 21st century's dominant demographic phenomenon, with significant implications for employment, savings, consumption, economic growth, asset values, and fiscal balance. Yoshino and Miyamoto (2017) examine the effect of the aging population on economic performance and the effectiveness of Japan's fiscal and monetary policies. They find that as the proportion of retirees increase, policy effectiveness decreases.

The aging population has its plethora of repercussions on the national economy, health systems, pensions systems, deficits in specific workforce, and depopulation of villages and smaller cities. The impact of demographic aging is enormous and multifaceted, i.e., deteriorating fiscal balance, changes in patterns of saving and investment, shortage in labour supply, lack of adequate welfare system, particularly in developing economies, a possible decline in productivity and economic growth, and ineffectiveness of macroeconomic policy (Yoshino et al., 2019). The effect that demographic aging has on government health expenditure is the core matter of this research. The traditional understanding says that as the number of older citizens increases, health expenditures are also on the rise because, on average, health care expenditures are higher for older than younger persons. However, many published analyses in previous decades seem to challenge this perception. This paper aims to investigate the potential influence of the increasing old population on government health expenditure. Other determinants are considered in the analysis to expand the knowledge of the potential factors influencing health spending.

Literature review

One of the most important controversies in health economics concerns whether the imminent aging of the population in most OECD countries will burden taxpayers who finance public health care systems (Lorenz et al., 2020). The influence of demographic aging on health expenditures was the subject of numerous analyses with differing results. A study that supports this relationship is the one of Lopreite and Mauro (2017). Their results show that health expenditure in Italy reacts more to the aging population compared with life expectancy and per capita GDP. Fuchs (1999) explains that the percentage of GDP spent on health in the United States increases as the number of persons 65 and above also increases due to aging baby boomers. Another study from Colombier (2018) shows that demographic aging is a relevant determinant of health care expenditure in Switzerland. Research previously made by Werblow et al. (2007) using a Swiss data set finds no or weak age effects on health care expenditure.

De Meijer et al. (2013) examine the effect of demographic aging on health expenditure growth. They acknowledge that the consequences of demographic aging for growth in health expenditures have been widely investigated and that research on this topic is somewhat fragmented. Their results only confirm that the direct effect of population aging is modest, and yet age and aging remain essential factors in the debate on health expenditure growth. Martín et al. (2011) reviewed the literature on determinants of healthcare expenditure from 1998 to 2007 in 20 primary studies, and they found no single pattern of results. They conclude that no solid empirical evidence exists that population aging is one of the principal determinants of healthcare expenditure. Felder (2013) examined several empirical studies. The studies suggested that the impact of a longer life on future health care expenditure will be moderate because of the high costs of dying and the compression of mortality and morbidity in old age. Suppose proximity to death, not age per se, determines the bulk of expenditure. A shift in mortality risk to higher ages will not significantly affect lifetime health care expenditure, as death occurs only once in every life. There are exceptions for people of high age (85 – 90 years) who need more long-term care in their last years of life, thus health expenditures will increase.

A common understanding is that the aging population increases health expenditure. Zweifel et al. (1999) challenged this finding in their article "Aging of Population and Health Care Expenditure: A Red Herring?". They elaborate that age does not influence health care expenditure. Also, age did not predict health expenditure after controlling for the time of death. Regarding the issue presented in this paper, there is a "red herring" hypothesis that supports the finding that aging does not have an impact

on health expenditures. The term "red herring" refers to a fact or idea used to draw attention away from the central point or the critical question. After this research was published, most of the analyses either supported their findings or challenged them, creating two opposite points of view. For example, Karlsson et al. (2018) came up with the finding that there is a significant age gradient in health expenditure, most of which are for long-term care expenditures, and costs of dying are substantial with limited impact on the age gradient in health expenditure. Their results are against the "red herring" hypothesis.

Another research that opposes the "red herring" is by Lorenz et al. (2020). They conclude that aging positively impacts per capita health expenditures in Germany, small for medical care expenditure, yet much more significant for expenditure in the long-term. Their simulation of per capita health expenditure and long-term care showed that the annual growth rate was more than 2%. Even the most optimistic per capita GDP growth scenarios indicate that the German health care financing system is at risk in the long run.

Previously cited research by Werblow et al. (2007), on the other hand, confirms the existence of a "school of red herrings" (with a possible exception to long-term care). Aging matters despite its proximity to death. Thus, they also oppose the "red herring" hypothesis.

Williams et al. (2019) examine sustainable health financing with an aging population in the EU, Japan, and Indonesia. Their findings, again contrary to expectations, confirm that an aging population is unlikely to translate into significantly higher growth in health spending. For the EU, the study confirms that health care expenditures are often more significant on average for people in older age groups. Nevertheless, the main factor for demographic aging to drive growth in health spending is the size of the difference in average spending levels between older and younger age groups.

With extensive literature that tackles this debatable issue, it would be good to provide fresh insight from the countries that are deeply in the process of demographic aging, to confirm or deny the existence of the effect of the growing old population on the government health expenditure.

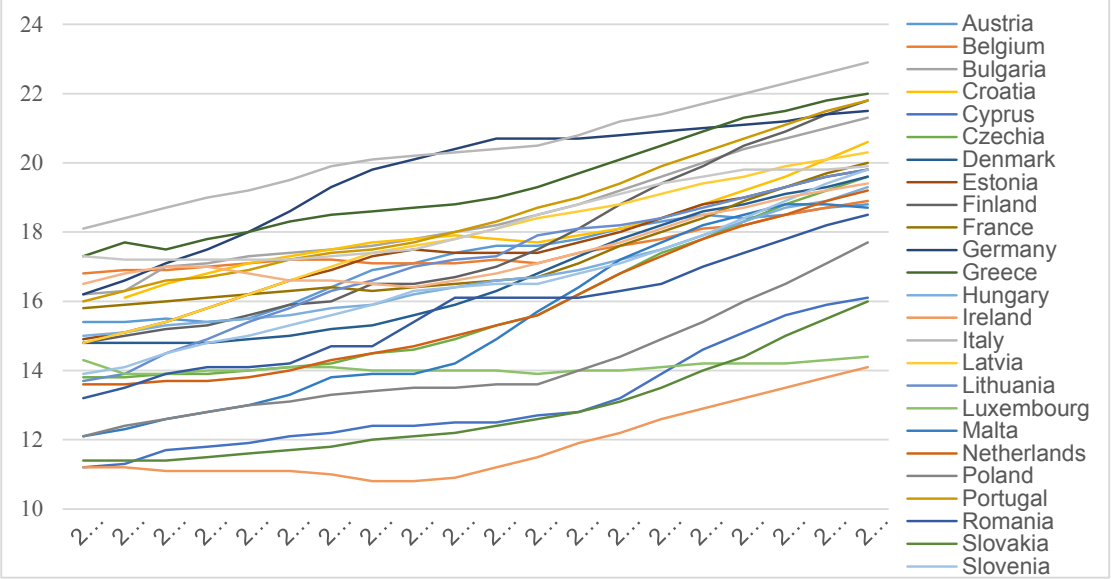
The aging population in Europe

The population in Europe has been facing the problem of demographic aging for decades. The aging of Europe's population reflects declining birth rates, leading to fewer young people and increasing life expectancy so that more people live into old age (Rechel et al., 2009). The repercussions of this phenomenon impact all segments of society i.e., the economy, the health systems, the labour markets, and the pension systems. It is an important issue that needs to be addressed and considered by policymakers of each national economy. However, the situation is not the same in every country in the European Union. Some countries have been facing severe demographic aging in the past two decades, whereas in other countries, the effect of population aging is moderate.

Figure 1 presents the trends of the proportion of the senior population (aged 65 years and older) in all EU countries for the period 2000 – 2019. A general conclusion is that all countries mark increasing trends. However, the percentage of the old population differs by country. Nations like Italy, Greece, Germany, Portugal, Finland, Bulgaria, and Latvia had more than 20% of the population aged 65 and older in 2019. Latvia, Sweden, Croatia, Estonia, Lithuania, France, Denmark, Spain, Slovenia, Czech Republic, and Hungary follow, with more than 19% of the population aged 65 and more in the same year.

On the other hand, there are still countries where the percentage of the old population is low. Ireland had the lowest percentage of the old population in 2019, at 13.5%, followed by Luxembourg with 14.3%; Slovakia with 15%, and Cyprus with 15.6%. Nevertheless, these countries seem to follow a rapid increase in older populations. Trends intensify in their growth (starting from 2020), and if this rate pertains in the following decades, the percentages will increase, deepening the process of demographic aging.

Figure 1: Proportion of population aged 65 years and more in EU countries



Source: Population structure indicators at a national level, Eurostat

All countries in Europe are experiencing an aging of their populations. This process is a significant cause of upward pressure on health care costs (Rechel et al., 2009).

Empirical research

Methods and data

This research aims to examine the ageing population's effect on government health expenses. All 27 EU member countries were initially analysed. However, a preliminary examination of the data showed that the process of demographic aging is different in its intensity for different countries. Countries were ranked according to the percentage of the population aged 65 and older. The average percentage for the past five years was calculated (2015 – 2019). Fourteen countries with a percentage higher than 19% were considered since these are the ones that are most affected by the aging process: Italy (22.3%), Greece (21.5%), Germany (21.2%), Portugal (21.1%), Finland (20.9%), Bulgaria (20.7%), Latvia (19.9%), Sweden (19.8%), Croatia (19.7%), Estonia (19.3%), Lithuania (19.3%), France (19.3%), Denmark (19.1%) and Spain (19.0%).

Health expenditure and social expenditure are part of the report General government expenditure by function from Eurostat, which includes different segments of government spending as a percentage of GDP: public service, defence, public order and safety, economic affairs, environmental protection, housing and community amenities, health, recreation, culture and religion, education and social protection.

The analysis includes 14 countries, with annual data from 2000 to 2019 (the model has 280 observations). Table 1 contains the selected variables.

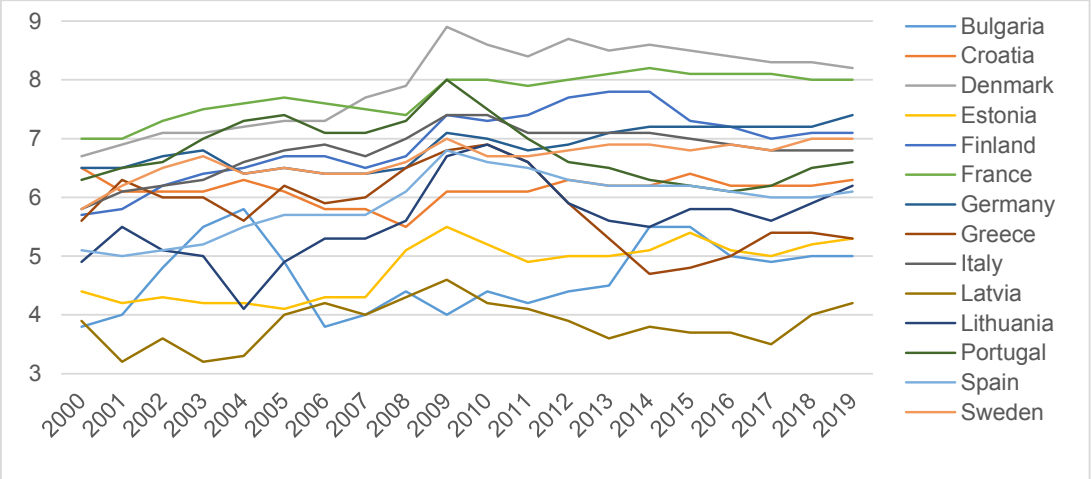
Table 1: Analysed variables

Abbreviation	Variable	Specification	Source
HEALTH	General government expenditure HEALTH (% of GDP)	Dependent variable	Eurostat
SOCIAL	General government expenditure SOCIAL PROTECTION (% of GDP)	Independent variable	Eurostat
GDP	GDP per capita, current prices, euro	Independent variable	Eurostat
LIFE	Life expectancy (years)	Independent variable	Eurostat
OLD	Old-age dependency ratio (population 65+ to population 15 to 64 years)	Independent variable	Eurostat

Source: Presented by the author

Health expenditure as a percentage of GDP is the crucial variable. According to Eurostat, this expenditure entails medical products, appliances and equipment, outpatient services, hospital services, public health services, and research and development. As presented in Figure 2, expenditure continued to rise from 2000 until 2009. They reached their peak in 2009 in almost all countries.

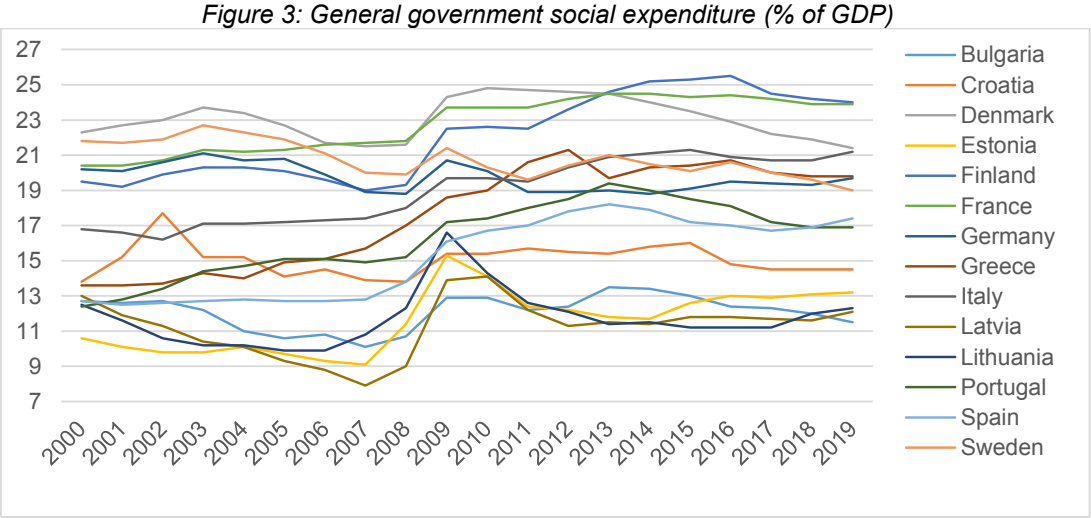
Figure 2: General government health expenditure (% of GDP)



Source: General government expenditure by function, Eurostat

After the Global recession, due to increased spending in other government segments, they started to decrease in the following years, with a tendency to stabilize (Denmark, Sweden, Finland) or even increase (Germany, Portugal, Spain, Latvia, Estonia, Lithuania, Croatia). It seems that the recession had a profound impact on health expenditure in these countries, in a way that it slowed down the increasing trends. Health spending is back on a growth path after the slowdown following the financial crisis (OECD (2018).
Countries like Denmark, France, Finland, Germany, and Sweden have higher percentages for health expenditure (more than 7%), while Latvia and Estonia are below 5%.

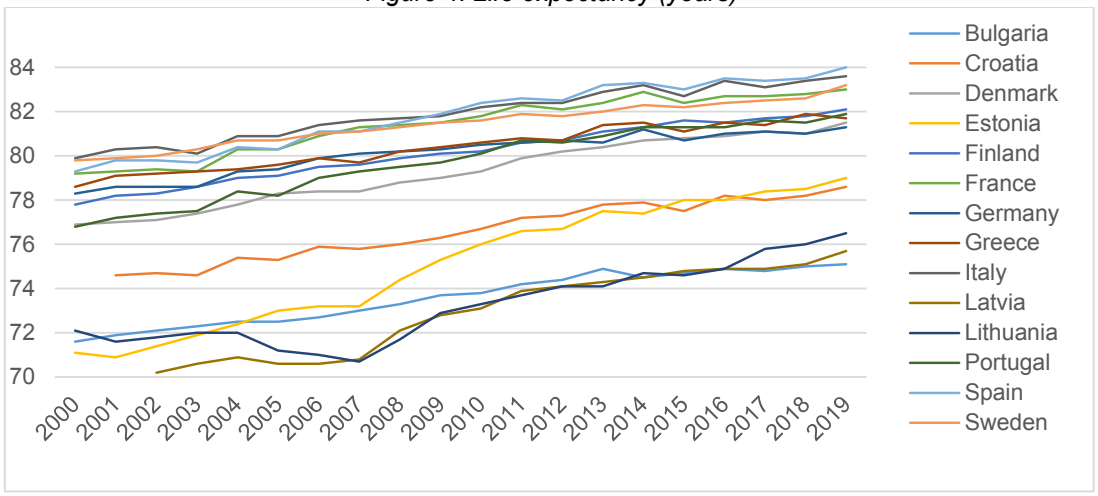
Figure 3: General government social expenditure (% of GDP)



Source: General government expenditure by function, Eurostat

Social expenditure, also described as social protection, includes sickness and disability, old age, survivors, family and children, unemployment, housing, social exclusion, and research and development. They are calculated as a percentage of GDP.

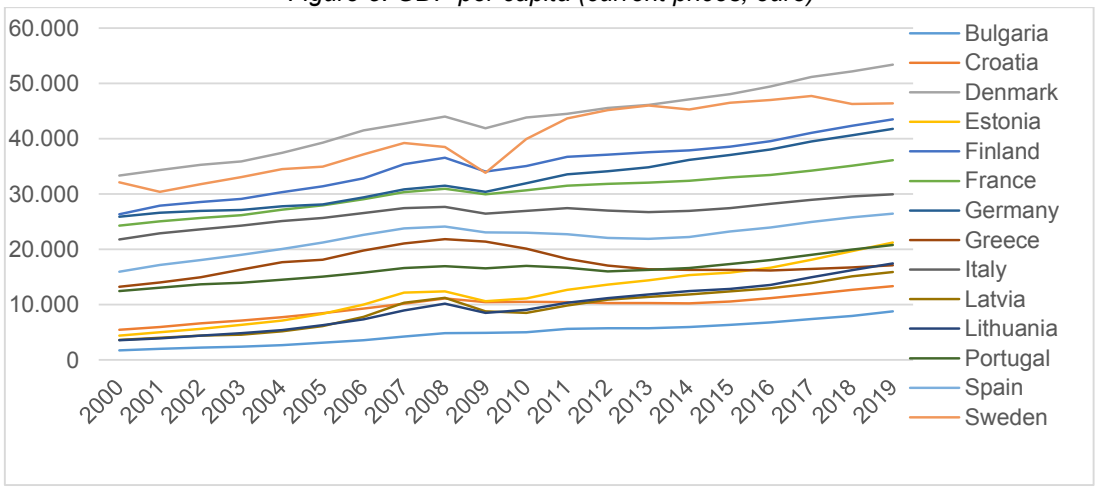
Figure 4: Life expectancy (years)



Source: Life expectancy by age and sex, Eurostat

Affected by the global economic crisis, there has been a fall in almost all national trends stabilised in the past several years. Social expenditure tends to rise from 2000 to 2009, reaching its peak like health expenditure. Finland, France, Denmark and Italy are the top countries that separate more than 20% of their GDP towards social protection. At the same time, this percentage is low in Bulgaria, Latvia, Lithuania, Croatia, and Estonia (less than 15%).

Figure 5: GDP per capita (current prices, euro)



Source: Main GDP aggregates per capita, Eurostat

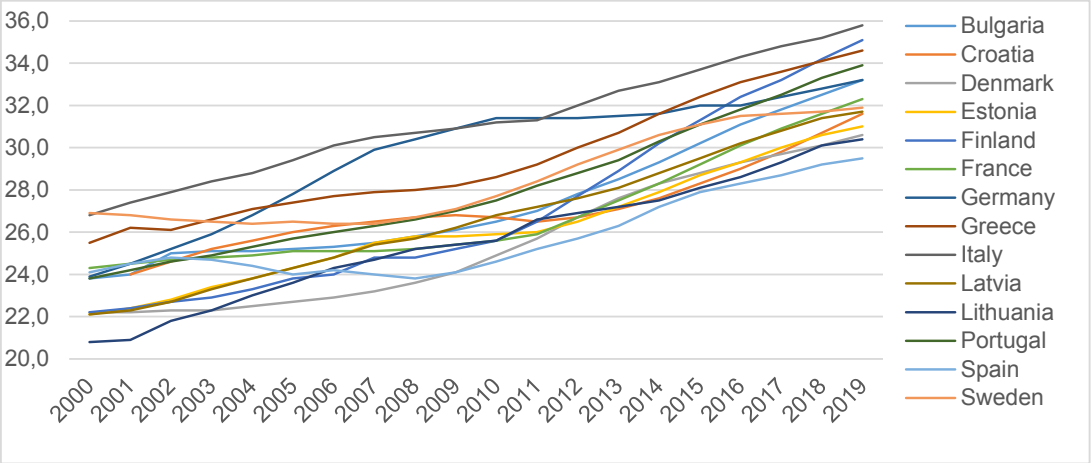
As presented in Figure 4, in all observed countries, life expectancy is an indicator of a rising trend in the past twenty years. Spain, Sweden, Italy and France have a high life expectancy, above 83 years, while Estonia, Croatia, Lithuania, Latvia and Bulgaria have a lower life expectancy, below 80 years.

The previous implies that the percentage of older adults is increasing. Also, the living age is prolonged, adding to the burden on the health system.

Even though the selected countries share a high percentage of the old population, there is a significant difference in the level of economic development. As presented in Figure 5, Denmark, Sweden, Finland and Germany have the highest GDP per capita (more than 40,000 euros) while Greece, Latvia, Lithuania, Croatia and Bulgaria are below half of the most economically developed countries (less than 20,000 euros).

Dealing with the aging population and its repercussions is difficult, especially for countries facing economic problems, reflected by their low GDP per capita. From the presented trends, it is easy to notice the global recession's effect on the economy, where most of the countries have a drop in the trend for 2009. After this year, trends seem to have stabilised.

Figure 6: Old-age dependency ratio (population 65 years or over to population 15 to 64 years)



Source: Population structure indicators at a national level, Eurostat

The old-age dependency ratio represents the ratio of people 65 years or older to the population 15 to 64 years. This variable shows the burden of the senior population on the working force. All countries mark a steep rise in their trends. Italy, for example, had a ratio of 26.8 in 2000, and it had the most significant increase of 35.8 in 2019. Finland, Greece and Portugal followed it.

Model estimation

Three equations for different observation periods were estimated, and therefore all examined variables were tested three times for the existence of a unit root. The first estimation is for all observed years (2000 – 2019) to confirm if the effect of the independent variables on the health expenditure maintains. In this equation, a dummy variable was introduced to consider the effect of the global economic crisis, which impacts all observed indicators presented previously (dummy includes a value of one for 2008 and 2009 and zeros for the rest of the period). The other two equations examine the period pre-crisis (2000 – 2007) and post-crisis (2010 – 2019). The analysis was divided in this manner to examine if the global recession impacted the way national governments decided to determine the amount of health expenditure. Also, to establish which determinants persist in impacting health expenditure. According to Figure 2, most countries have more stochastic trends in the pre-crisis period. In contrast, in the post-crisis period, they seem to stabilise and continue to develop with linear or parabolic trends.

Testing for stationarity

Variables are tested for stationarity to provide the correct model specification. The specification was given according to the trends of the variables (individual intercept, individual intercept and trend, and no intercept or trend).

Table 2 illustrates the results from unit root testing. Within the panel unit root-testing framework, there are two generations of tests. The first generation of tests assumes that cross-section units are cross-sectionally independent. In contrast, the second generation of panel unit root tests relaxes this assumption and allows for cross-sectional dependence (Tugcu, 2018). The Levin-Lin-Chu test has high power if the time dimension T is large. This can be problematic because one might infer stationarity for the whole panel, even if it is only accurate for a few individuals.
One can conclude non-stationarity when most series display stationary behaviour. On the other hand, it has low power for a small-time dimension. Thus, it is advisable to analyse the outcome of both the Levin-Lin-Chu and the Im-Pesaran-Shin tests (Nell and Zimmermann, 2011).

Table 2: Testing for stationarity

Variable	Specification	Null hypothesis:	
		Unit root (assumes common unit root process)	Unit root (assumes individual unit root process)
		Levin, Lin & Chu (probability for I(0))	Im, Pesaran and Shin W-statistic (probability for I(0))
2000 - 2019			
HEALTH	Intercept	0.0010***	0.0332**
SOCIAL	Intercept	0.0061***	0.0817*
GDP	Intercept and trend	0.0077***	0.0706*
LIFE	Intercept and trend	0.8822	0.9972
OLD	Intercept and trend	0.0003***	0.6104
2000 - 2007			
HEALTH	Intercept	0.0000***	0.1364
SOCIAL	Intercept	0.0414**	0.8680
GDP	Intercept and trend	1.0000	0.9885
LIFE	Intercept and trend	0.0219**	0.7673
OLD	Intercept and trend	0.0000***	0.2036
2010 - 2019			
HEALTH	Intercept	0.0000***	0.0826*
SOCIAL	Intercept	0.0015***	0.0947*
GDP	Intercept and trend	0.0000***	0.0722*
LIFE	Intercept and trend	0.0015***	0.5950
OLD	Intercept and trend	0.0000***	0.7680

Significance at 0.1; ** at 0.05; * at 0.01*
Source: Presented by the author

The results from both tests differ in their claims about data stationarity in some of the variables. Both tests are considered, and two sets of equations will be estimated according to the test results – the variable will be differenced if the test confirms its non-stationarity.

Panel regression model and estimation of the equations

A panel regression model is used to estimate the equations to determine which of the statistically significant variables determines health expenditures. Panel data is a set of both time series and cross-sectional elements (Brooks, 2014) – in this example, the cross-elements represent countries from the EU. Panel data account for more information and more variability.

Many demographic studies apply this method since it provides an insight into a group of countries (or other cross-sectional elements). Thus, conclusions drawn from the results will gain relevance. Kelley and Schmidt (2005) used a cross-country panel regression model to examine the population's role in economic growth. Liddle (2004) examines how population changes (in aging, households, and urbanisation/density) explain changes in personal transport using macro and micro-level data and panel regressions. More precisely, panel regression models examined the effects of aging and other factors on health expenditures, like this analysis does. A study of 35 OECD member countries where factors affecting health expenditure are examined was performed by Boz et al. (2020). Their findings confirm that aging, urbanisation, and income positively affect health expenditures per capita. Similar research can be found in Tian et al. (2018), Abdolah et al. (2017), Hosoya (2014), Georgiou (2012), Ke et al. (2011). The significant number of papers that use the panel regression model in addressing demographic and economic issues contribute to the applicability of this econometric technique in demographic data processing.

Despite the panel regression model being an instrumental research technique, there are limitations when used on demographic data sets such as problems in the design, data collection, and data management. Coverage problems may occur, such as an incomplete account of the population of interest and missing responses for specific countries in certain periods. Another limitation of panel

data sets is the distortion due to measurement errors and the exhibition of bias due to sample selection problems (Greene and Zhang, 2019).

Table 3 shows the results from the estimated equations. The set includes six estimated equations.

Table 3: Estimation of the results

Variable	Coefficient (probability)	Variable	Coefficient (probability)
2000 - 2019			
Equation 1 with specification according to LLC test		**Equation 2 with specification according to IPS test**	
SOCIAL	0.13 (0.00)***	SOCIAL	0.07 (0.00)***
GDP	0.00012 (0.00)***	GDP	0.000057 (0.00)***
D(LIFE)	0.06 (0.42)	D(LIFE)	0.11 (0.19)
OLD	-0.11 (0.00)***	D(OLD)	-0.05 (0.63)
DUMMY	0.15 (0.07)*	DUMMY	0.27 (0.00)***
C	4.46 (0.00)***	C	3.65 (0.00)***
Cross-section effects	Fixed	Effects specification	Random
Hausman test (probability)	28.07 (0.00)	Hausman test (probability)	9.23 (0.10)
Adjusted R-squared	0.91	Adjusted R-squared	0.4
Durbin-Watson statistic	0.71	Durbin-Watson statistic	0.58
Jarque-Bera test (probability)	13.34 (0.001)	Jarque-Bera test (probability)	1.18 (0.56)
Cross-section dependence test	Confirms CSD	Cross-section dependence test	Confirms CSD
2000 - 2007			
Equation 3 with specification according to LLC test		**Equation 4 with specification according to IPS test**	
SOCIAL	0.13 (0.00)***	D(SOCIAL)	0.05 (0.40)
D(GDP)	0.00006 (0.42)	D(GDP)	-0.00007 (0.25)
LIFE	0.11 (0.02)**	D(LIFE)	-0.17 (0.12)
OLD	0.02 (0.64)	D(OLD)	-0.02 (0.83)
C	-5.12 (0.07)*	C	0.17 (0.03)**
Cross-section effects	Random	Cross-section effects	Random
Hausman test (probability)	6.45 (0.17)	Hausman test (probability)	3.46 (0.48)
Adjusted R-squared	0.37	Adjusted R-squared	0.02
Durbin-Watson statistic	0.99	Durbin-Watson statistic	1.91
Jarque-Bera test (probability)	2.43 (0.3)	Jarque-Bera test (probability)	69.03 (0.00)
Cross-section dependence test	Only Pesaran CD denies CSD	Cross-section dependence test	Denies CSD
2010 - 2019			
Equation 5 with specification according to LLC test		**Equation 6 with specification according to IPS test**	
SOCIAL	0.10 (0.00)***	SOCIAL	0.13 (0.00)***
GDP	0.00007 (0.00)***	GDP	0.00003 (0.007)***
LIFE	-0.07 (0.23)	D(LIFE)	0.1 (0.35)
OLD	-0.08 (0.00)***	D(OLD)	-0.02 (0.87)
C	10.82 (0.012)**	C	3.32 (0.00)**
Cross-section effects	Random	Cross-section effects	Random
Hausman test (probability)	6.64 (0.16)	Hausman test (probability)	6.02 (0.197)
Adjusted R-squared	0.3	Adjusted R-squared	0.19
Durbin-Watson statistic	0.56	Durbin-Watson statistic	0.52
Jarque-Bera test (probability)	4.48 (0.11)	Jarque-Bera test (probability)	10.3 (0.006)
Cross-section dependence test	Only Pesaran CD denies CSD	Cross-section dependence test	Only Pesaran CD denies CSD

Significance at 0.1; ** at 0.05; * at 0.01*
Source: Presented by the author

Variations are made by period (overall period 2000 – 2019; pre-crisis period 2000 – 2007 and the post-crisis period 2010 – 2019) and decisions on the stationarity of the variables according to Levin,

Lin & Chu test (LLC) and Im, Pesaran and Shin W-statistic (IPS). The equations are noted in the following manner:

Equation 1:

$$HEALTH_{i,t} = \beta_0 + \beta_1(SOCIAL_t) + \beta_2(GDP_t) + \beta_3(\Delta LIFE_t) + \beta_4(OLD_t) + \beta_5(DUMMY) + u_{i,t},$$
$$u_{i,t} = \mu_i + \upsilon_{i,t}$$

Where the disturbance term, $u_{i,t}$ is decomposed into an individual specific effect, μ_i, and the "remainder disturbance", $\upsilon_{i,t}$, that varies over time and entities (capturing everything that is left unexplained about the dependent variable), (Brooks, 2014).

Equation 2:

$$HEALTH_{i,t} = \beta_0 + \beta_1(SOCIAL_t) + \beta_2(GDP_t) + \beta_3(\Delta LIFE_t) + \beta_4(\Delta OLD_t) + \beta_5(DUMMY) + \omega_{i,t},$$
$$\omega_{i,t} = \epsilon_i + \upsilon_{i,t}$$

The heterogeneity (variation) in the cross-sectional dimension occurs via the ϵ_i. This framework assumes that the new cross-sectional error term, ϵ_i, has zero mean, is independent of the individual observation error term (υ_{it}), has constant variance, and is independent of the explanatory variables (Brooks, 2014).

Equation 3:

$$HEALTH_{i,t} = \beta_0 + \beta_1(SOCIAL_t) + \beta_2(\Delta GDP_t) + \beta_3(LIFE_t) + \beta_4(OLD_t) + \omega_{i,t},$$
$$\omega_{i,t} = \epsilon_i + \upsilon_{i,t}$$

Equation 4:

$$\Delta HEALTH_{i,t} = \beta_0 + \beta_1(\Delta SOCIAL_t) + \beta_2(\Delta GDP_t) + \beta_3(\Delta LIFE_t) + \beta_4(\Delta OLD_t) + \omega_{i,t},$$
$$\omega_{i,t} = \epsilon_i + \upsilon_{i,t}$$

Equation 5:

$$HEALTH_{i,t} = \beta_0 + \beta_1(SOCIAL_t) + \beta_2(GDP_t) + \beta_3(LIFE_t) + \beta_4(OLD_t) + \omega_{i,t},$$
$$\omega_{i,t} = \epsilon_i + \upsilon_{i,t}$$

Equation 6:

$$HEALTH_{i,t} = \beta_0 + \beta_1(SOCIAL_t) + \beta_2(GDP_t) + \beta_3(\Delta LIFE_t) + \beta_4(\Delta OLD_t) + \omega_{i,t},$$
$$\omega_{i,t} = \epsilon_i + \upsilon_{i,t}$$

Corresponding to the results of the Hausman test, the equations are estimated with random or fixed effects accordingly.

Results and discussion

General government expenditure on social protection proves to have a positive and significant effect on government health expenditure in all equations except equation 4. This confirms that the effect on health expenditure is robust and continues for different observed periods. With the results considered and trends presented in Figures 2 and 3, one logical explanation is that when the social expenditure influences health expenditure, or when the government decides to increase or decrease the social expenditure, they will also do the same correction with health expenditure. This is important when the effects of these two types of spending are analysed i.e., when there is the question "Does greater spending on health and social protection have positive results? " Interesting findings can be found in Bradley and Taylor (2013). They analysed the American health system and its expenditures. They suggest that investment in social determinants of health (access to healthy food, recreational spaces, housing, and education) will improve overall health instead of direct investment into the medical system. In another research by Bradley et al. (2011) for all OECD countries, the authors found that the ratio of social expenditures to health expenditures was significantly associated with better outcomes in infant mortality, life expectancy and increased potential life years lost. Their research found that overall higher levels of social spending are associated with better health outcomes for OECD countries. The conclusion is that attention to broader domains of social policy may help accomplish improvements in health envisioned by advocates of health care reform.

Social protection expenditure has a positive and significant influence on health expenditure. Further, a higher social to health spending ratio in OECD countries was associated with better health outcomes (Rubin et al., 2016). Government policymakers might consider reassigning more of the funds towards social protection to achieve a better health care system.

Gross domestic product per capita has a positive and statistically significant impact on health expenditure in the overall and post-crisis periods. There is no confirmation of the relationship in the pre-crisis period. We shall suppose that the trends of these two indicators are analysed. In that case, GDP is a variable with a constantly growing trend (except for the slight drop in 2009 due to the global recession), while health expenditures seem to stabilise in the post-crisis period. In contrast, they seem

to have higher fluctuations in the pre-crisis period. This explains why the relationship is confirmed in the post-crisis period and not in the pre-crisis period. In the policy brief Spending on Health: Latest Trends, from OECD, 2018, it is stated that health expenditure in 2016 grew at its fastest rate in seven years, with further growth expected in 2017, and that health spending is back on a growth path after the slowdown following the financial crisis. Keegan et al. (2013) examined the initial responsiveness of health expenditures to the crisis and whether recession severity could be considered a predictor of health expenditure growth. Their findings indicated that health expenditures displayed counter-cyclical tendencies, and that initial national responses to crises were to protect health expenditures. The findings are concordant with some recent empirical evidence for developed countries that find public health expenditures tend to respond to recessions stabilising (or cyclical). Our analysis confirms that GDP per capita determines government health expenditures, meaning higher economic development will provide higher health expenditures. Also, the global economic recession proves to influence health expenditure positively. The governments tend to protect the health system after the crisis, which further stabilises government health expenditure.

The significance of the dummy variable confirms the impact of the global crisis on health expenditure. This variable was significant in both regressions for the overall period, confirming the previously stated assumption that the global recession impacted national health expenditure trends.

Life expectancy is a variable that is expected to influence government decisions about health expenditure since it is on the rise in the analysed period. The estimated results present the opposite, except in equation 3. All other equations for different periods find this indicator to be statistically insignificant. Foreseeing this possibility, another variable that indicates demographic aging was introduced – the old-age dependency ratio. It does not prove significant for the pre-crisis period. However, it is significant for the overall period and the post-crisis period in equations estimated by the unit root results from the Levin, Lin & Chu test. Very specific to mention is that this variable has an inverse influence on health expenditure. Even though the population is aging fast, the population of 65 years or over to 15 to 64 years is constantly increasing. The governments of different nations do not follow with an increase in the health expenditures, and on the contrary, the results show a decline.

More than 20 years ago, Zweifel et al. (1999) introduced the idea of a "red herring" regarding the aging population and health care expenditure. Their research concludes that the limited impact of age on health care expenditure suggests that demographic aging contributes very little to the future growth of the healthcare sector than most observers. Previous results were vindicated in further research from the same authors (Zweifel et al., 2004). They stated that the latter paper reaffirms the original results of no age effect on health expenditure. These findings challenge conventional wisdom that the country's health expenditure rises with the proportion of elderly persons. After many debates on this matter, Breyer and Lorenz (2021) published their research regarding the "red herring" after 20 years. Their concluding remarks were that a tentative conclusion could be drawn about future demographic aging and its positive impact on health expenditures. It can be argued that the growth rate caused by demographic aging is low compared to the one due to other factors such as medical progress and rising GDP.

Conclusion

Demographic aging is taking place in developed and developing economies worldwide, creating challenges for different segments of society. National policymakers must analyse and address its impact on the health system. The main findings from this research are the following ones i.e., 1) the government should consider that "prevention is better than cure" and create programs where funds will be assigned towards social protection, meaning access to quality food, clean water, clean air, education, campaigns for the improvement of health and lifestyle habits; 2) economic development influences the health expenditure. Economic and other crisis have negative and passing effect on the health system, which governments tend to stabilise very quickly. Having in mind the importance of the health system, governments must make their efforts to protect it. Health care expenditures tend to stabilise post-crisis; 3) this analysis confirms the "red herring" hypothesis. Life expectance is not a significant determinant, and the old-age dependency ratio (despite being statistically significant) because it has an inverse relationship with health expenditure. There was no statistically significant proof to confirm that the aging population drives health expenditure.

From all three findings presented above, accent should be placed on social protection and health. World Health Organization (2015) has already recognized the importance of comprehensive social protection policies which can be especially powerful in protecting health in economic crisis. Thus, the Health 2020 policy framework was created and adopted by all Member States of the WHO European region to address the great social and health challenges. Social protection can make a difference to health by fostering a healthy start for children, increasing labour market participation, reducing poverty and social exclusion, promoting active aging, and reducing gender-based inequalities.

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