Measuring and Decomposing Income Health Inequalities Among the Elderly Population In European Countries

Sheriff Tolulope Ibrahim

Faculty of Social Sciences

School of Economics and Business Administration

Master's Thesis

Supervisor: Andres Võrk

Tartu, 2021

I have written this Master thesis independently. Any ideas or data taken from other authors or other sources have been fully referenced.

Acknowledgments

First, I would like to thank Almighty Allah for given me the strength and grace to start and finish my MA program. I will forever be indebted to my thesis supervisor Andres Võrk whom always found time to go through my work and codes given his very busy schedule. I also want to use this opportunity to thank Dr. Eve Parts for helping with data access and giving constructive feedback in earlier version of the thesis. Also, I want to say a big thank you to my opponent Ave Roots for her constructive and insightful feedback.

I am using this opportunity to appreciate all my lecturers in whom I have benefited from their knowledge in this journey so far. Personally, I would like to mention Indrek Seppo, Jaan Masso and Mykola Herashymovich for being patient with me while I learn form them. I also want to thank Abraham, Pearl, Ariana, Faruh, Zak, Berk, Wanting and all class members, I must say it was nice meeting you all.

To my father, mother, siblings (Saheed, Aisha, Faruq, Kudrat, Kawthar), my nice and nephew (Su'ad, Ahmad, Zayad) you guys have been wonderful through this journey. To my fiancee (Hameedah) you have always been my life support through thick and thin. This work is dedicated to Ahmad my lookalike.

Abstract

Developed and developing economies have continued to experience increase in number of their elderly population. This can be due to the increase in life expectancy and decrease in birth rate which can be ascribed to the growth and development in health care technology. This continued increase birthed some challenges amongst health policy makers and government one of which is income health inequality. Thus, this study employs the Survey of Health Ageing and Retirement (SHARE 7.1.1) to measure and decompose income health inequality among the elderly population in European countries. Adopting self reported health as the outcome variable this study estimated an the ordered probit model to predict the latent health variable that was further used to measure and decompose health inequality among the elderly population following the method proposed by Wagstaff.

The main Finding of the study submits that health inequality exist among the elderly population in Europe and these inequalities differ from one country to another. The study further submit that among the achieved factors (non-natural) that contribute to income health inequality include income, years of education, job status.

Based on the findings of the study, the study recommends that in order to reduce income health inequality government should encourage a more equitable distribution of income among the elderly population. Secondly, policy makers and government should encourage and support life long learning as this will make the population acquitted with new innovations that could improve their health, unlearn unhealthy behaviour, relearn healthy behaviour thus, reducing income health inequality.

Keywords : Health inequality, measure, decompose, elderly population, concentration index, concentration curve

Contents

Introduction **1**

Statement of Research Problem **2**

Research Objectives 3

Literature Review **4**

Conceptual Literature 4

The Concept of Health and its Measurment 4

Inequality in Health 5

Elderly Population in Europe 7

Emprical Literature 8

Methodology **12**

Measurment of Health Inequality 12

Decomposing Health Inequality 14

Data **16**

Results **20**

Discussion and Policy Implication **25**

Conclusion **26**

Suggestion for Further studies **26**

References **27**

Appendix **33**

Introduction

Amongst the major driver of any economy is demography. The demography of economies determines labour force, productivity, social protection and environment to mention a few. A common feature of developed economies in which the European Union (EU) is not an exception is ageing population (Kiss, 2020). In 2018, dependency ratio for EU-28 increased to 54.6% from 48.9% in 2001, of this increase, old age dependence ratio stands at 30.5% showing that population distribution has been skewed towards the elderly (Eurostat, 2018). Increase in population aging has been found to be associated with some economic consequences such as pressure on public finances and health care, increased cost of household through high dependence ratio and most of all downward pressure on economic growth (Ká˘cerová and Mladek, 2012; Cristea and Mitraca,2016)

Inequalities in health are generally the result of inequalities in many other socio-economic factors such as income, education etc. The inequalities that exist in these socio-economic variables are directly transmitted to health outcome of population (Marmot, 2015). Health inequalities are the differences that exist among the health of a group of people. These differences can be as a result of several factors amongst them are socio-economic factors such as income level, education level, age, locational factors, government policies (Marmot, 2005) to mention a few. Health inequality are usually unavoidable however, a proper understanding of factors that contribute to the current state of health inequality is important in order to properly focus and reduce the health inequality that may arise. To be able to a make policy that reduces health inequality among the older population a proper understanding of current economic behaviour that affect health inequality is indispensable (Gu, Kou,You, Xu, Yang, Liu, Gu and Li 2019).

It is due to this increase in ageing population in the EU that this study is carried out to ascertain socio-economic factors affecting inequality in health outcome of the elderly. The findings of this study will be useful to both government, multilateral organization as well as policy makers to understand socio-economic factor and behaviour that affect current health of the elderly. This is necessary as it will inform appropriate policy to achieve reduced income related health inequality among the elderly through influencing population behaviour at all stages of life.

Statement of Research Problem

Health inequality is the unavoidable difference in the health of a group of people, these inequalities can be as a result of some observable characteristics such as socio-economic factors, demographic factors or even locational factors (Arcaya, Arcaya and Subramanian, 2015). However, when theses difference can be avoidable, and they still exist they become health inequity (WHO, 2017). Over the years government and public health policy makers are at the fore front of reducing, income related health inequality through reducing health inequity (WHO, 2008). However, with the concerted effort from both government and organization such as WHO there still exist a wide inequality in health outcomes among the older generation (Marmot, 2005; Tajvar, Arab and Montazeri, 2008; Lauridsen, Christiansen and Vitved, 2019) Since the current state of health among the elderly, depends upon their current socio-economic state as well as their behavior, a proper understanding of how socio-economic factors and individual behaviour contribute to their health will inform policy direction to reduce these income related health inequalities that has plagued the world in the area of public health outcomes. Thus, the novelty of this study is that it incorporates beahviour of the elderly and how that can affect their current health status as well as including the complete European union countries. To the best of the researcher's knowledge no study has been carried out to include the full EU-27.

Research Objectives

The main aim of the study is to quantify the extent and causes of income-related health inequalities among the elderly population in Europe. The specific objectives of the study are as follows:

1. to quantitatively access the income related inequality in self reported health among the elderly population in Europe

2. to decompose income related inequality into the explained and non explained factors contributing to inequality.

3. based on our findings, give policy implication on how to reduce inequality among the elderly in Europe

Literature Review

Conceptual Literature

This section of the study presents literature on the various important concept of this research study

The Concept of Health and its Measurment

According to WHO, health is defined as "a state of complete physical, mental and social well-being, and not merely the absence of disease." From the above definition, it is clear that health can be both objective and subjective. This nature of health makes it a complex concept to measure. Health is objective in the sense that some pre-existing or pre-defined metrics can be adopted to measure health. The strength of these group of health indicator lies in their objectivity as they can be be easily quantified and defined without without being influenced by personal feeling of the individual, while health is subjective, through the perception that, to understand an individual satisfaction it is important to examine individual feeling not just towards their physical health but also mental, social and other sphere of life that can only be experienced and felt by the individual. An example of the subjective measure of health that is popular among health policy researchers is the Self-Reported Health (SRH). From its name, the SRH is a single item usually featured as a survey that accesses an individual's health, which predicts morbidity and mortality (Idler and Angel, 1990; Idler and Benyamini, 1997). The efficacy of SRH in predicting the heath of individual has been extensively researched despite concerns on individual reporter bias (Tessler and Mechanic, 1978; Manderbacka, Lundberg and Martikainen, 1999; Ferraro and Yu, 1995; Van Doorslaer and Gertham, 2003; Denis, Denzil, Meliyanni and Agne, 2015). Using the Survey of Health Ageing and Retirement in Europe 2004 (SHARE) (Jurges, 2006), submits that there existed a large cross country difference in self reported health, according to the finding, the healthiest elderly people live in the Scandinavian countries and the least

heathy live in the Southern part of Europe.

Inequality in Health

Inequality in health is differences that exist in the health of individuals or group of individuals, which could be as a result of geography, economic status, social strata, health-related behaviours and other social factors (Mariana, Alyssa, and Subramanian, 2015; McCartney, Collins and Mackenzie, 2013). Health inequality does not have any moral justification. Its measurement is the first step in understanding the socio-economic determinants of health, followed by determining the sources of health inequality that can either be natural or artificial factors (Van Doorslaer and O'Donnell, 2008). In other words, ascribed or achieved factors.

In the European Union, variation in health following socio-economic status has been a long-debated topic among researchers and policy analyst (Atkinson, Cantillon, Marlier and Nolan, 2002). Among earlier study which tried to measure and decompose health inequality in the EU with similar submission that there exists inequality in health between and among countries in Europe includes although adopting different methods of estimating inequality and measures of health (Van Doorslaer, Wagstaff and Bleichrodt et al, 1997; Van Doorslaer and Jones, 2003; Van Doorslaer, and Koolman, 2000). In the work of (Brennenstuhl et al 2012), within country inequality in health can be attributable to the welfare state systems similar studies in this area include (Bergqvist et al, 2013; Eikemo et al 2008b, 2008c). A hypothesis by Wilkinson (1990, 1992) states that income inequality is detrimental to the population health which was further asserted upon by several researchers (Waldmann 1992). A similar study have been carried out to tests if health differences generate income inequality or vice versa, among studies that tests both the former and latter (O'Donnell, Van Doorslaer and Van Ourti, 2013), the study submitted that health differences are found to generate income inequality while the hypothesis that income differences cause health inequality is not proven.

Various socio-economic factors have been considered to be a major contributor to health disparities that have been present in human life (Elo, 2009) and also how these factors have shaped access to health and ultimately health outcome in societies (Heard et al., 2007). Education attainment is considered as in important single factor that plays and serve as a foundation for all other socio-economic factors that contributes to health outcomes. For example individuals with higher education attainment live a better and improved live which results in lower mortality (Cutler, 2006; Smith, 2007). According to (Lynch 2003; Mirowsky & Ross, 2003) the pass through of education to health is in human activity of healthy behaviour and lifestyle, as well as appropriate and timely use of health care services.

Income plays a significant role in enhancing access to health care which then influences human health outcomes. However, educational attainment determines income and wealth of individuals (Elo & Preston, 1996; Lynch 2003). Studies have also been to carried out to document effect of income on health and mortality and the submission by these studies points to the fact that the effect of income or wealth on health can be strengthened or weakened by age (Krueger et al. 2003; McDonough & Berglund 2003) as well as occupation (Kunst et al. 1998a; Mackenbach et al. 2008). Mixed evidences have also been reported on the effect of gender on health (Case & Paxson 2005). Perlman and Bobak (2008) identified demographic characteristics as important factor in determining inequality in health as well as Danso (2016) who also posited that socio-economic characteristics cannot be down played.

Elderly Population in Europe

The constituents of ageing and the transformation that occurs to human in the ageing process are random and complex (Kirkwood 2008). Biologically, ageing is defined as the gradual accumulation of a wide variety of molecular and cellular damage (Steves, Spector, and Jackson, 2012; Vasto S, Scapagnini G, Bulati, et al, 2010). This damage has been found to gradually reduce physiological reserves, increase exposure to diseases, and more generally, a decline in the physical and psychological capacity of the individual . As mentioned earlier that changes in the elderly are random for example a 75-years-old individual may possess good physical and mental health, another may not. But it is also worthy to mention that changes in the elderly are also majorly determined by individuals' environment, socio-economical and healthy behaviour.

Population ageing has been an important social and economic challenge that is facing the world. Developed economies experienced ageing as a result of reduced birth rate and increased life expectancy. Similarly, developing economies have experiencing ageing as a result of reducing birth rate and increasing life expectancy which is caused by the increased socio-economic development experiences globally within the past 50 years. Ageing population is expected to reach a record high by two-third by 2030 (Olivera, Pessa, Schenatto and Bernartt, 2019). In Vancea and Casals (2015) the low birth rate and high life expectancy have transformed the shape of EU-28 pyramid depicting a much older population becoming widespread. The EU-27 median age increased from 35.4 years in 1991 to 41.2 years by 2011, by the year 2060 the median age of the EU-27 population is projected to increase around 7 years higher than in 2011 i.e., to 47.6 years. It should also be noted that the share of the total EU 27 population older than 65 is expected to increase from 17.5 % in 2011 to 29.5 % by 2060 (Vancea and Casals, 2015).

Emprical Literature

Various studies have been carried out to ascertain the factors that determine and contribute to inequality in SRH of the elderly.however, little evidence have been found for the European Elderly population. This section of the study presents some of these studies and their finding to shed more light on this study's main subject matter.

Yan, Gill and Chen (2019) studied the effect of childhood behaviour on health inequality among the elderly in China. Their study submits that the behaviour of an individual during childhood could contribute around 1 and 22 percent to health inequality at old age. In addition, their study also concluded that the geographical location of individual also plays a significant role in determining the health status of individual. They found that Chinese citizen who lived in Urban area have a better health as compared to their rural counterpart.

Evidence has also been found to support socio-economic factors as a major determinant of Self-Reported health among the elderly (Wang, Yu, Noh and Kwon, 2014; Fonta, Nonvignon, Aikens et al, 2017). Most studies in this strand of literature believe that to reduce the inequality in the health of the elderly, policymakers should in all circumstances embark on policies that will reduce the disparities in citizens' socio-economic condition. It has also been found that health risk behaviour influences self-rated health among the elderly. similarly, social support positively influencing SRH (Dong, Wan, Xu, Chen et al, 2017).

The causes of health inequality among the elderly have also be modelled to include variable beyond income such as age, gender, education, employment, geography and health related behaviour (Jutz, 2015; Liu, Byles, Xu et al, 2017). In Gu, Kou, You, Xu et al (2019) the determinants of self-rated health were divided into four categories namely social demographic characteristics, physical condition, health related behaviour and health insurance and economic conditions. Their study submits that avoidable factors such as income, residence, region, employment and health insurance contribute about 60 percent to health inequality among the elderly in China.

Using the first and seventh wave of the Survey of Health, Ageing and Retirement

in Europe (SHARE) Lauridsen, Christiansen and Vitved (2019) explored the determinants of inequalities in health In Europe. The study found evidence of retirement status contributing differently to income related health inequality in different countries within Europe.

Using data from European Value Studies (2008/2009) round 4 and 44 European countries Jutz (2015), adopted the subjective general health as the explained variable and income quantiles, age, sex, living together with spouse and unemployment status. The study adopted the two steps hierarchical estimation technique. The finding of study submits that income related health inequality exist across Europe. On a country-level analysis, higher income inequality is significantly positively related to health inequality on the other hand social policies is insignificant.

Table 1: Summary of Empirical Literature

Author	**Scope**	**Methodology**	**Outcome**
Yan, Gill & Chen, (2019)	China Health and Retirement Longitudinal 2013	Shapley value decomposition approach	childhood circumstance may explain1-23% inequality in health, indirect health-related circumstances contributes more to health inequality than direct health related circumstances
Wang, Yu, Noh & Dea Kwon, (2001)	South Korea	Stepwise multivariabale linear regression	Elderly female north Korea defectors who had low annual income and reported low health status, however a higher health status was recorded for peopel who had lived in South Korea for more than 18months.
Humphries & Van Doorslaer (2003)	Canadian National Population Health Survey 1994-1995	Constructing latent health variable method	there exist significant inequality in self reported ill health and this favours the high income group

Author	Scope	Methodology	Outcome
Lauridsen, Christiansen & Vitved (2019)	Survey of Health Ageing and Retirement (wave 1) and (wave 7)	Concentration Index method	Retirement status contribute differently to income related health across Europe. The study also concluded that differences can be related to income as well as health differences
Jutz, (2015)	European Value Study (2008/2009), Eurostat,ILO,42 European Countries	Two step hierarchical estimation approach	Income related health inequality exist across Europe, further the study shows that the higer the income inequality the more the health inequality present

Methodology

Measurment of Health Inequality

In order to measure the income related health inequality, the health concentration index (wagstaff et al., 1989) was adopted. This method has been widely adopted in various studies of health inequality (see Humphiries and Van Doorslaer 2000; Gerdtham and Johnneson, 2000; Van Doorslaer et al., 1997). Suppose we have a continuous cardinal measure of health y^i, the concentration index is calculated as twice the area between concentration curve and the diagonal line. The value of the CI ranges from -1 to +1. A value of -1 indicates that good health is concentrated among the poor on the other hand a value of +1 indicates that good health is concentrated among the rich.

In order to visualize the distribution of health among the population, the concentration curve is constructed to plot the cumulative proportion of the population (ranked by income from lowest to highest) against the distribution of cumulative proportion of health. If the curve lies above the 45 degree diagonal line it indicates that health is concentrated among the worst off in the society, if on the other hand it lies below the 45 degree line, this indicates that health is being concentrated among the better off in the society. If the curve lies on the 45 degree line this indicates that health is equally distributed between both the worse off and better off. As Shown in Fig.1 health is more concentrated among the rich and the shaded region is the part of the inequality in health that can be explained (ascribed and achieved) by our proposed midel and the unshaded part is that which cannot be explained by our model (Residual).

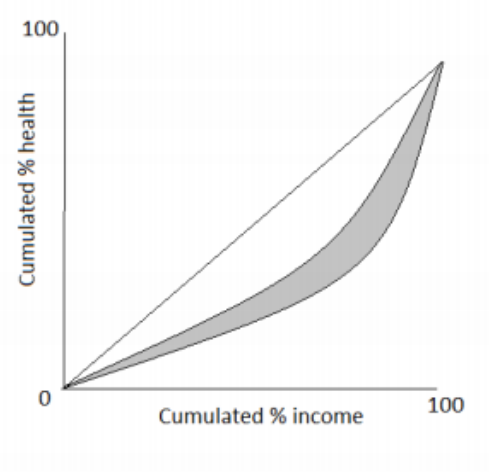

Fig 1: Concentration Curve and its Decomposition

This study adopts a country by country level analysis, as evidence of variation in self reported heath according to location has been reported (Jurges, 2006). This gives the study the advantage of exploring the income related inequality in self reported health and their decomposition on a country level. Thus, making countries benefits from other well performing countries in the area of health equality among the elderly population.

The study adopts the following mathematical formula to calculate the income related inequality in health (wagstaff and Van Doorslaer 1994):

$$C = \frac{2}{\mu} \sum_{i=1}^{N} w_i y^i R_i - 1 \tag{1}$$

where

$$\mu = \sum_{i=1}^{N} w_i y^i R_i \tag{2}$$

where equation (2) is the weighted mean health of the sample, N is the sample size, w_i is the sampling weight of individual i (with the sum of w_i equal to N) and R_i is the weighted relative fractional rank of the ith individual and y^i is the cardinal measure of health.

$$R_i = \frac{1}{N}\sum_{j=1}^{i-1} w_j + \frac{1}{2}w_i \tag{3}$$

where $w_0 = 0$ indicating the weighted cumulative proportion of the population up to the midpoint of each individual weight.

Decomposing Health Inequality

The study aims not only to measure the inequality in income related health among the elderly population but also to decompose it into various factors contributing to the income health inequality. The method adopted to decompose the health inequality follows (Wagstaff et al. 2003 and Wagstaff & Van Doorslaer, 1994).

In order to decompose health inequality into various contributing factors and given the nature of our outcome variable following an ordered multinomial response, the study estimated an ordered probit model. Given that

$$y_i = m \tag{4}$$

where m is the ordered category taken by the outcome variable in our case self reported health. Given that $\mu_{m-1}<y_i^*<\mu_m$ where the latent variable y_i^* follows a linear process. Since the self reported health in it's original form cannot be used to measure health inequality. Thus, the latent variable y_i^* is then predicted from the ordered probit model. This will be our measure of health that satisfies the continuous condition specified above which will be used to measure and decompose income health inequality into various sources. equation (5) will be estimated using an ordered probit regression technique, after which equation (6) standardizes the linear predictions of the estimated model.

$$y_i = \alpha + \sum_k \beta_k x_{ki} + \varepsilon_i \tag{5}$$

After the estimation of the ordered probit model, and extraction of the latent variable which follows a linear process, equation (6) is then used to standardize the latent variable to [0,1] interval as equation (1) above requires that the mean of health variable be positive. This is carried out using the following formula following Van Doorslaer and Jones (2003).

$$y^i = \frac{\hat{y^*} - y^{*min}}{y^{*max} - y^{*min}} \tag{6}$$

After the rescaling in equation (6), equation (7) is then used to estimate beta parameters that will be used for decomposing the income inequality in self reported health into ascribed (gender, age) and the achieved factors (marital status, education, occupation)

$$y^i = \alpha + \sum_k \beta_k x_{ki} + \varepsilon_i \tag{7}$$

where y^i is the standardized health variable. Equation (8) is then used to decompose health inequality

$$C = \sum_k \left(\frac{\beta_k \bar{x}_k}{\mu} \right) C_k + \frac{GC_\varepsilon}{\mu} \tag{8}$$

where μ is the mean of the estimated health from (4), $\bar{x}_k$ is the mean of x_k, C_k is the concentration index for x_k and GC_ε is the generalized concentration index for ε_i. From (7) above the inequality in health is made up of two components, the deterministic (explained) which is arrived at as the weighted sum of the concentration indices of the explanatory variables and the residual (unexplained) part. The residual measures the inequality that cannot be explained by systematic variation in the x_k across income groups.

To give a summary of methodology stages, the following was carried out one after the other:

1. Estimate an ordered probit model and extract the linear predictions of health from the model.

2. Standardize the linear prediction to get rid of negative value in health.

3. Estimate beta parameters of of independent variable and their concentration indices.

4. Calculate the concentration index of health and it's decomposition into various sources.

Data

To achieve the objective of the study using the above explained methodology, the study adopted the Survey for Health Ageing and Retirement (SHARE) date wave (7.1.1) released in 2020. This survey is carried out to elicit information on the effect of health, social economic and environmental policies over the life course of European citizen and beyond (Borsch-Supan, 2020). SHARE wave (7.1.1) contains information on individual who are aged 50 and above from 26 European countries and Switzerland. The data contains 386315 observations. Taking into account the multiple imputation technique adopted by the survey design (SHARE Release Guide 7.1.1), the study was left with 77263 older individual who participated in the survey. After cleaning the data to include individual that are 50 years and above and household income that is not zero our study is left with 75615 observation

Table 2: Region and Countries that Participated in SHARE Wave 7.1.1

Region	**Country**
EU	Austria, Belgium, Bulgaria, Cyprus, Czech, Germany, Denmark, Estonia, Spain, France, Finland, Greece, Croatia, Hungary, Italy, Lithuania, Luxembourg, Latvia, Malta, Poland, Portugal, Romania, Sweden, Slovenia, Slovakia,
Non-EU	Switzerland,

Source: SHARE Wave 7.1.1, (2020)

The data set contain information on spectrum of human life and activities of the older population of about 272 variables, however our study selected the variable of interest form the large spectrum of information to include household income, self rated health, current job status, gender, age, years of education and household size.

Self Reported health variable was ascertained by asking each respondents to rate their health on a scale of 1-5,where 1 -poor health, 2-fair health, 3- Good health, 4-Very Good health, 5- Excellent health. Table 3 presents the distribution of health on the basis of countries. Among the countries with a high level of health (i.e. excellent, very good and good health) among the elderly include, slovakia (80.38%), Switzerland (78.34%),Denmark (74.28%) followed by Sweden (69.25%), Belgium (68.34%), Greece (66.87%), Austria (62.39%),France (63.07%), Czech Republic (67.96%),Luxembourg (62.48%), Cyprus (64.26%), Bulgaria (60%), Finland (59.55%),Malta (59.04%),Germany (57.23%),Italy (55.94%), Spain (55.65%), Romania (50.1%). Among the countries with the worse level of health among the elderly include, Estonia (72.98%),Portugal (68.11%), Latvia (66.1%), Lithuania (60.81%), Hungary (57.11%), Poland (50.71%)

Table 3: Distribution of Self Reported Health by Country

Country	**Excellent**	**Very good**	**Good**	**Fair**	**Poor**	**Total**
Austria	5.93	20.86	35.6	28.1	9.51	100
Germany	3.7	12.94	40.59	32.28	10.49	100
Sweden	12.76	18.49	38	24.86	5.89	100
Spain	4.18	16.37	35.1	28.33	16.02	100
Italy	7.11	15.08	33.75	34.17	9.88	100
France	6.17	12.59	44.31	25.98	10.95	100
Denmark	16.33	33.61	24.34	19.64	6.08	100
Greece	4.38	23.89	38.6	25.11	8.03	100
Switzerland	9.7	25.56	43.08	17.35	4.32	100
Belgium	6.58	18.72	43.04	24.83	6.83	100
Israel	6.51	27.39	25.57	26.05	14.46	100
Czech Republic	2.79	12.14	53.03	23.33	8.72	100
Poland	1.77	7.84	39.68	31.62	19.09	100
Luxembourg	6.4	16.34	39.74	29.06	8.46	100
Hungary	3.21	10.23	29.44	37.18	19.93	100
Portugal	4.31	3.83	23.76	41.87	26.24	100
Slovenia	4.49	11.26	42.3	27.97	13.97	100
Estonia	1.54	4.02	21.46	51.52	21.46	100
Croatia	5.49	16.59	32.33	27.69	17.9	100
Lithuania	2.31	4.62	32.26	47.79	13.02	100
Bulgaria	8.26	20.53	31.21	23.2	16.79	100
Cyprus	8.95	23.18	32.13	26.61	9.12	100
Finland	6.2	13.11	40.24	33.18	7.27	100
Latvia	0.59	2.66	30.65	44.56	21.54	100
Malta	4.89	21.74	32.41	36.81	4.15	100
Romania	3.01	10.5	36.59	24.73	25.17	100
Slovakia	12.61	25.08	42.69	15.52	4.1	100

Source: SHARE Wave 7.1.1, (2020)

In order to further understand the distribution of health as well as check if our linear predictions of health represent the distribution of self reported health, table 4 Income quatile and the percentages of each category of seflf reported health. The last column presents the mean of the lineally predicted health by income quartile

Table 4: Distribution self reported health of health by Income Quartile and Mean of Linear prediction of Health

	Original SRH					**Standardized SRH**
	Poor	Fair	Good	Very Good	Excellent	Mean
First Quartile	21.52	36.87	30.94	7.92	2.76	0.17
Second Quartile	13.26	31.96	37.93	12.88	3.97	0.18
Third Quartile	9.4	29.91	38.22	16.39	6.09	0.19
Fourth Quartile	5.79	21.08	38.45	26.68	10	0.25

Source: Author's Calculation

Results

Equivalized household income was calculated using the OECD equivalence scale. the scale gives weight to members of the household i.e. 1 to the first adult household, 0.5 to the second house hold member and any subsequent member of the household aged 14 and above. 0.3 is assigned to children aged 13 and below. After which the household income is divided by the scaled household composition (Pettinicchi and Borsch_Supan, 2019). Table 5 presents the average equalized income by country. Countries with low spread of income according to the value of the Gini coefficient include Hungary (0.233), Bulgaria (0.270), Austria (0.284).

Table 5: Mean Income, and Gini coefficient by Country

Country	**Income**	**Gini**	**N**
Austria	24409.386	0.284	3135
Bulgaria	3392.965	0.270	3755
Belgium	23037.039	0.259	3126
Cyprus	33356.955	0.288	4613
Czech Republic	8017.876	0.385	4515
Switzerland	46403.406	0.307	3241
Germany	22911.914	0.332	3172
Denmark	38351.038	0.413	3039
Estonia	8267.816	0.352	2340
Spain	13664.162	0.247	4728
France	24598.116	0.334	2088
Finland	25367.420	0.218	4128
Greece	13433.945	0.287	4640
Croatia	6819.087	0.273	1218
Hungary	5729.268	0.233	1525
Italy	19743.853	0.325	1254
Israel	26024.397	0.273	3650
Lithuania	5566.772	0.317	5004
Luxembourg	43828.478	0.318	2369
Latvia	4925.887	0.339	1990
Malta	12393.829	0.330	1948
Poland	6871.980	0.581	1195
Portugal	11155.549	0.278	1968
Romania	3091.141	0.314	1690
Sweden	27853.204	0.331	1228
Slovenia	11218.143	0.338	2057
Slovakia	10578.741	0.341	1999
Total	17815.273	0.317	75615

Source: SHARE Wave 7.1.1, (2020)

The study estimated a probit regression model where the dependent variable y_i is the self reported health and the independent variables are classified into two categories. The first, termed ascribed factors and the the second termed, achieved factors, the ascribed factors are natural they include age and gender while the achieved factors are non natural and can be influenced to affect health inequality among the elderly, they include income, education and single and current job status

$$y_i = \beta_0 + \beta_1 income_i + \beta_2 male_i + \beta_3 single_i + \beta_4 edu_i + \beta_5 age_i + \beta_6 employed_i + \beta_7 hmaker_i + \beta_8 male_i * single_i + \varepsilon_i \quad (9)$$

where y_i is the self reported health as perceived by the individual.Table 10 in the appendix section presents the parameter estimates of the probit model. It is from equation (9) the linear prediction of health was generated. The linear health predictions is then used to calculate income health inequality for each of the EU-27 countries and the mean of each of these factors were also calculated as they will be input needed for the purpose of decomposing the factors that contribute to health inequality among the elderly.

Equation (8) is then used to decompose the income inequality in health in each countries. Table 6 presents the parameter estimates using the linear health predictions as outcome variable. Age in all countries exhibit a negative and significant relationship with health on the other hand Income exhibit a positive and significant relationship with health except in Italy where it is negative. Education also exhibit a positive and significant relationship with health (such that the more educated an individual is the more the health). In most of the countries considered in the study being single shows a negative relationship with self health.

Table 7 presents the health concentration index and its decomposition into various factors that contributes to income health inequality. Generally, a positive value will indicate that such determinant increases income health inequality. The last column (residual) shows the amount of variation that our model was not able to explain for example In Estonia, the health concentration index among the elderly population is 0.168, this implies that there exist income health inequality among the elderly and this inequality is pro-rich i.e. good health is concentrated among the rich older population. To this observed inequality, 30.50% is contributed by income, such that the inequality in income among the elderly population is passed on to health inequality. A male compared to a female contributes -1.17% to the inequality,thus, a male elderly individual compared to a female reduces health inequality by 1.17%. Education also contributes positively to the inequality, 11.01% of the inequality is contributed by education, such that the more educated in the society have better health than the less educated people, 21.12% of the inequality is composed of contribution form age, Also the interaction term in our model an individual who is a male and single as compared to a female and married contributes negatively to income health inequality -4.10% and the estimated model performed well in decomposing income health inequality as it accounts for 97.08% in income health inequality among the elderly while the remaining 2.92% is not explained by our estimated model.

Table 6: Prameter Estimate of Model with Linear Health prediction

Country	Income	Male	Single	Edu	Age	Employed	Hmaker	Male*Single
Austria	0.032***	-0.029**	-0.049***	0.008***	-0.011**	0.118***	0.002***	0.011***
Bulgaria	0.204***	0.045**	0.013***	0.009***	-0.009**	0.171***	0.174***	0.040***
Belgium	0.067***	0.019***	-0.083**	0.018***	0.002***	0.193***	0.041***	-0.009***
Cyprus	0.014***	0.067***	-0.030***	0.018***	-0.007**	0.080***	0.087***	-0.136***
Czech Republic	0.182***	-0.076**	-0.043***	0.016***	-0.009**	0.151***	-0.056***	0.036***
Switzerland	0.010***	-0.023**	-0.109***	0.006***	-0.014**	0.136***	-0.037***	0.061***
Germany	0.087***	-0.025**	-0.043***	0.010***	-0.003**	0.145***	0.027***	-0.020**
Denmark	0.010***	0.007**	-0.081***	0.022***	0.002**	0.202***	-0.152***	-0.067**
Estonia	0.091***	-0.037**	-0.010**	0.014***	-0.007**	0.185***	0.085***	0.026**
Spain	0.039***	0.030**	-0.060**	0.010***	-0.010**	0.129***	-0.028***	0.018***
France	0.018***	0.034**	-0.033**	0.020***	-0.009**	0.130***	-0.011***	-0.050***
Finland	0.041***	-0.045**	-0.034***	0.014***	-0.007**	0.127***	-0.085***	0.019**
Greece	0.009***	0.048***	-0.030***	0.007***	-0.016**	0.057***	0.034***	0.023**
Croatia	0.076***	0.029***	-0.006***	0.019***	-0.006**	0.191***	0.032***	0.025***
Hungary	0.075***	0.019***	-0.044***	0.027***	-0.009**	0.177***	0.087***	-0.080***
Italy	-0.001**	0.037***	-0.062**	0.011***	-0.013**	0.093***	0.033***	-0.023**
Israel	0.050***	-0.022**	-0.064**	0.008***	-0.009**	0.148***	0.052***	-0.041***
Lithuania	0.119***	0.076***	0.015**	0.018***	-0.005**	0.253***	0.214***	-0.010***
Luxembourg	0.033***	0.006***	-0.081**	0.018**	-0.003**	0.111***	0.077***	0.004***
Latvia	0.168***	0.027***	-0.043***	0.018***	-0.005**	0.181***	0.054***	0.106***
Malta	0.013***	-0.018**	-0.059**	0.019***	-0.009**	0.086***	-0.037***	0.147***
Poland	0.135***	-0.004***	-0.025**	0.012***	-0.008**	0.184***	0.068***	0.024***
Portugal	0.095***	0.140***	0.074**	0.018***	-0.006**	0.149***	0.140***	-0.112***
Romania	0.197**	0.089***	-0.007**	0.013***	-0.009**	0.135***	0.074***	-0.031***
Sweden	0.096***	-0.030**	-0.060**	0.013***	-0.003**	0.136***	0.065***	0.047**
Slovenia	0.070***	-0.027**	0.017***	0.022***	-0.011**	0.084***	-0.066***	-0.015**
Slovakia	0.011**	0.054***	-0.060***	0.018***	-0.008**	0.170***	0.095***	-0.027***

*p<0.1; **p<0.05; ***p<0.01, Hmaker- Home maker

Table 7: Concentration Index and Decomposition of Income Health Inequality

Country	CI	Income	Male	Single	Edu	Age	Employed	Hmaker	Male*Single	Residual
Austria	0.092	47.02	-1.86	5.56	5.88	22.70	20.93	-0.10	-0.52	0.40
Bulgaria	0.174	30.06	2.49	-1.03	9.03	30.25	28.77	0.50	-0.24	0.16
Belgium	0.160	48.28	0.67	5.15	22.54	-4.68	29.34	-1.39	0.31	-0.23
Cyprus	0.131	42.39	2.83	0.58	27.17	19.35	10.14	-0.46	-14.20	12.21
Czech Republic	0.149	36.71	-4.31	4.48	11.06	28.30	24.28	-0.01	-3.68	3.17
Switzerland	0.061	44.09	-1.67	-1.17	8.91	25.32	20.26	1.14	15.36	-12.24
Germany	0.218	66.49	-0.76	3.08	9.71	4.18	17.34	-0.32	0.72	-0.44
Denmark	0.110	21.51	0.20	6.89	26.33	-7.38	51.14	-0.12	5.80	-4.37
Estonia	0.168	30.50	-1.17	1.37	11.01	21.12	38.56	-0.21	-4.10	2.92
Spain	0.102	28.12	1.05	2.11	19.10	27.15	19.92	2.30	1.20	-0.96
France	0.085	26.84	1.47	2.61	38.64	17.13	12.28	0.27	4.25	-3.49
Finland	0.170	39.87	-1.13	2.86	20.45	19.95	18.26	0.05	-0.86	0.53
Greece	0.053	16.98	3.02	0.93	16.28	57.51	8.90	-4.39	6.47	-5.70
Croatia	0.128	32.82	0.82	0.26	26.18	11.65	30.02	-1.57	-0.76	0.57
Hungary	0.096	20.57	1.51	5.86	35.36	16.01	21.47	-2.11	7.53	-6.20
Italy	0.060	-1.37	2.57	4.92	29.98	46.96	21.80	-4.46	-2.22	1.83
Israel	0.117	55.23	-0.58	3.37	11.25	16.44	17.74	-3.28	-0.83	0.66
Lithuania	0.154	29.26	2.94	-1.30	9.42	11.90	48.55	-0.94	0.74	-0.59
Luxembourg	0.178	55.26	0.24	1.33	34.02	3.51	9.31	-3.68	0.08	-0.06
Latvia	0.133	35.44	1.15	4.70	14.25	13.72	34.12	-0.44	-10.56	7.61
Malta	0.091	12.58	-0.73	-2.93	25.97	33.16	19.70	4.43	45.19	-37.38
Poland	0.125	49.27	-0.10	1.48	14.17	13.04	23.58	-1.10	-1.19	0.85
Portugal	0.131	62.06	0.30	3.66	38.94	-4.13	7.23	-4.80	-12.15	8.90
Romania	0.071	66.61	2.28	0.09	21.67	4.86	17.44	-12.03	-4.82	3.90
Sweden	0.251	57.14	-0.98	5.32	11.06	8.79	19.38	0.09	-2.45	1.64
Slovenia	0.115	33.48	-0.82	-1.29	29.23	23.66	13.06	2.43	1.25	-1.00
Slovakia	0.115	7.60	2.56	5.59	13.61	30.44	39.92	-0.29	2.54	-1.98

CI- Concentartion Index, Hmaker- Home maker

Discussion and Policy Implication

This study classifies the variables adopted in the study into ascribed (Male,age) and achieved (Income, Single, Education, employed and homemaker). To the ascribed variables there is little or nothing policy makers can do to influence them however, the variables which are not natural (achieved) are the policy variables that can be influenced by policy makers to reduce the income related inequality in health among the elderly. Income, education, age and job status were found to be the major contributor to the existing income related health inequality among the elderly population in European Countries. It is also important to note that the interaction between gender and marital status is also an important an important factor in determining the health status and income related health inequality among the elderly population in Europe.

Based on the findings of the study, the following policy implication were submitted:

1. Policy makers should make policies that will reduce inequality in income as inequality in income contributes majorly to inequality in health. A reduction in income inequality among the elderly will go a long way to reduce inequality in health among the senior citizen .

2. Education also contributes positively to income related inequality in health. The more educated an elderly individual the more better health such individual has as compared to individual with less education. Thus, government should encourage education in early years of life and support lifelong learning among citizen.

3. Being single at old age tends to contribute positively to health inequality, thus policy makers should encourage citizens to have a life partners. This should go a long way to reduce the health inequality among the elderly.

Conclusion

The main aim of the study is to quantify the extent and causes of income related health inequality among the elderly population in European countries. The study adopted the Survey of health, Ageing and Retirement wave (7.1.1) released in 2020. In order to achieve the aim and objectives of the study, three research objectives were raised. the study adopted the method proposed by Wagstaff and Jones(2003) to measure and decompose the income related health inequality among the elderly population .

There exist varying inequality in health across European countries, among countries with high health inequality are Bulgaria, Israel, Estonia, Latvia, Luxembourg. On the other hand, countries with low level of health inequality include, Portugal, Italy, Hungary, Switzerland to mention a few.

In most countries income was found to be the major contributor to health inequality among the elderly followed by age and education. Thus, health inequality can be reduced among the elderly through intervention of policy makers in the area on making policy to encourage citizens to acquire education, make policies to reduce the inequality in income and encourage citizens to get life partner, based on our model all these will contribute to reducing the income related health inequality among the elderly in European countries.

Suggestion for Further studies

At the point of carrying out the Survey of Health Ageing and Retirement (SHARE WAVE 7.1.1), the outbreak of Covid-19 was at its early stage. Thus, further studies should be carried out to explore the contribution of Covid-19 to health inequality among the elderly population in European countries.

References

Arcaya, M. C., Arcaya, A, L. & Subramanian, S.V. (2015). Inequalities in Health: Definitions, Concepts and Theories. Global Healthy Action, 8

Atkinson, A., Cantillon, B., Marlier, E. & Nolan, B. (2002). Social Indicators: The EU and Social Inclusion. Oxford University Press: Oxford.

Brennenstuhl, S., Quesnel-Vallee, A. & Mc Donough, P., (2012). Welfare Regimes, Population Health and Health Inequalities: A Research Synthesis. J. Epidemiology. Community 66, 397-409.

Borsch-Supan, A. (2020). Survey of Health, Ageing and Retirement in Europe (SHARE) Wave 7. Release Version:7.1.1 SHARE-ERIC. Data set DOI: 10.6103/SHARE.W7.711

Case, A. and Paxson, C. (2005). Sex Differences in Morbidity and Mortality. Demography 42:189–214

Cristea, M. & Mitrica, A. (2016). Global ageing: Do Privately Managed Pension Funds Represent a Long-Term Alternative for the Romanian Pension system? Empirical research. Rom. J. Polit. Sci. 16, 63–106.

Cutler, D., Deaton, A. & Lleras-Muney, A. (2006). The Determinants of Mortality. J. Econ. Perspect. 20(3):97–120 Denise, D., Denzil, G. F., Meliyanni, J & Agne, S. (2015). Does Self -Assessed Health Measure Health. Journal of Applied Economics 47(2) Pp 180-19 Danso, K.(2016). Nativity and Health Disparities: Predictors of Immigrant Health. Soc Work Public Health. 31:175–87 Demographic Outlook for the European Union 2020. European Parliamentary Research Service.

De Olivera, S. M. L., Pessa, S. L. R., Schenatto, F. J & Bernartt, M. L. (2019). Cities and Population Aging: A Literature Review. S. Bagnara et al (Eds) IEA AISC 824 pp1395-1404

Dong, W., Wan, J., Xu, Y., Chen, C., Bai, G., Fang, L., Sun, A. & Yang, Y. (2017). Determinants of Self-Rated Health Among Shanghai Elders: A Cross-Sectional Study. BMC Public Health. 17: 807

Elo, I. T. & Preston, S. H. (1996). Educational Differentials in Mortality in the United States 1979–1985. Soc. Sci. Med. 42:47–57

Eikemo, T. A., Bambara, C., Joyce, K. & Dahl, E. (2008a). Welfare State Regimes and Income Related Health Inequalities: A comparison of 23 European Countries. Eur.J.Publ Health 18, 593-599

Eikemo, T. A., Bambara, C., Judge, K. & Ringdal, K. (2008b). Welfare State Regimes and Differences in Self –Perceived Health in Europe: A Multilevel Analysis. Soc. Sci. Med 66, 2281-2295

Elo, I. T. (2009). Social Class Differentials in Health and Mortality: Patterns and Explanations in Comparative Perspective. Annual Review of Sociology, 35, 553–572

Fonta, C. L., Nonvignon, J., Aikins, M., Nwosu, E. & Aryeetey (2017). Predictors of Self Reported Health Among the Elderly in Ghana: A Cross Sectional Study. BMC Geriatrics 17:171

Ferraro Kenneth F.& Yu Yan. (1995) Body Weight and Self-Ratings of Health. Journal of Health and Social Behavior. 1995

Gerdtham, U.-G. & Johanneson, M.(2000). Income-related inequality in life-years and quality-adjusted life-years. Journal of Health Economics 19 (6), 1007–1026.

Gu, H., Kou, Y., You, H., Xu, X., Yang, N., Liu, J., Liu, X., Gu, J. & Li, X. (2019). Measurement and Decomposition of Income Related Inequality In Self-Rated Health Among the Elderly in China. International Journal for Equity in Health. 18:4

Humphries, K. & Van Doorslaer, E. (2003). Income-related inequalities in health in Canada. Social Science and Medicine 50, 663–671

Herd, P. Goesling, B. & House, J. S. (2007). Socioeconomic position and health: the differential effects of education versus income on the onset versus progression of health problems. J. Health Soc. Behav. 48:223–38

Idler E. L., & Angel R. J. (1990) Self-Rated Health and Mortality in the Nhanes-I Epidemiologic Follow-up Study. American Journal of Public Health.80(4):446–52.

Idler E. L. & Benyamini, Y. (1997) Self-Rated Health and Mortality: A Review of Twenty-Seven Community Studies. Journal of Health and Social Behavior. 38:21–37

Jutz R. (2015) The Role of Income Inequality and Social Policies on Income-Related Health Inequalities in Europe. Int J Equity Health.14:117

Kirkwood, T. B. A. (2008) A Systematic Look at an Old Problem. Nature. 451(7179): pp 644–7

Ká˘cerová, M. & Mladek, J. (2012). Population Ageing as Generation Substitutions: Economic and social aspects. Ekon. Cas. 60, 259–276.

Kiss, M., Laaninen, T., Margaras, V., Zamfir, L., Augere-Granier, M-L., & Atanassov, N. (2020). Demographic Outlook for the European Union 2020. European Parliamentary Research Service PE 646.181

Krueger, P.M., Rogers, R.G., Hummer, R. A., LeClere, F.B. & Huie, S.A. B. (2003). Socioeconomic Status and Age: The Effect of Income Sources and Portfolios on U.S. Adult Mortality. Sociol. Forum 18:465–82

Kunst, A.E., Groenhof, F. & Mackenbach, J., EU Work. Group Socioecon. Inequal. Health. (1998a). Occupational Class and Cause Specific Mortality in Middle Aged Men in 11 European countries: Comparison of Population Based Studies. Br. Med. J. 316:1636–42

Lauridsen, J. T., Christiansen, T & Vitved, A. R. (2019). Dynamic Changes in Determinants of Inequalities in Health in Europe with a Focus on Retirement: Extended Results. NHE Discussion Paper: No. 5/2019

Liu, H., Byles, J. E., Xu, X., Zhang, M., Wu, X. & Hall, J, J. (2017) Evaluation of Successful Aging Among Older People in China: Results from China Health and Retirement Longitudinal Study. Geriatr Gerontol Int.17(8):1183–90

Lauridsen, J. T., Christiansen, T. & Vitved, A. R (2019). Dynamic Changes in Determinant of Inequalities in Health in Europe with a Focus on Retirement: SHARE Working paper Series 44-2019

Lynch, S. M. (2003). Cohort and Life-course Patterns in the Relationship between Education and Health: a Hierarchical Approach. Demography 40:309–31

Manderbacka, K., Lundberg, O. & Martikainen, P. (1999). Do Risk Factors and Health Behaviours Contribute to Self-Ratings of Health? Social Science & Medicine. 48(12):1713–1720

Mariana, C. A., Alyssa, L. A. & Subramanian, S. V. (2015). Inequalities in Health: Definitions, Concepts and Theories. Global Health Action 8(27) 106-117

McCartney, G., Collins, C. & Mackenzie, M. (2013) What (or who) Causes Health Inequalities: Theories, Evidence and Implications? Health Policy 2013; 113: 221_7.

McDonough, P. & Berglund, P. (2003). Histories of Poverty and Self-rated Health Trajectories. J. Health Soc. Behav. 44(2):198–214

Marmot, M (2005). Social Determinants of Health inequalities. Lancet 365, 1099-1104

Marmot, M. (2015). The health Gap: The Challenge of an Unequal World. London: Bloomsbury

Mackenbach, J. P., Stirbu, I., Roskam, A-JR., Schaap, M. M. & Menvielle, G. et al. (2008). Socioeconomic Inequalities in Health in 22 European countries. N. Engl. J. Med. 358:2468–81

Mirowsky, J. & Ross, C. E. (2003). Education, Social Status and Health. New York: Aldine De Gruyter

O'Donnell, O., Van Doorslaer, E. & Van Ourti, T. (2013). Health and Inequality, Tinbergen Institute Discussion Paper, No. 13-170/V, Tinbergen Institute, Amsterdam and Rotterdam. Perlman, F. & Bobak, M.(2008) Determinants of Self Rated Health and Mortality in Russia – Are they the same? Int J Equity Health. 7:19

Pettinicchi, Y. & Borsch-Supan, A. (2019). Retirement Income Adequacy of Traditionally Employed and Self -Employed Workers: Analysis with SHARE Data. MEA Discussion Papers

Steves C, J., Spector T, D. & Jackson S, H. (2012). Ageing, Genes, Environment and Epigenetics: What Twin Studies Tell Us Now, and in The Future. Age Ageing. 41(5)

SHARE Release Guide 7.1.1, Survey of Health Ageing and Retirement in Europe.

Smith J, P. (2007). The Impact of Socioeconomic Status on Health over the Life-course. J. Hum. Serv. XLII:739–64

Tessler, R. & Mechanic, D. (1978) Psychological Distress and Perceived Health Status. Journal of Health and Social Behavior.19(3):254–62. Statistics Office of the European Communities. (2018). Eurostat: Regional Statistics True Health vs. Response Styles: Exploring Cross country Differences in Self-reported Health. DIW Discussion Papers No. 588

Tajvar, M., Arab, M. & Montazeri, A. (2008). Determinants of Health-Related Quality of Life in Elderly in Tehran, Iran. BMC Public Health 8, 323

Vasto, S., Scapagnini, G., Bulati, M., Candore, G., Castiglia, L. & Colonna-Romano G, et al. (2010) Biomarkes of Aging. Front Biosci (Schol Ed)

Van Doorslaer, E. & Gertham, U-G. (2003). Does Inequality in Self-Assessed Health Predict Inequality in Survival by Income? Social Science and Medicine, 57, 1621-1629

Van Doorslaer, E. & O'Donnell, O. (2008). Measurement and Explanation of Inequality in Health and Health Care in Low-Income Settings. Discussion Paper No 2008/04. World Institute for Development Economic Research

Van Doorslaer, E., Wagstaff, A., & Bleichrodt, H. et al. (1997) Income-related Inequalities in Health: some international comparisons. J Health Econ, 16: 93–112.

Van Doorslaer, E. & Jones, A. M. (2003) Inequalities in Self-Reported Health: Validation of a New Approach to Measurement. J Health Econ; 22: 61–87.

Van Doorslaer, E. & Koolman, X. (2000). Income-Related Inequalities in Health in Europe: Evidence from The European Community Household Panel, ECuity II Project Working Paper No 1, Department of Health Policy and Management, Erasmus University, Rotterdam, 2000.

Vancea, M. & Casals, J. S. (2016). Population Ageing in the European Information Societies: Towards a Comprehensive Research Agenda in eHealth Innovation for Elderly. Ageing and Disease. 7(4) 526-539

World Health Organisation (2017). WHO Health Inequality and Inequity World Health Organization, Health Impact Assessment Glossary Health Inequality and inequity.

WHO Commission on Social Determinants of Health, World Health Organization (WHO) (2008).Closing the Gap in a Generation: Health Equity Through Action on the Social Determinants of Health: Commission on Social Determinants of Health Final Report. Geneva

Waldmann, R. J. (1992). Income Distribution and Infant Mortality. Quarterly Journal of Economics, 107, pp. 1283-1302.

Wagstaff, A., van Doorslaer, E. & Watanabe, N. (2003). On Decomposing the Causes of Health Sector Inequalities with an Application to Malnutrition Inequalities in Vietnam. Journal of Econometrics, 112(1) 207-223

Wagstaff, A. & van Doorslaer, E. (1994). Measuring Inequalities in Health in the Presence of Multiple-Category Morbidity Indicators. Health Economics 3, 281–291.

Wagstaff, A., van Doorslaer, E., & Paci, P. (1989). Equity in the Finance and Delivery of Health Care: Some Tentative Cross-Country Comparisons. Oxford Review of Economic Policy 5 (1), 89–112.

Wang, B.R., Yu, S., Noh, J. W., & Kwon, Y.D. (2014) Factors Associated with Self-Rated Health Among North Korean Defectors Residing in South Korea. BMC Public Health. 14:999.

Yan, B. Gill, T.M. & Chen, X. (2019) Health Inequality Among Chinese Older Adults: The Role of Childhood Circumstances. IZA Discussion Paper Series No 12873

Appendix

Table 8: Parameter Estimate of OLS Model

Country	Income	Male	Single	edu	age	employed	hmaker	male*single
Austria	0.086***	-0.061	-0.121**	0.015***	-0.013***	0.322***	0.046	-0.006***
Bulgaria	0.558***	0.128*	0.036	0.021***	-0.028***	0.517***	0.467***	0.095***
Belgium	0.141***	0.023	-0.151***	0.030***	0.003**	0.273***	0.070	0.015**
Cyprus	0.035***	0.178**	-0.195**	0.052***	-0.013***	0.315***	0.218**	-0.446**
Czech Republic	0.337***	-0.010	-0.069*	0.021***	-0.007***	0.477***	0.031	0.167***
Switzerland	0.021***	-0.055	-0.155***	0.004	-0.010***	0.305***	0.023	0.155***
Germany	0.179***	-0.076**	-0.102**	0.015***	-0.002	0.348***	0.085	0.037*
Denmark	0.024***	0.051	-0.178***	0.050***	0.007**	0.513***	-0.334***	-0.181**
Estonia	0.223***	-0.063**	-0.030	0.024***	-0.011***	0.401***	0.146*	0.052*
Spain	0.109***	-0.026	-0.054	0.025***	-0.018***	0.447***	0.027	0.068*
France	0.033***	0.080*	-0.003	0.027***	-0.010***	0.266***	-0.018	-0.153***
Finland	0.047***	-0.133**	-0.157***	0.047***	-0.017***	0.269***	-0.191	0.180***
Greece	0.030***	0.136***	-0.095**	0.016***	-0.047***	0.187***	0.121***	0.032*
Croatia	0.160***	0.053	-0.055	0.037***	-0.012***	0.518***	0.054	0.061**
Hungary	-0.003	-0.030	-0.229***	0.073***	-0.005	0.830***	0.997***	-0.148**
Italy	0.011	0.102***	-0.180***	0.020***	-0.023***	0.329***	0.122***	-0.084*
Israel	0.163***	-0.076	-0.177***	0.027***	-0.020***	0.623***	0.213***	-0.264***
Lithuania	0.229***	0.110**	0.050	0.029***	-0.008***	0.406***	0.334***	0.024***
Luxembourg	0.097***	0.038	-0.235***	0.046***	0.000	0.328***	0.231***	-0.024***
Latvia	0.359***	0.050	-0.098*	0.036***	-0.009***	0.391***	0.126	0.223**
Malta	0.014	-0.037	-0.073	0.035***	-0.010***	0.216***	0.029	0.166***
Poland	0.262***	-0.026	-0.050	0.024***	-0.015***	0.416***	0.132***	0.059**
Portugal	0.220***	0.563***	-0.028	-0.009	-0.024***	0.670***	0.593***	-0.239***
Romania	0.449***	0.261***	-0.009	0.042***	-0.022***	0.454***	0.231***	-0.069**
Sweden	0.176***	0.021	-0.100*	0.026***	0.003	0.470***	0.280*	-0.073**
Slovenia	0.167***	-0.031	0.071	0.045***	-0.024	0.263***	-0.092	0.048***
Slovakia	0.032*	0.123**	-0.176***	0.051***	-0.025	0.442***	0.178	-0.057*

*p<0.1; **p<0.05; ***p<0.01. hmaker- home maker

Table 9: Concentration Index and Decomposition of Income Health Inequality OLS

Country	CI	Income	Male	Single	Edu	Age	Employed	Hmaker	Male*Single	Residual
Austria	0.051	38.53	-1.16	4.10	3.22	8.18	17.04	-0.76	0.39	30.45
Bulgaria	0.081	26.87	2.32	-0.97	6.91	29.24	28.55	0.44	-1.60	8.24
Belgium	0.043	54.87	0.42	5.03	19.75	-5.35	22.29	-1.26	-1.03	5.28
Cyprus	0.069	31.84	2.33	1.18	24.08	11.55	12.33	-0.36	0.03	17.03
Czech Republic	0.049	35.56	-0.30	3.81	7.42	12.61	40.31	0.00	-0.17	0.75
Switzerland	0.029	35.00	-1.50	-0.64	2.47	6.98	17.45	-0.28	-1.52	42.04
Germany	0.065	61.77	-1.05	3.29	6.77	1.30	18.81	-0.45	-1.31	10.87
Denmark	0.048	18.87	0.56	5.62	22.63	-12.05	48.21	-0.09	0.40	15.86
Estonia	0.075	33.35	-0.90	1.80	8.19	14.23	36.96	-0.16	-1.00	7.53
Spain	0.052	29.72	-0.34	0.72	16.98	17.76	25.97	-0.83	-1.60	11.62
France	0.047	17.75	1.23	0.08	18.11	6.93	8.92	0.15	0.69	46.14
Finland	0.054	20.66	-1.50	5.90	29.96	22.62	17.39	0.05	-0.51	5.44
Greece	0.030	19.04	3.00	1.03	13.53	59.67	10.25	-5.50	-2.63	1.61
Croatia	0.049	26.78	0.58	0.93	20.38	9.13	31.62	-1.00	-2.79	14.38
Hungary	0.044	-0.36	-1.03	13.51	43.01	3.73	44.49	-10.64	2.91	4.38
Italy	0.047	6.12	1.71	3.45	13.01	20.37	18.77	-4.04	1.45	39.16
Israel	0.075	53.48	-0.58	2.73	11.62	10.73	21.93	-3.94	0.07	3.96
Lithuania	0.048	34.45	2.62	-2.63	9.45	12.30	47.86	-0.90	-1.76	-1.40
Luxembourg	0.068	54.58	0.51	1.30	29.22	0.02	9.28	-3.70	1.14	7.65
Latvia	0.066	36.32	1.01	5.11	14.00	10.63	35.28	-0.50	-0.07	-1.79
Malta	0.034	6.04	-0.68	-1.66	21.94	16.34	22.72	-1.61	-3.67	40.58
Poland	0.054	39.63	-0.23	1.22	11.89	10.41	22.05	-0.88	-1.43	17.35
Portugal	0.032	100.71	0.86	-0.95	-13.44	-12.33	22.79	-14.25	2.69	13.93
Romania	0.035	55.68	2.45	0.04	26.28	4.51	21.55	-13.84	4.49	-1.17
Sweden	0.069	51.04	0.33	4.30	10.57	-4.13	32.79	0.19	1.26	3.64
Slovenia	0.057	31.13	-0.37	-2.08	23.94	20.61	16.10	1.32	-1.64	10.98
Slovakia	0.061	6.25	1.73	4.84	11.28	29.66	30.59	-0.16	1.69	14.12

Hmaker- Home maker

Table 10: Ordered Probit Model Parameter Estimate

Country	Income	Male	Single	Edu	Age	Empl	Hmaker	Male*Sing	Poor|Fair	Fair|Good	Good|V.good	V.good|E
Austria	0.064	-0.059	-0.099	0.017	-0.022	0.238	0.004	0.022	-2.642	-1.601	-0.615	0.364
Bulgaria	0.565	0.124	0.035	0.025	-0.026	0.472	0.481	0.111	-2.144	-1.341	-0.416	0.502
Belgium	0.129	0.037	-0.160	0.035	0.003	0.371	0.080	-0.017	-0.552	0.504	1.699	2.578
Cyprus	0.043	0.200	-0.089	0.055	-0.020	0.240	0.261	-0.405	-2.197	-1.086	-0.108	0.874
Czech Republic	0.409	-0.170	-0.096	0.036	-0.019	0.338	-0.126	0.081	-2.098	-1.162	0.444	1.375
Switzerland	0.014	-0.033	-0.153	0.008	-0.019	0.190	-0.052	0.085	-2.978	-2.027	-0.819	0.141
Germany	0.203	-0.058	-0.101	0.023	-0.007	0.337	0.063	-0.046	-1.017	0.130	1.365	2.224
Denmark	0.021	0.014	-0.168	0.045	0.003	0.419	-0.316	-0.139	-0.622	0.327	1.019	2.048
Estonia	0.244	-0.099	-0.028	0.039	-0.020	0.501	0.229	0.069	-1.510	0.073	1.190	1.820
Spain	0.085	0.066	-0.131	0.023	-0.022	0.284	-0.061	0.039	-2.311	-1.383	-0.338	0.629
France	0.029	0.055	-0.053	0.033	-0.015	0.213	-0.019	-0.082	-1.786	-0.858	0.418	1.102
Finland	0.101	-0.112	-0.085	0.036	-0.017	0.317	-0.212	0.049	-1.988	-0.652	0.575	1.288
Greece	0.034	0.171	-0.107	0.024	-0.057	0.202	0.121	0.082	-5.228	-4.075	-2.864	-1.553
Croatia	0.186	0.071	-0.015	0.046	-0.014	0.465	0.079	0.060	-1.199	-0.336	0.616	1.512
Hungary	0.191	0.049	-0.111	0.068	-0.024	0.450	0.222	-0.203	-1.711	-0.588	0.423	1.207
Italy	-0.001	0.089	-0.149	0.026	-0.031	0.222	0.078	-0.054	-3.237	-1.987	-0.980	-0.230
Israel	0.161	-0.072	-0.210	0.025	-0.029	0.483	0.170	-0.134	-2.514	-1.543	-0.755	0.493
Lithuania	0.273	0.173	0.034	0.041	-0.011	0.580	0.491	-0.024	-1.115	0.449	1.790	2.330
Luxembourg	0.085	0.015	-0.209	0.047	-0.007	0.286	0.199	0.010	-0.988	0.143	1.306	2.140
Latvia	0.521	0.084	-0.133	0.055	-0.017	0.561	0.166	0.329	-0.969	0.442	2.076	2.773
Malta	0.022	-0.030	-0.096	0.031	-0.015	0.140	-0.060	0.239	-2.484	-0.927	-0.050	1.003
Poland	0.337	-0.011	-0.063	0.029	-0.019	0.462	0.170	0.061	-1.598	-0.618	0.803	1.657
Portugal	0.242	0.357	0.190	0.045	-0.015	0.380	0.357	-0.285	-0.882	0.335	1.352	1.688
Romania	0.646	0.292	-0.022	0.042	-0.028	0.442	0.241	-0.103	-1.779	-1.016	0.241	1.085
Sweden	0.191	-0.060	-0.120	0.026	-0.006	0.271	0.129	0.094	-1.300	-0.181	0.884	1.574
Slovenia	0.186	-0.072	0.046	0.057	-0.029	0.221	-0.175	-0.040	-2.379	-1.420	-0.098	0.658
Slovakia	0.037	0.177	-0.198	0.060	-0.025	0.562	0.314	-0.088	-2.571	-1.551	-0.172	0.778

Resümee

Euroopa riikide vanemaealise rahvastiku tervise ebavõrdsuse mõõtmine ja dekomponeerimine

Sheriff Tolulope Ibrahim

Eakate inimeste arv jätkab arenenud riikides kasvu. Selle põhjuseks on keskmise eluea pikenemine, mida võib seostada tervisetehnoloogia arenguga, ja sündimuse vähenemine. See jätkuv kasv toob kaasa väljakutsed tervisepoliitika kujundajatele ja valitsustele, näiteks kasvav sissetulekute ja tervisega seotud ebavõrdsus. Käesolev uuring kasutab SHARE (Survey of Health Ageing and Retirement) uuringu andmeid, et mõõta ebavõrdsust tervises ja dekomponeerida selle põhjuseid Euroopa riikide eakate elanike seas. Analüüsis hinnatakse inimeste endi öeldud tervisehinnangute kohta järjestatud probit-mudel, mille abil leitakse hinnang latentsele tervisenäitajale. Saadud näitajat kasutatakse eakate inimeste tervisealase ebavõrdsuse mõõtmiseks ja dekomponeerimiseks Wagstaffi pakutud meetodi järgi. Uuringu tulemused näitavad, et tervisealane ebavõrdsus eksisteerib Euroopa eakate elanike hulgas ja need erinevused on riigiti erinevad. Uuring näitab lisaks, et tervisealast ebavõrdsust selgitavate tegurite hulka kuuluvad sissetulek, haridus ja tööturuseisund. Uuringu tulemuste põhjal soovitatakse uuringus, et tervisealase ebavõrdsuse vähendamiseks peaks valitsus soodustama sissetulekute võrdsemat jaotamist eakate elanike vahel, kuna see aitab tervisealast ebavõrdsust vähendada. Teiseks peaksid poliitikakujundajad ja valitsused julgustama ja toetama elukestvat õpet, kuna see paneb elanikkonna omandama uusi teadmisi, mis võivad parandada nende tervist ja vähendada tervisealast ebavõrdsust.

Märksõnad: Tervise ebavõrdsus, mõõtmine, dekomponeerimine, eakad inimesed, kontsentratsiooniindeks, kontsentratsioonikõver

Non-exclusive licence to reproduce thesis and make thesis public

Sheriff Tolulope Ibrahim

(author's name)

herewith grant the University of Tartu a free permit (non-exclusive licence) to reproduce, for the purpose of preservation, including for adding to the DSpace digital archives until the expiry of the term of copyright,

Measuring and Decomposing Income Health Inequalities Among the Elderly Population In European Countries

(title of thesis)

supervised by

Andres Võrk

(supervisor's name)

2. I grant the University of Tartu a permit to make the work specified in p. 1 available to the public via the web environment of the University of Tartu, including via the DSpace digital archives, under the Creative Commons licence CC BY NC ND 3.0, which allows, by giving appropriate credit to the author, to reproduce, distribute the work and communicate it to the public, and prohibits the creation of derivative works and any commercial use of the work until the expiry of the term of copyright.

3. I am aware of the fact that the author retains the rights specified in p. 1 and 2.

4. I certify that granting the non-exclusive licence does not infringe other persons' intellectual property rights or rights arising from the personal data protection legislation.

Sheriff Tolulope Ibrahim

25/05/2021