

UNIVERSITY OF TARTU

Faculty of Social Sciences School of Economics and Business Administration

Haji Hajizada, Sanan Abdullayev

Factors explain continuing working after the official
retirement age

Master's Thesis

Supervisor: Eve Parts (Associate Professor of Economic Theory)

Tartu (2020)

Name and signature of supervisor

Eve Parts

Allowed for defense on (date)

I have written this master's thesis independently. All viewpoints of other authors, literary sources and data from elsewhere used for writing this paper have been referenced.

Sanan Abdullayev

Haji Hajizada

(signature of author)

Acknowledgements

Firstly, we thank to our supervisor Eve Parts for her support and guidance by providing us with important feedback during our research process. We are also thankful to our reviewer Andres Võrk for his contribution and critiques for the improvement of our MA thesis.

We also feel grateful to our programme director Jaan Masso for all his supports and kindness during our studying period at the University of Tartu. At the same time, we thank to all professors for their contributions to the enhancement of our educational background over 2 years of studying period.

Throughout some stressfull periods of study, the support of our friends and family were priceless for us. We specially want to thank to our friends Elvin Mammadli, Ulkar Gurzaliyeva, Sevil Javarova and Renis Krisafi for their helps during this research.

Abstract

This paper examines the determining factors that explain elderly's decision to stay longer in the labor market after the official retirement ages of the corresponding countries by using the 7th wave from Survey of Health, Ageing and Retirement in Europe (SHARE). 22,738 observations aged between the official retirement age and 75 from 24 European countries are analysed using multivariate logistic regression models by including socio-demographic, education, health, well-being, personality traits, work related and country level variables. Our main results show that higher levels of consciousness, being employed in a public sector compared to the private sector, being self-employed rather than being employed regardless of sector, and not having any grandchildren increases the likelihood of being employed after the official retirement age. In addition to previous studies, we found that the impact of level of educational attainment is stronger for females compared to males.

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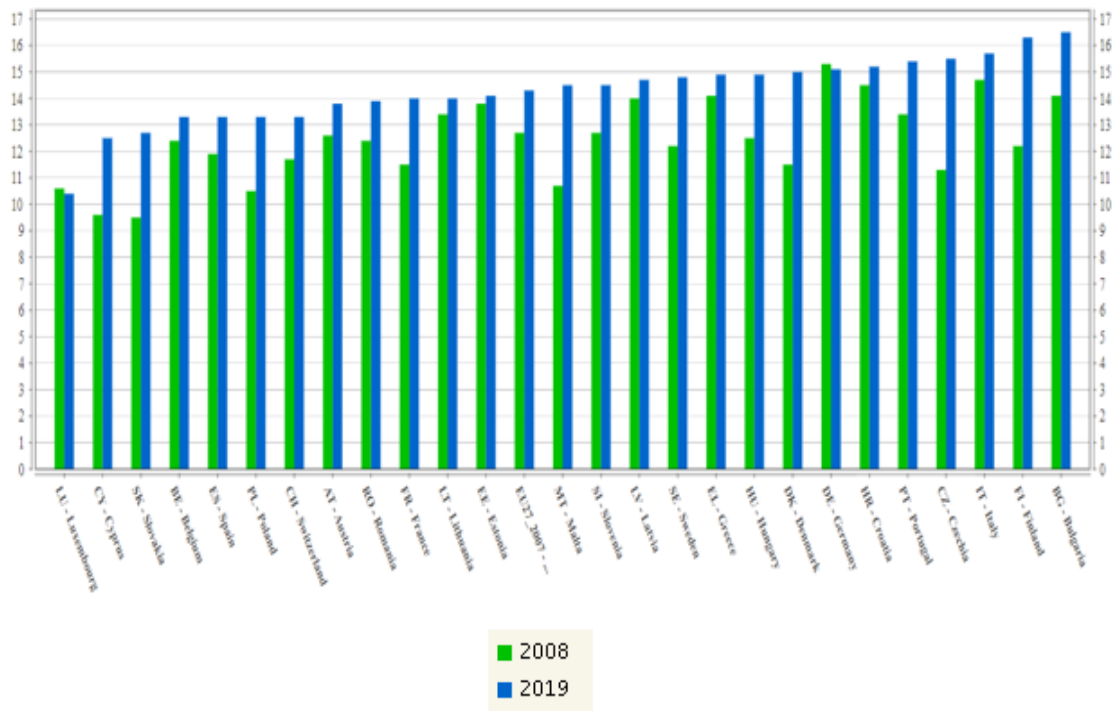
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Introduction

Along with the increase in life expectancy, the remarkable decline in fertility rates, especially starting from the late 1960s, contributes substantially to the population aging process globally. The share of people over 65 years old increased to 9 per cent in 2019 from 6 per cent in 1990 and it is predicted to reach 16 per cent by 2050 all over the world (Neels 2006; OECD 2011; Sleenbos 2003; United Nations, Department of Economic and Social Affairs, and Population Division 2020). The comparison of the structure of European population in 2000 and projections for 2050 by Börsch-Supan et.al (2005) shows that while the size of new birth and 65-years-old cohorts in 2000 was close to each other, the cohort of 65-years-olds becomes quite larger compared to the size of newly born children in the projections of 2050. The more recent data from Eurostat shows that the proportion of the population aged 65-79 years in the whole population increased significantly from 2008 to 2019 in almost all countries that the SHARE questionnaire has conducted (except Germany and Luxembourg) (Figure 1), while the share of population aged 15-24 and 25-49 years decreased substantially (Appendix 1,2). This brings huge concerns in terms of decreasing the labor force, in return the financial sustainability of pension systems, and increasing costs of healthcare and long-term care systems. Specifically, it is a bigger problem for the countries, in which the proportion of older people (old-age dependency ratio) in society is high and income of this part of the population is highly dependent on public transfers (United Nations et al. 2020). Furthermore, if taxation patterns to finance pension systems remain unchanged and the portion of the population in the labor force decreases (because of declining fertility rates and increasing old-aged part of the population), it becomes a serious problem for welfare states to maintain financial stability.

One of the solutions to this issue can be prolonging the working lives of the elderly. Previous literature shows that differences in welfare states across countries result in different patterns of retirement behavior among elderly (De Preter, Van Looy, and Mortelmans 2013; Dingemans, Henkens, and Solinge 2017; van Oorschot and Jensen 2009; Schils 2008). Therefore, there can be a need for adjustments in pension and social security systems to keep elderly longer in the workforce for lightening the undesired results of the population aging process.

Figure 1: The share of population aged between 65-79 years in total population



Source of Data: Eurostat, available at <https://ec.europa.eu/eurostat/web/products-datasets/-/tps00010>

The determinants of elderly’s behavior towards working at later ages were analysed by several studies and it has been found that in addition to individual characteristics (e.g, socio-demographic, educational attainment levels, health status) working conditions, work history and country level differences are some of main predictors (Börsch-Supan, Brugiavini, and Croda 2009; De Preter et al. 2013; Wahrendorf et al. 2017; Dingemans et al. 2017; Dingemans and Möhring 2019). Although the effect of personality traits was only investigated by few studies, it has not been analysed by using the SHARE database since it was recently introduced with a release of wave 7. On the other hand, these studies only covered one particular country (Norway, Netherlands, Sweden and the USA) while the SHARE questionnaire allows us to do multinational analysis with a large sample size (Blekesaune and Skirbekk 2012; Schwaba and Bleidorn 2019; Hudomiet, Parker, and Rohwedder 2018; Anxo et al. 2019). Regarding the work environment, some factors, such as effort-reward balance, number of years in employment, work stress, position and so on, were found to affect the likelihood of

working beyond retirement age. However, the effect of the sector of employment was investigated only in the case of Lithuania (Zitikytė 2020), posing a need to study it further on a multinational scale. Our main aim is to investigate factors affecting the decision of the elderly to work past retirement age in individual and institutional context, simultaneously to see comparison of our results with previous findings and fill the gaps regarding the analysis of personality traits and sector of employment. By using “individual” and “institutional” above and in the paper from now on, we mean the variables that were asked in the SHARE questionnaire and collected from other databases which we used as country level variables in our models, respectively. Besides, by taking the sample of the latest wave 7 of SHARE, a higher number of countries allows more variation in institutional level than previous studies. Separating our main model by gender allows us to see the difference in the effect of these factors between men and women.

In addition to the positive impact of a high level of education, living with a partner, better health and quality of life on the likelihood of working after retirement age which is in line with previous findings, our main results show that the sector of employment (public and private sector employees, and self-employed), having grandchildren, and personality traits are also significant factors. In addition to previous studies, we also found that an effect of educational attainment for women is stronger compared to men. Besides individual level variables, the generosity of the pension systems and normative support of societies to work partially after retirement age are found to be able to explain country level differences to some extent.

The following section presents analysis of previous empirical studies classified according to factors and the table which demonstrates the comparison of papers that used the SHARE data in the related topic (Table 1). The third section provides the overview of our dataset, the methodology that we used and the explanation of the variables included in our regression models. The fourth section illustrates descriptive and multivariate findings, while the final section gives an overview of our concluding remarks, limitations and strengths of our study.

Literature review

There are numerous studies in the literature investigating different factors that contribute to the decision of the elderly whether to stay in the workforce after the official

retirement age. Factors affecting the decision making process of the elderly people are mostly grouped under two levels, micro and macro. Most of the studies were focused on both micro and macro level motives (Börsch-Supan, Brugiavini, and Croda 2009; De Preter et al. 2013; Fischer and Sousa-Poza 2006) simultaneously, whereas some investigated only the impact of individual determinants (Bennett, Beehr, and Lepisto 2016; Kim and Feldman 2000; Wahrendorf et al. 2017).

Previous studies suggested that the retirement decision of elderly differs by gender. Quinn and Kozy (1996) reported that females were more prone to work in bridge employment in the U.S.A. However, in most papers it has been found out that males were more likely to stay in the labor force in older ages than females (Anxo, Ericson, and Herbert 2019; Bonsdorff et al. 2009; Davis 2003). Also Wahrendorf et al. (2017) concluded the same result who used SHARE database which might be because of traditional division of labor by gender as women used to be mostly “homemakers”. Marital status also found to be one of the predictors of working beyond retirement for both genders. Although, De Preter et al. (2013) reported that being married or living with a partner did not have a significant effect on the decision to retire early or later by using data from the first and second waves of SHARE database, Dingemans and Möhring (2017) found out that divorced or widowed were more likely to engage in bridge employment by using the fourth wave of SHARE database. These contrasting results might be due to ignoring the interactions with other factors. For example, divorced single women, women with dependents were more likely to continue working at later ages (Cahill, Giandrea, and Quinn 2006; Damman 2014). Pleau (2010) found out that being married and having higher household wealth in case of women had a negative effect on working beyond retirement age compared to divorced women. Since men are “breadwinners” in the households, divorced women became more economically vulnerable, while men had more likelihood to continue to participate in the labor market with higher wealth. At the same time, Dingemans et al. (2019) who used lifetime history data from SHARE database concluded that being divorced rather than married had a positive effect on women’s decision to work after retirement, while for men it did not have significant effect .

The time period starting from a person’s investment in education ending in retirement age accounts for the return that a person gets from investing in himself,

according to human capital theory (Ben-Porath 1967). Therefore people who attain more years of education are also willing to increase the length of the working period in order to increase this return. Another study investigated that in the job market requirements for qualified employees increase as organizations are continuously changing technologically. Individuals tend to spend more time obtaining required skills (Bartel and Sicherman 1993). As a result, the elderly want to stay more in the labor market in order to compensate for the financial gains that they sacrificed to obtain the right skills. Besides these, low levels of education were also found to be positively associated with early retirement in a cross-national analysis with 10 European countries (Fischer and Sousa-Poza 2006). This association was also found in some studies of particular countries, e.g. Norway (Røed and Haugen 2003) and the U.S.A. (Holtmann et al. 1994). At the same time, some studies who investigated association between educational attainment and working after retirement age by using the SHARE data found a positive significant relationship (De Preter et al. 2013; Dingemans et al. 2017; Dingemans and Möhring 2019; Wahrendorf et al. 2017b).

Since males were conventionally the “breadwinners” in most families, females that participate in the labor market increasingly started to share the financial burden of families with their partners, especially in the last decades. Increasing labor force participation of women in recent centuries in most countries caused the gender revolution of households (Goldscheider, Bernhardt, and Lappegård 2015). Starting from the 1960s, enrollment in higher education expanded remarkably especially in terms of females in most countries (Schofer and W. Meyer 2005). In return, expansion of higher education attainment of females resulted in higher labor participation of females and also a higher likelihood of being employed of high educated females compared to less educated (Eckstein and Lifshitz 2011; Heath and Jayachandran 2018; Psacharopoulos and Tzannatos 1989; Schofer and W. Meyer 2005). Working women started to have more bargaining power within the households (Heath and Jayachandran 2018). As educated women are more concentrated on their career and more likely to work, males are not the only “breadwinners” in those families compared to families where females do not work. However, the situation for men is different. Even males without education are supposed to work due to “breadwinners” status. Thus, we expect a stronger effect of education on women’s prolonged working lives at later ages than on men.

The level of the occupational position can be an influencing factor when the elderly decide to continue working beyond retirement age. Some findings show that people who are working in positions that require more manual work such as manufacturing, agriculture and so on are more exposed to the physical risks. Therefore, they are less likely to continue working at older ages (Villosio et al. 2008). On the other hand, people working in higher positions have more autonomy and favorable conditions in their daily job tasks and that gives incentive to them to continue working. Besides, employers are not willing to lose skilled workers, so they give incentive to avert early retirement of these skilled workers (Komp, Tilburg, and Groenou 2010). Furthermore, people with high positions have higher chances and opportunities to get another job after leaving their current job (Oude Mulders 2016). The study of Wahrendorf et.al (2017) who used wave 4 from SHARE database, found elderly with higher skills (managers and professionals) to be more likely to stay in the labor market longer compared to people who work in elementary occupations. All of these findings lead us to assume that having a high occupational position increases likelihood of working after retirement age.

Firms applying innovations are not willing to hire old-age employees due to their slow adaptation to the changing technologies. Also, these innovations have a positive effect on the probability of old-aged employees' exit from the labor market (Aubert, Caroli, and Roger 2006). Another study using firm-level data in Germany found that when firms adopt new technologies or innovations, demand for the older labor force decreases and the opposite happens for younger employees (Beckmann and Schauenberg 2007). Innovations are a crucial part of private sector organizations due to high competitiveness in the marketplace, while the public sector lacks competitiveness. There are differences between the public and private sector regarding the pace of the adaptation process. Decision-making regarding innovation policies are time-consuming in the public sector, since they are risk-averse or more afraid of failure. Also, compared to the private sector, the public sector can have some barriers to innovations due to societal objectives (Cankar and Petkovsek 2013; Bloch and Bugge 2013). We assume that older employees in the public sector are more likely to continue working beyond the retirement age compared to the private sector.

Some researches emphasize the importance of working conditions on retirement timing. When employees have tasks with low levels of autonomy, they are more likely to

retire early from this job (Blekesaune and Solem 2016). Besides low levels of decision authority, low levels of recognition at an employee's current job is also positively associated with early exit (Carr et al. 2016). Since self-employees are more committed to their work and have more autonomy, we assume self-employment to be a predictor of working after retirement age (Komp et al. 2010). Likewise, some findings suggest that self-employment and flexible careers are statistically significant predictors of working after retirement age (Anxo et al. 2019; Dingemans and Möhring 2019; Wahrendorf et al. 2017).

Individuals who had high job satisfaction could be disturbed by the exit from their job, since participating in the related position was valuable for them and it was also highly favourable for them to communicate with their colleagues (Cytrynbaum, 1989). Association between job satisfaction and retirement was found in a longitudinal study among British civil servants. The results showed that poor job satisfaction was an individual predictor of early retirement (Mein et al. 2000) Therefore, we expect a positive association between job satisfaction and working after retirement age.

Socio-emotional selectivity theory suggests that when individuals get older, the feeling of “time left” increases. Thus, they change their environment in order to achieve goals like keeping emotional well-being high and increasing life satisfaction. Many elderly look at retirement as an opportunity to be close with their grandchildren (Carstensen, Fung, and Charles 2003). Besides, retirees spend more time with their grandchildren and children to compensate for past neglected contacts (Szinovacz, DeViney, and Davey 2001).

There are quite contrasting findings in previous researches investigating predictive power of personality traits. A study investigating elderly aged between 50 and 69 years old in Norway used a longitudinal approach to find whether personality traits can predict retirement timing or paths. The results showed that except from disability retirement, personality traits do not predict retirement (Blekesaune and Skirbekk 2012). Schwaba and Bleidorn investigated developments and changes of Big Five personality traits in response to transition to retirement. A longitudinal analysis of retirees in the Netherlands showed that level of agreeableness and openness suddenly increase during the first month after retirement and start decreasing gradually in the following 5 year time period. However, extraversion and conscientiousness are found to be unchangeable in the

transition period to retirement (Schwaba and Bleidorn 2019). In contrast, another study investigating the relationship between pathway to retirement and personality found that extraversion is a consistent and strong predictor of prolonged working life for the elderly. Although low levels of agreeableness and high levels of conscientiousness were also associated with working longer, these effects were not strong and consistent (Hudomiet, Parker, and Rohwedder 2018). Furthermore, a large sample of 20,000 elderly in Sweden was analysed using a multinomial logit model to find predictors of late retirement. Extraversion, conscientiousness and openness were found to be positively related to working after official retirement age. The opposite effect was true for neuroticism and agreeableness. However, neuroticism was a significant predictor only for male respondents (Anxo et al. 2019).

Retirement is an important phenomena of the elderly's life making them pass to the next stage of adulthood. It can be related to overall well-being of the elderly, since it is not only a one-off transition of employment path in a lifetime, but also is a subjective social and psychological transformation (Kim and Moen 2001). People who ceased their employment career were found to report worse psychological well-being and health compared to those who preferred partial retirement with some amount of work (Herzog, House, and Morgan 1991). Besides, another study suggests that low self-efficacy and personal control are significant factors affecting retirement adjustment (Fretz et al. 1989). Nevertheless, some studies found well-being as a significant predictor of retirement decisions (Siegrist et al. 2007; Wahrendorf et al. 2017).

Another predictor of working beyond retirement is being eligible to work in terms of health condition. The variable "health status limits work" is found to be significant in the decision-making process of the elderly over different career trajectories (Ingrid Boveda and A. J. Metz, 2016). The people with chronic diseases are less likely to work beyond retirement age compared to without chronic diseases (Astrid de Wind, Micky Scharn et al., 2018). Another study analyzed data of 3 years from Dutch longitudinal Study on Transitions in Employment, Ability and Motivation which is constituted from employees aged between 45 - 64 years old (N=8149). Their findings suggested that different health issues predict unemployment, disability benefits and early retirement to varying extents. However, psychological health problems especially had significant effects on older employees' decisions towards unemployment and early retirement

(Leijten, F.R.M., de Wind, A. et al., 2015). Different from using short-term data, 12 years period health condition of employees was followed up using a linked survey-administrative dataset for Canada. Not only is the long-term impact of chronic disease on transition out of employment analysed, but also variability of impacts of different diseases was taken into account. It is found that the comorbidity of mental and musculoskeletal disorders has significant impact on individuals' early retirement decisions, however the presence of diabetes and cardiovascular problems is found to be more influential (Wen-Hao Chen, 2019). Studies that have used the SHARE database also investigated the effect of health with different measurement methods such as self-rated health, ADL (number of limitations regarding daily activities), depression scale etc. and all found health as a significant predictor of retirement behavior of elderly (De Preter et al. 2013; Dingemans et al. 2017; Dingemans and Möhring 2019; Wahrendorf et al. 2017).

On the other hand, some empirical studies have come to a conclusion that health is not a principal cause of early retirement decisions. Danish nurses, who were offered an early retirement plan (PEW - Post-Employment Wage) allowing them to retire at the age of 60, were subject to a cohort study. Hazard ratio (1.28) showed that nurses with self-reported poor health were more likely to retire than those with good health. However, two thirds of nurses also joined this program who had reported good or very good health. This results indicates that health is not the principal predictor of early retirement (Friis et al. 2007). The influence of health was also examined in richer cross national analysis of European countries using SHARE data. The findings showed that health factors did not account for large variations among countries in terms of retirement decisions. The generosity of social security systems was the main determinant causing different patterns in retirement and labor participation in these countries (Börsch-Supan et al. 2009). At the same time, a study was done in Finland which investigated how the effects of health issues on retirement decisions changed after the new pension scheme (the statutory pension system was modified in 2005 replacing the prior fixed old-age pension limit of 65 with a flexible pension age between 63 and 68). The findings illustrated that poor or good health condition was not a determinant factor of retiring earlier or continuing to work beyond retirement after pension reform. After the changes in the pension system, the older people had more flexibility to retire (Leinonen et al. 2016).

Several comparative analyses among OECD countries have been carried out to see to what extent variations in social security and pension systems affected people's behavior to retire early or work beyond official retirement age. In Trudie Schils's paper, three national panel surveys were used for the analysis: 16 waves of the GSOEP (1990-2005) survey, 14 waves of the BHPS (1991-2004) and 12 waves of the Dutch SEP (1990-2001) survey. The main intention of the paper was to investigate the variation of early retirement behaviors of elderly people in three countries (Germany, Netherlands and United Kingdom) with different social security and pension systems. The results suggested that the generosity of the systems such as disability or unemployment pathways to early retirement can motivate elderly more to retire earlier in Germany and the Netherlands rather than the United Kingdom. Furthermore, another result suggested that the degree of the replacement rates is in accordance with an intention to early retirement among elderly people which was lowest in the United Kingdom and the highest in Germany and the Netherlands (Schils 2008). The early retirement incentives, ageing population, reducing workforce made most EU countries to make some public pension reforms during the last decades to persuade the older population to stay in the workforce until their retirement age or more (Carone et al. 2017). A study done by D. Hofäcker and E. Naumann in Germany showed that after adopting less generous pension schemes the behaviors of elderly people towards retirement have changed. The results show that the portion of people who work beyond the official retirement age of 65 has increased significantly. These reforms had more impact on low educated people's behavior mainly because of the financial needs (Hofäcker and Naumann 2015). The elderly people were more attracted to retirement by generous pension systems as they were provided with financially good circumstances when they opted for retirement (Rennemark and Berggren 2006).

According to rational choice theory, when income loss is minimized, the elderly workforce will opt for retirement regardless of their job conditions. Hence, financial incentives play an important role in the process of retirement decisions. The higher wage retirees get, the more freedom they have in terms of financial situation. The income of retirees was found to be inversely related to likelihood of their participation in any type of bridge employment (Kim and Feldman 2000).

The main finding of Liefbroer and Billari (2010) showed that societal norms were still shaping behavior of people even in the societies where individualisation and secularised people were prevalent. These norms did not have a significant impact on the career path decision of people as employment and education decisions were influenced by regulations and formal rules (Settersten 2003). However, societal norms gained some importance in the process of retirement as formal rules for official retirement age had some flexibility rather than being strict at 65, especially in western nations (Liefbroer and Billari 2010). Therefore, we expect that the societal support towards employment after the retirement age has an effect on the retirement decisions of elderly.

Data and Methods

In our study, we used wave 7 from “Survey of Health, Aging and Retirement in Europe” (SHARE) database. SHARE is a cross-national and panel database covering 27 European countries and Israel. It contains multidisciplinary micro data on socio-economic status, health, family and social network for individuals aged 50 and above. The data was collected roughly every two years between 2004 and 2017. We used the latest release (wave 7) which allowed us to make a cross sectional analysis. This data also contains additional data for newly joined countries (Bulgaria, Cyprus, Finland, Latvia, Lithuania, Malta, Romania and Slovakia). Compared to previous waves, the wave 7 also contains data about the personality traits of individuals which allowed us to analyse the effect of personal characters of respondents on their decision towards activity in the labor market. These traits are measured based on 10-item Big Five inventory (BFI-10) which was introduced by Rammstedt and John (2007). At the same time, we also retrieved some data from previous waves since some survey questions, which do not change over time, are not asked again if they are collected in previous waves. Response rates are above the average when comparing with other European surveys (Bergmann et al. 2019). Among newly joined countries, Bulgaria showed the highest individual response rate with 61%. Except from Slovakia (39%), all other new countries passed 40% which was a desired minimum. Compared to these baseline samples for new countries, longitudinal samples showed higher individual response rates with an average of 68% (Appendix 3).

The country-level data is gathered from Eurostat , Worldbank and Eurobarometer databases.

Table 1: Comparison of previous SHARE studies

Study (author(s), year)	Research aim, research questions, and / or hypotheses	Data, sample	Method	DV (dependent variable)	IV (independent), controls	Main results
Johannes Siegrist, Morten Wahrendorf, Olaf von dem Knesebeck, Hendrik Jürges, Axel Börsch-Supan (2006)	To investigate association of early retirement intention with quality of work.	The data was collected from the first wave of ‘Survey of Health, Ageing and Retirement in Europe’ (SHARE). The sample size was 6,836 individuals from 10 European countries who are aged 65 or less. Only those who reported to have any paid work were included as the quality of their current job is the main focus.	Binary logistic regression models	Binary outcome variables: 1 - individuals who want to retire as early as possible, 0 - those who do not want.	Quality of work (low control at work and effort–reward imbalance), measures of well-being (depressive symptoms, self-perceived health, number of reported bodily symptoms and quality of life). Controlled for age, gender, income, and education.	Poor quality of work, which was captured by low control at work and effort-reward imbalance, increased the likelihood of intended early retirement. Additionally, low level of well-being was found to be positively associated with early retirement intention.
Axel Börsch-Supan, Agar Brugiavini and Enrica Croda (2009)	To shed light on whether institutional differences or health differences are the dominant factor in explaining different retirement patterns across European countries.	The data was collected from the 1st and 2nd wave of the Survey of Health, Ageing and Retirement in Europe (SHARE). The sample containing respondents from 11 European countries was 13,244. The sample was also restricted to individuals aged between 50 and	Probit regression with country dummies	Self-reported binary outcome variables: 1 - retired, 0 - otherwise (homemakers, unemployed and disabled individuals are excluded)	Relative social-security wealth, health, subjective survival probability, subjective lifespan. Controlled for age, education and gender	The institutional differences are found to be the primary reason explaining the differences in retirement patterns among countries, whereas health and demographic

		69.				differences have only a small impact.
Hanne De Preter, Dorien Van Looy, Dimitri Mortelmans (2013)	Getting insight into the influence of push and pull factors on the decision of elderly towards retirement, and how individual and macro level factors explain variation on retirement timing. Additionally, determining whether push or pull factors are more dominant in the decision of retirement timing of the elderly in Europe.	5127 individuals aged over 50 in 11 European countries using the first (2004) and second (2006) waves of the SHARE database.	Multilevel event history analysis	In the SHARE questionnaires, respondents were asked about their labor market status, and the 'retired' answer was used to define the retirement event	Control variables (age, gender, education), individual (job satisfaction, physical health status, having a care task, income level, looking after grandchildren, marital status) and institutional (expenditure on labor market policies, gross replacement rate, implicit tax on continued work, etc.) level predictors	The findings showed that health problems of the elderly and spending time with their grandchildren were positively associated with retirement, and they were considered as push and pull factors at the individual level, respectively. Push factors were less important at the institutional level, while high implicit tax on continued work and high expenditures on early exit schemes pulled the elderly towards retirement.
Morten Wahrendorf, Bola Akinwale,	How working, employment and health conditions were related to working at later ages	17,625 older individuals from 16 European countries using the wave 4 of SHARE database collected between 2009 and 2011.	Multivariable logistic regression models	People who answered the question about their current job situation as "retired" (0) and "employed or self-	Sociodemographic variables, work and employment conditions, health and well-being	Those who work in high occupational positions and who are self-employed had higher

Rebecca Landy, Katey Matthews, David Blane (2016)	compared to retired people who were in the same age group (between 65 and 80).		(with random Intercept) and conventional logistic regression (with country dummies)	employed” (1). The sample was limited by age from 65 to 80.	measures	likelihood to work after retirement age. Health and psychosocial working conditions were found to be better among people working at the age of 65-80, compared to those retired at the same age group.
Ellen Dingemans, Kène Henkens and Hanna van Solinge (2017)	There are three aims: 1) Present descriptive information explaining variability of engagement in bridge employment across 16 European countries. 2) Using multilevel modelling approach to investigate the effects of individual and institutional factors on bridge employment simultaneously. 3) Investigating the effects of some individual level	The data was collected from 4th wave of the Survey of Health, Ageing and Retirement in Europe (SHARE). The sample size containing observations from 16 European countries was 22,485.	Multilevel logit model	Binary outcome variable: 0 - full retirees (retirees without any paid work), 1 - bridge employees (retirees who answered the questions about their current jobs)	Educational attainment, pension income, general health status, marital status, informal care tasks, expenditure on pensions, normative support for bridge employment. Controlled for age and gender	Normative support of a society towards bridge employment is positively related to engagement of retirees in bridge jobs, whereas expenditure on pensions exhibits negative association. High educational attainment (OR=2.64), better health (OR=1.54) and low pension income (OR=0.94) increase likelihood of working in bridge employment.

	variables such as marital status, informal care-giving activities etc. on engagement in bridge employment.					Married retirees are more likely to work in bridge jobs compared to those who are divorced or widowed.
Ellen Dingemans, Katja Möhring (2019)	Investigating the association between the labor market participation of the elderly and the previous work history (such as number of working years, occupational status, flexibility of the career, etc.).	First five waves of the SHARE database were used. The sample size consisted of 11,369 individuals whose ages were between 60-75 (to prevent the effect of extreme cases on the results) in 13 countries.	Multilevel logistic regression	The elderly people who received only pension income considered as retired (0) and who also received income from paid work considered as working retirees (1).	The main independent variables: years in total employment, years in full-time and part-time employment, years in self-employment, occupational status and numbers of jobs, marital status. Control variables: the level of pension income, age, levels of educational attainment, health status, and whether the respondent has children	The results of this study showed that the elderly with a higher number of years in part-time work or self-employment, higher occupational status and flexible career were more likely to stay in the labor market after retirement. In terms of sociodemographic factors, divorced females who were not married again, were found to be more likely to work after retirement.

Outcome variable: Our sample consists of 22,738 respondents who participated in the SHARE questionnaire. We determined our sample according to the “current job status” of respondents. We only kept the individuals who answered to the related question as “retired” (0) or “employed or self-employed” (1). We further restricted our respondents with age limits. Going into details, we defined the lower bound with the official retirement ages by gender for each country by using the data from Trading Economics data source (<https://tradingeconomics.com/indicators>). The unavailability of around half of the respondents’ retirement years data in our sample prevented us from limiting the ages by cohorts. Thus, we limited our sample size by the official retirement ages of 2017 since the wave 7 was conducted in 2017. The previous studies which did cross-sectional analysis of SHARE data in the related topic, also used the similar way of sample selection (Table 1). As an advancement to those papers, we allowed the retirement ages to vary by gender and country. Additionally, as an upper bound, we excluded individuals whose age is over 75 by considering the people who work beyond this age would be due to specific reasons. At the same time, the proportion of people who work after the age of 75 was too small in our sample.

Sociodemographic variables. In addition to our control variable (age), we also included gender, partnership status (living with or without a partner) and the having or not having grandchildren of respondents as our sociodemographic variables.

Education. Since education systems have quite differences across European countries, SHARE uses International Standard Classification of Educational Degrees (ISCED-97) in order to classify the education level of individuals. We regrouped education levels under “low”, “medium” and “high” categories. First category contains the first two levels of ISCED (primary and lower secondary education). ISCED 3 (upper secondary) and ISCED 4 (post-secondary) constitute the “medium” category and “high” category consists of ISCED 5 (first stage of tertiary education) and ISCED 6 (second stage of tertiary education).

Well-being. To measure the quality of the elderly’s lives we used CASP-12. This variable has its four main subscales: control, autonomy, self-realization and pleasure. Under these

subscales 12 questions or statements are asked to the elderly. Answers are recorded as “often”, “sometimes”, “rarely” or “never” according to Likert scale. The points gathered from the 12 questions are summed to calculate the final score which has the range from 12 to 48. Higher final score means better life quality (Stefan Gruber, Tabea Mehrbrodt, Melanie Wagner 2019).

Health. Two measures are used in order to gauge physical health status of the older people. The first measure, IADL index, is related to the number of limitations in terms of daily instrumental activities such as making telephone calls, doing personal laundry, preparing a hot meal or taking medications (Lawton and Brody 1969). The second measure specifies the number of chronic diseases that an individual has.

Personality traits. To assess the impact of personality traits on the likelihood of working beyond retirement age among the elderly, we used the 10-item Big Five Inventory (BFI-10). This measure is firstly introduced in the latest release (wave 7) of SHARE. The “Big Five” personality traits are neuroticism, openness to experience, extraversion, conscientiousness and agreeableness. Each trait with two items (statements) has 9 response options ranging from 1 (Strongly disagree) to 5 (Strongly agree).

Occupation. Occupational positions of the respondents are classified according to The International Standard Classification of Occupations (isco-08) (International Labour Office 2012). This classification method, which is used in SHARE, helps us to group positions in a comparable way across countries. There are ten response options: 1. Legislator, senior official or manager 2. Professional 3. Technician or associate professional 4. Clerk 5. Service worker and shop and market sales worker 6. Skilled agricultural or fishery worker 7. Craft and related trades worker 8. Plant and machine operator or assembler 9. Elementary occupation 10. Armed forces. We regroup first and second groups as “Managers and Professionals” and 9th group as “Elementary occupation”. The rest are regrouped under the name “Other skilled workers” (Wahrendorf et al. 2017).

Sector of employment. This categorical variable has 3 levels specifying in which sector respondents were employed (for retirees) or are currently working (for employees). The response options are “public sector employee”, “private sector employee” or “self-employed”.

Job satisfaction. This variable is measured depending on respondents’ self-perceived satisfaction with their current job. The scales are “Strongly disagree”, “Disagree”, “Agree” and “Strongly agree”. This variable is available only for employed respondents. Therefore, we also retrieved data from the previous waves for retired people who were employed in those waves to compare the differences on the job satisfaction levels of retirees and employed elderly with their last and current jobs, respectively.

Generosity. To measure the generosity of the pension system of each country, we divided the ratio of pensions spending to the GDP by old-age dependency ratio in corresponding countries. We obtained pension spending and old age dependency ratio from Eurostat (<https://ec.europa.eu/eurostat>) and Worldbank (<https://data.worldbank.org>) databases, respectively, over the time period 2006 - 2017 to calculate the average. Pension spending is calculated based on the following pension benefits: “old-age and anticipated old-age pension, disability pension, early-retirement due to reduced capacity to work, survivors' pension, partial pensions, early-retirement benefit for labour market reasons”. And old-age dependency ratio is calculated by dividing the percentage of older population (people whose age is over 64) to the ratio of active population in the labor market (those whose ages are between 15-64).

Normative support. We used a survey question from Special Eurobarometer 378 to measure societal norms for working after official retirement age (Doe 2012). People from different age groups are asked whether it is appealing for them to combine partial pension and part-time job rather than full retirement. The answers were “more appealing”, “less appealing” and “do not know”. We used the percentage of people who answered “more appealing” for each country.

Summary statistics of our explanatory variables of the final samples used in the regression models are given at Appendix 4.

Analytical strategy

To analyse our binary response variable (“0” - retired, “1” - working) we used a multivariate logistic regression model (including country dummies to single-level logistic regression). This approach is also called a fixed effects (FE) model in some literature (Möhring 2012; Bryan and Jenkins 2013).

Logistic regression model with country dummies or fixed effects (FE) model:

$$y = \beta_0 + \beta_1 \text{age}_i + \beta_2 \text{gender}_i + \beta_3 \text{partnership}_i + \beta_4 \text{education}_i + \beta_5 \text{CASP}_i + \beta_6 \text{IADL}_i + \beta_7 \text{chronic}_i + \beta_8 \text{openness}_i + \beta_9 \text{extraversion}_i + \beta_{10} \text{neuroticism}_i + \beta_{11} \text{conscientiousness}_i + \beta_{12} \text{agreeableness}_i + \beta_{13} \text{country dummies}$$

Next, to get more insight into country specific variation, we included a few institutional variables (generosity and normative support) using a multilevel logistic model with a random intercept ($\beta_0 + u_{0j}$). It also helps us to compare estimates of individual level variables to conventional logistic regression with country dummies.

Multilevel logistic model with a random intercept (RE):

$$\log(\pi/(1-\pi)) = \beta_0 + \beta_1 \text{age}_{ij} + \beta_2 \text{gender}_{ij} + \beta_3 \text{partnership}_{ij} + \beta_4 \text{education}_{ij} + \beta_5 \text{CASP}_{ij} + \beta_6 \text{IADL}_{ij} + \beta_7 \text{chronic}_{ij} + \beta_8 \text{openness}_{ij} + \beta_9 \text{extraversion}_{ij} + \beta_{10} \text{neuroticism}_{ij} + \beta_{11} \text{conscientiousness}_{ij} + \beta_{12} \text{agreeableness}_{ij} + \beta_{13} \text{generosity}_j + \beta_{14} \text{normativesupport}_j + u_{0j}$$

Here, β_0 is an intercept shared by all countries. While u_{0j} is a random effect specific for each country j , subscript i represents the individual in j th country. It is assumed that random effect (u_{0j}) is normally distributed with variance σ^2_{u0} .

We also used a variance partition coefficient (VPC) to calculate the proportion of total residual variance due to between-country differences after controlling for explanatory variables.

$$\text{VPC} = \sigma^2_{u0} / (\sigma^2_{u0} + 3.29).$$

3.29 represents variance of individual level residuals (σ^2_e) as they are assumed to be logistically distributed.

There can be some limitations occurring when using multilevel modelling with the random intercept. First limitation introduced by most researchers is the few number of upper level units, causing a small number of degrees of freedom in country level. Möhring (2012) suggested that multilevel models with more than 50 upper level units can result in unbiased estimators of group level. However, Bryan and Jenkins (2016) was suggesting that the minimum required number of countries is 25 for linear and 30 for logit models, while it was recommended by Hox (2010) that this number can change between the range of 10 and 100 regarding the estimator and software used. Another limitation of using this model is related to outliers in the country level variables. The slope estimator for country level can be unreliable due to outliers, especially in a small sample size. The third problem can be omitted variable bias which happens because of small size in country level units. In multilevel modelling, random effect u_{0j} (specific to country j) is uncorrelated with error term and all variables in individual level (Möhring 2012). Unless we control for all variables, the results can be biased because of omitted variable bias.

However, multilevel modelling with the random intercept is still widely used in cross-national analysis despite the problems mentioned above. Because multilevel methods allow us to investigate the direct effect of country level variables. And the most problematic models are those which have less than 15 countries. To the best of our knowledge, the maximum number of countries investigated in our topic is 16. However, the last wave of SHARE data let us increase this number to 24 countries. We dropped Israel and Switzerland due to missing data in the country level and Greece was considered as an outlier because of considerably low level of normative support. Additionally, we also could not include the Netherlands to our study because the wave 7 data was not still available. Alternative approach can be a fixed effects model which controls for country level variation rather than explaining it. This approach is especially appropriate when the number of countries is less and it eliminates the problem of omitted variable bias (Bryan and Jenkins 2016; Möhring 2012). We controlled multicollinearity by using variance inflation factor (VIF).

Furthermore, we present Table 2 for descriptive summary for some social and work related variables in the descriptive findings part of empirical results which have lots

of missing data. Significance of association of these variables with retirement decision of the elderly is measured by using chi-square testing. However, we do not include those variables (i.e, job satisfaction, occupational position, sector of employment) into the main regression models (Table 3) since they decrease our sample size dramatically and cause bias on the coefficients of other predictors and significance levels of p-values. There are three types of missing data problems such as MCAR (missing completely at random), MAR (missing at random) and MNAR(missing not at random) classified by Rubin (1974). If missingness is completely at random (MCAR) that would not pose any problem and our model still could give unbiased results of estimators. However, if missing is due to some reasons (i.e, other variables, outcome variable or unknown reasons) including these variables the regression with many missing values could cause biases on the estimators of other variables. To detect the type of missingness we created new binary variables for the variables with lots of missing values and assigned “0” to the available part of data and “1” to the missing values. Then, we checked the correlation between these binary variables with other explanatory variables and an outcome variable in the data and there was an association in most cases. For example, the missingness in the “occupational position” of individuals had an association with gender, levels of education, country, well-being variables. After adding those variables to our model the coefficients and p-values of other values changed substantially. To sum up, we concluded that including these particular variables with many missing values may bias our results.

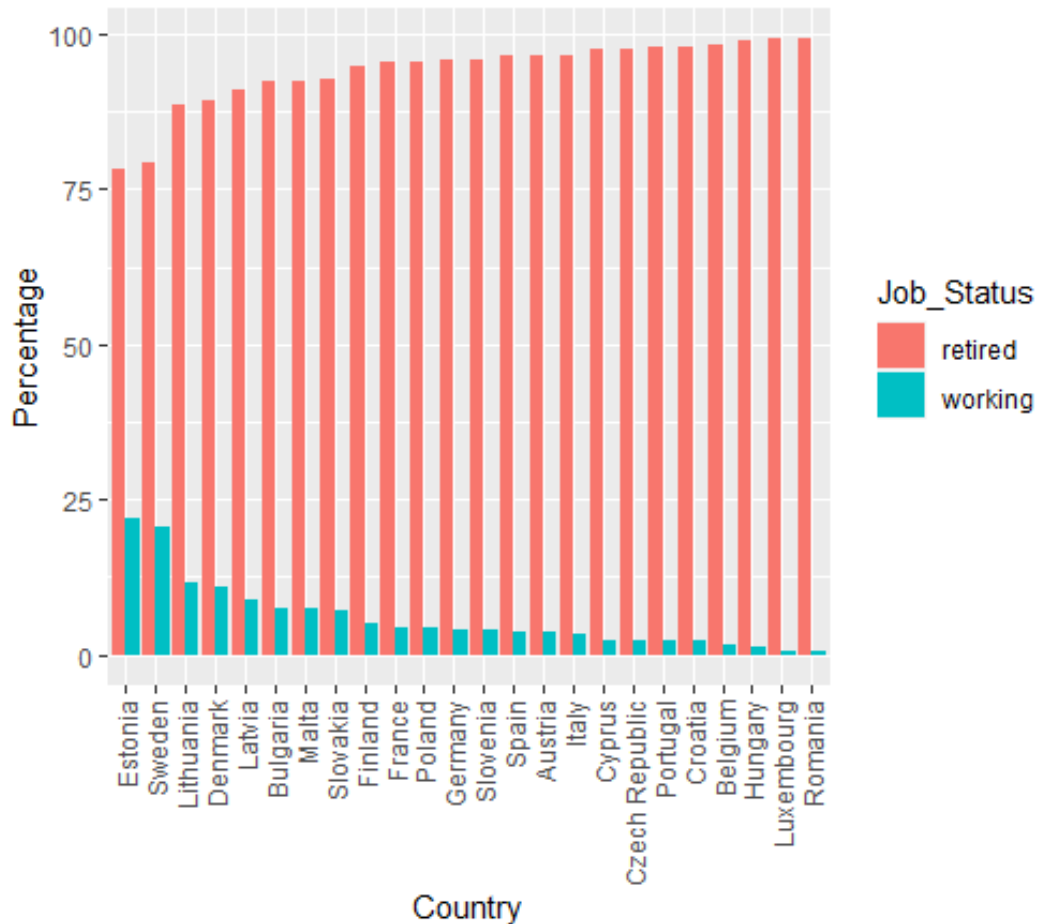
Empirical Results

Our sample size is 22,738 individual observations for 24 European countries with about half of them being male. Average age for the sample, in which respondents are between official retirement age and 75 in corresponding countries, is 69. Around 70 percent of the respondents are living with a partner. Average number of observations per country is approximately 947 where Czech Republic has the largest proportions with 1969 observations and Portugal has the lowest with 91 observations.

Overall, 6 percent of the elderly people aged between the official retirement age and 75 in European countries decided to stay in the labor force even after their official retirement age. However, this number is quite different across the countries. Estonia (22%), Sweden (20%), Lithuania (11%) and Denmark (11%) are the countries where

working after retirement age is the most prevalent among the elderly, whereas Hungary (1%), Luxembourg (1%), Romania (1%), Belgium (2%) and Cyprus (2%) are standing in the margin (Figure 2).

Figure 2: The percentages of working elderly between official retirement age and 75 across countries



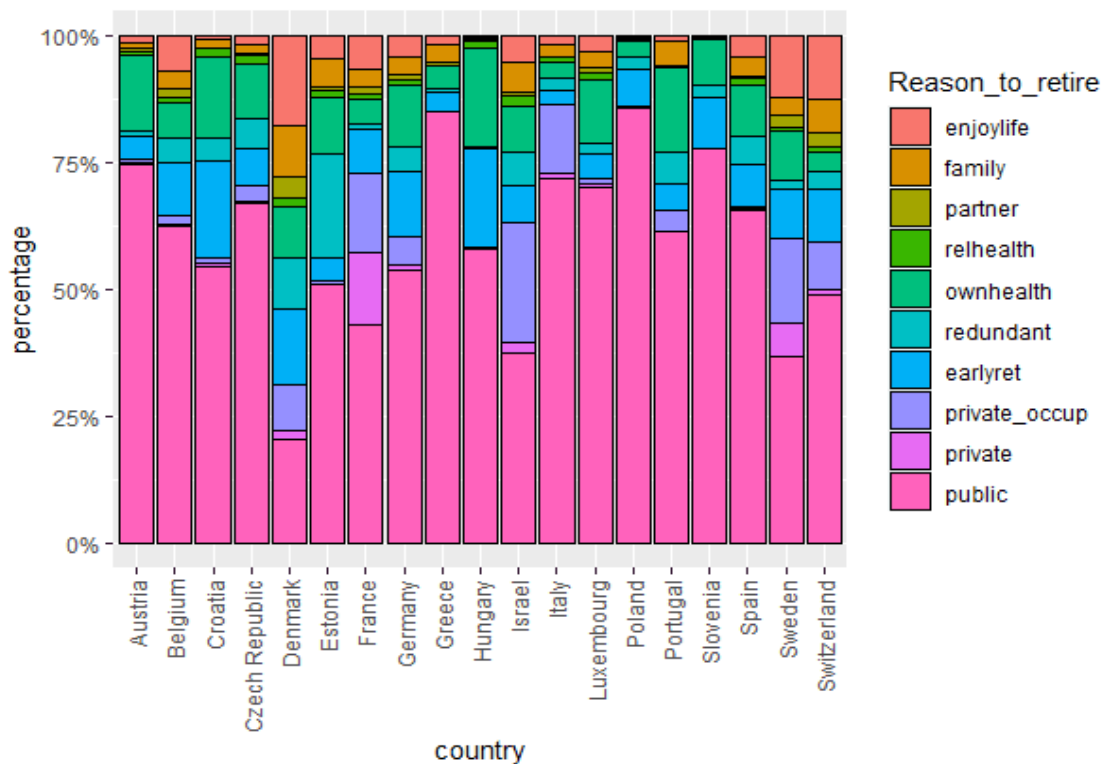
Source: Authors' calculation using SHARE database, wave 7, 2017

In the SHARE interviews retired people asked about their reasons for retirement. Specifically speaking, they were asked to choose the reasons written in the given card to them for their retirement which are represented below:

1. Became eligible for public pension
2. Became eligible for private occupational pension - according to OECD classification and glossary private occupational pension plans are established by employers of individuals. There are mandatory and voluntary types of occupational pension plans which are defined due to being obliged to introduce these plans to employees by the employer or plan sponsor (OECD 2005)

3. Became eligible for a private pension - private pensions also called as personal pension plans due to OECD classification, are the plans that there is no involvement of employers in the establishment of pension plans. These are directly established by pension funds and it can be mandatory or voluntary as well (OECD 2005)
4. Was offered an early retirement option/window with special incentives or bonus
5. Made redundant (for example pre-retirement)
6. Own ill health
7. Ill health of relative or friend
8. To retire at same time as spouse or partner
9. To spend more time with family
10. To enjoy life

Figure 3: Distribution of ratios of retirement reasons of retired respondents



Source: SHARE database, wave7, missing data retrieved from waves 1,2,4,5,6

However, this data was not available for the new countries joined to the SHARE database in the last wave 7 (2017). Hence, available data was gathered from all waves and represented the results in Figure 3. This data includes the individuals whose ages were between 61 and 75 in 2017, and who got retired between the years of 1990 and 2017.

Results show that almost in all countries, especially in Austria, Greece, Poland and Slovenia being eligible for the public pensions is the main reason to retire for elderly who responded to this questionnaire. While in a few countries with higher standards of living such as Sweden, Switzerland, Denmark, and relatively less in Belgium, France the proportion of retirees who retired to be able to enjoy life and spend more time with their families are higher. Getting retired because of health issues follow almost similar patterns over countries. Depending on retirement schemes of some countries (France, Israel, Italy and Sweden) availability of private occupational pensions constitute a considerably higher portion of elderly's retirement reasons compared to other countries. Particularly, in France and Sweden presence of mandatory occupational pension plans can intuitively be the main reason behind this pattern (OECD 2005). To sum up, the main reason behind the retirement decision of retired people in European countries is mostly due to being eligible for pensions. Although this graph gives us insights about the reasons for retirement, it only takes into account the retired people. However, we are more interested in the main factors that stimulate aged people to continue working even after they become eligible for pensions provided by welfare states by analysing both groups of retired and working elderly. We are going to illustrate the results of our further investigation below.

Descriptive findings

In Table 2, we represent the results of descriptive statistics for some individual level variables. The most of the reported associations are statistically significant according to the chi-squared test, except partnership status of elderly. As we expected, the elderly who are older, female and have lower education attainment are more likely to be in the retired group rather than the working group. People working at higher positions (managers and professionals) are more common among the respondents who work beyond the official retirement age, whereas elementary professions are more common among the retirees. The percentage of people working in the public sector or self-employed is higher among the working elderly compared to retired, while the people who worked in the private sector are more likely to be among retirees at the later ages. Having grandchildren is more common among the retired group. Intuitively, the elderly prefer to

spend more time with their grandchildren to increase life satisfaction and emotional well-being.

Table 2: Distribution of variables over retired and working groups

	Retired		Working		Total	
	N	Percentage or mean	N	Percentage or mean	N	Percentage or mean
Age						
Range: 61 - 75	22913	69.28	1619	66.35	24532	69.08
<i>p < 0.001</i>						
Gender						
Male	10307	45.0%	801	49.5%	11108	45.3%
Female	12606	55.0%	818	50.5%	13424	54.7%
<i>p < 0.001</i>						
Education						
Low education	7220	32.3%	220	13.7%	7440	31.1%
Medium education	10221	45.8%	704	43.7%	10925	45.6%
High education	4898	21.9%	686	42.6%	5584	23.3%
<i>p < 0.001</i>						
Partnership						
Living with partner	16837	73.5%	1193	73.7%	18030	73.5%
Living without partner	6076	26.5%	426	26.3%	6502	26.5%
<i>p = 0.879</i>						
Job satisfaction						
Satisfied	4287	93.0%	1084	95.6%	5371	93.5%
Not satisfied	322	7.0%	50	4.4%	372	6.5%
<i>p = 0.002</i>						
Occupation						
Elementary occupations	1923	51.7%	414	40.9%	2337	49.4%
Managers and professionals	840	22.6%	381	37.7%	1221	25.8%
Other skilled workers	954	25.7%	216	21.4%	1170	24.7%
<i>p < 0.001</i>						
Sector of employment						
Private	3379	59.9%	474	39.4%	3853	56.3%
Public	1209	21.4%	420	34.9%	1629	23.8%
Self-employment	1052	18.7%	308	25.6%	1360	19.9%
<i>p < 0.001</i>						
Grandchildren						
Yes	3874	83.2%	174	69.9%	4048	82.5%
No	781	16.8%	75	30.1%	856	17.5%
<i>p < 0.001</i>						

Note: Job related variables for retired individuals were collected referring to their last job

Multivariable findings

We investigated the effects of individual and institutional variables on the likelihood of working after the official retirement age by using multivariate logistic regression models with/without country dummies and a multilevel logistic regression model with a random intercept. As we can see from Table 3, the coefficients of individual level variables are almost the same in both fixed effects and multilevel logistic regression (RE) models and slightly different from the multivariate logistic regression model without country dummies.

The results presented in Table 3 are mostly in line with our expectations represented in literature review. As we expected, age is negatively associated with the likelihood of prolonged working time for the elderly. Gender is another significant predictor of late retirement. Compared to men, women are less likely to stay in the labor force with an odds ratio of 0.63. As in line with our hypothesis, living without a partner increases the likelihood of prolonged working life (OR = 1.24), compared to those who are living with a spouse. However, the odds ratio (OR = 1.12) for men is remarkably small compared to the odds ratio (OR = 1.29) for women and the effect of partnership status for men is not found to be a statistically significant predictor (see Table 4). Since men are usually “breadwinners” in the family, their earnings constitute the larger or whole proportion of the family budget in the case when women are “homemakers”. Therefore, women living single are more vulnerable regarding financial conditions. For that reason, single women tend to continue working in order to meet their financial needs, compared to women who live with a partner. The strongest predictor of elderly’s decision towards staying in the labor force is found to be the education level. Aged individuals with high education attainment compared to low educated are more likely to work even after pensionable age with odds ratios of 3.03. More compelling finding is that the effect of educational attainment is remarkably higher for elderly women than men. While the odds of continuing to work at later ages for high educated males is 2.7 times that of less educated males, the odds ratio in terms of females is higher (3.13) (Table 4).

There is a positive association between well-being (CASP) of the elderly and late retirement. The odds ratio (OR = 1.03) is consistent even when we look at the models for men and women separately. To gauge the impact of physical health on prolonged

Table 3: Regression models summary

	Multilevel model with random intercept		Logit model with country dummies		Simple Logit model	
	Odds Ratio	Confidence Interval (95%)	Odds Ratio	Confidence Interval (95%)	Odds Ratio	Confidence Interval (95%)
Individual level						
Age	0.72***	(0.71 – 0.74)	0.72***	(0.71 – 0.74)	0.74***	(0.73 – 0.76)
Gender (ref. - Male)	0.63***	(0.56 – 0.71)	0.63***	(0.55 – 0.71)	0.69***	(0.61 – 0.77)
Partnership (ref. - With partner)	1.24**	(1.08 – 1.42)	1.24**	(1.08 – 1.42)	1.21**	(1.06 – 1.38)
Education (ref. - Low Education)						
Medium Education	1.52***	(1.27 – 1.81)	1.53***	(1.28 – 1.83)	1.52***	(1.29 – 1.80)
High Education	3.01***	(2.50 – 3.62)	3.03***	(2.52 – 3.66)	2.79***	(2.34 – 3.33)
CASP	1.03***	(1.02 – 1.05)	1.03***	(1.02 – 1.05)	1.03***	(1.02 – 1.05)
IADL	0.60***	(0.49 – 0.73)	0.60***	(0.48 – 0.72)	0.61***	(0.50 – 0.73)
Chronic	0.87***	(0.83 – 0.91)	0.87***	(0.83 – 0.91)	0.86***	(0.82 – 0.90)
Personal traits						
Openness	1.07 .	(1.00 – 1.14)	1.06 .	(1.00 – 1.13)	1.12***	(1.06 – 1.20)
Extraversion	0.92*	(0.86 – 0.98)	0.92*	(0.86 – 0.98)	0.96	(0.90 – 1.02)
Neuroticism	0.96	(0.91 – 1.03)	0.97	(0.91 – 1.04)	0.92*	(0.86 – 0.99)
Conscientiousness	1.11**	(1.03 – 1.20)	1.11**	(1.03 – 1.20)	1.03	(0.96 – 1.11)
Agreeableness	0.99	(0.92 – 1.07)	0.99	(0.92 – 1.07)	0.99	(0.92 – 1.07)
Institutional level						
Generosity	0.55**	(0.37 – 0.82)			0.39***	(0.36 – 0.42)
Normative Support	1.41**	(1.11 – 1.78)			1.44***	(1.38 – 1.50)
Country dummies (ref. - Italy)						
Austria			0.31***	(0.19 – 0.51)		
Belgium			0.29***	(0.16 – 0.51)		
Bulgaria			1.17	(0.74 – 1.88)		
Croatia			0.39**	(0.20 – 0.71)		
Cyprus			0.57	(0.23 – 1.25)		
Czech Republic			0.38***	(0.24 – 0.61)		
Denmark			2.02**	(1.33 – 3.12)		
Estonia			5.57***	(3.85 – 8.28)		
Finland			0.61 .	(0.27 – 1.00)		
France			0.39***	(0.25 – 0.62)		
Germany			0.65 .	(0.41 – 1.05)		
Hungary			0.15***	(0.06 – 0.32)		
Latvia			1.53 .	(0.94 – 2.50)		
Lithuania			1.80*	(1.14 – 2.88)		
Luxembourg			0.12**	(0.02 – 0.41)		
Malta			0.92	(0.52 – 1.61)		
Poland			0.51**	(0.33 – 0.80)		
Portugal			1.05	(0.17 – 3.60)		

<i>Romania</i>		0.08***	(0.03 – 0.20)
<i>Slovakia</i>		0.59*	(0.37 – 0.95)
<i>Slovenia</i>		0.25***	(0.16 – 0.39)
<i>Spain</i>		0.82	(0.49 – 1.37)
<i>Sweden</i>		3.18***	(2.19 – 4.975)
<i>Observations</i>	22,738	22,738	22,738
<i>Log Likelihood</i>	-4,138.1	-4,091.8	-4,393.4
<i>Akaike Inf. Crit.</i>	8,310.1	8,257.5	8,818.7
. <i>p</i> < 0.1, * <i>p</i> < 0.05, ** <i>p</i> < 0.01, *** <i>p</i> < 0.001			

Source: Authors' calculation using SHARE database, wave 7, 2017

working, we included two health measures (IADL and chronic) in our models. Supporting our hypotheses, these variables are found to be statistically significant factors which shows that bad health status affects working after normal retirement age negatively.

Turning to effects of personality traits, directions of associations are mostly in line with previous studies and our expectations, except extraversion. Findings show that respondents with high levels of conscientiousness (OR=1.11) are more prone to work beyond retirement regardless of gender, while surprisingly higher levels of extraversion (OR=0.92) are likely to push the elderly out of the labor force. According to Schwaba and Bleidorn (2019), these two traits are stable in the transition period to retirement. Turning to the regression models for men and women separately (Table 4), extraversion is statistically significant only among men whereas conscientiousness is significant among women.

Regarding modelling technique, when we included country dummies into our multivariate logistic regression, the majority of country dummies became statistically significant. At the same time, after adding the country dummies, the value of Likelihood ratio index (McFadden's R squared) increased substantially and the likelihood ratio (LR) test showed that the model with country dummies fits the data better than the more restricted model. As another way of testing the performance of models we used area under ROC (receiver operating characteristic) curves which indicated that the model with country dummies is better by plotting true positive (sensitivity) and false positive (specificity) percentages (see Appendix 5,6). These outcomes indicate that some of unexplained variation in the decision whether to continue working after the official retirement age is due to country level differences. Hence, we decided to employ multilevel modeling to account for these macro level differences. In the multilevel model without institutional variables, between-countries variance (σ^2_{u0}) is 0.89. The variance partition

Table 4: Regression models summary (separated by gender)

	Logit model with country dummies		
	OR (All)	OR (Men)	OR (Women)
<i>Age</i>	0.72***	0.74***	0.70***
<i>Gender (ref. - Male)</i>	0.63***		
<i>Partnership (ref. - With partner)</i>	1.24**	1.12	1.29**
<i>Education (ref. - Low Education)</i>			
<i>Medium Education</i>	1.53***	1.42**	1.57***
<i>High Education</i>	3.03***	2.71***	3.13***
<i>CASP</i>	1.03***	1.04***	1.03***
<i>IADL</i>	0.60***	0.61**	0.58***
<i>Chronic</i>	0.87***	0.82***	0.90**
<i>Personal traits</i>			
<i>Openness</i>	1.06 .	1.05	1.06
<i>Extraversion</i>	0.92*	0.90*	0.95
<i>Neuroticism</i>	0.97	0.93	0.99
<i>Conscientiousness</i>	1.11**	1.06	1.15*
<i>Agreeableness</i>	0.99	0.99	10.99
Observations	22,738	10,236	12,502

Note: Country level variation is controlled for by including country dummies. We did not include them to keep the table short.

. $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: Authors' calculation using SHARE database, wave 7, 2017

coefficient (VPC) calculation ($0.89/(0.89 + 3.29) = 0.21$) shows that 21% of the residual variation is due to unobserved country characteristics. However, when we introduced institutional variables into our model this variance (σ^2_{u0}) becomes 0.54 and VPC becomes 0.14 ($0.54/(0.54 + 3.29) = 0.14$) in return. This result indicates that unexplained variation due to country specific characteristics decreased by 7%. Thus, we conclude that these institutional variables explained some part of country specific variations, while there are still unobserved variables in country level (e.g, cultural differences).

Table 3 represents that the generosity of pension systems in countries tend to push the elderly workforce more into retirement. Regarding societies' normative support, the elderly people are 1.41 times more likely to work after retirement if there is a 10 percent increase in this factor. Additionally, we can visually see the direction of the effect of these

institutional variables from the Appendix 7 and 8. We can see from these graphs that Estonia, Sweden, Lithuania and Denmark have the highest percentages of working people. While in Estonia and Lithuania it can be more because of financial necessity (lower levels of generosity, and lower support in the society compared to Sweden), in Sweden and Denmark which has a higher level of standard of living, the reason behind high percentage of working can be a higher level of normative support. Turning into Romania with one of the lowest levels of working elderly, although there is a low level of generosity which would make us to expect a higher number of working elderly, support in the society for the working after retirement is the lowest in Romania. However, these two variables do not explain all variation for all the countries, which shows that there are some other factors affecting.

As we mentioned in the methodology section, we run another multiple logistic regression for grandchildren and work-related variables which have quite small sample size compared to our main regression models. As we can see from Table 5, satisfaction with a job (OR=1.81) increases the likelihood of working after retirement. Turning to occupational positions, being in higher positions such as managers or professionals are positively associated with continued working at later ages compared to those who work in elementary occupations. The distribution of education levels over positions showed that the portion of high education attainment levels is the highest who work as managers or professionals while the ratio of low educated people is the most among who work in elementary positions (see Appendix 9). Therefore, the individuals who have higher education are more likely to work in higher positions and have more favorable working conditions and, in return, more likely to continue working at later ages. As we can see from comparison of models with and without education factor Table 5, the coefficient and significance level of professionals and managers increases when there is not education in the model, while other results remain almost the same. The effect of the sector of employment on retirement decisions of the elderly has never been analysed in a multinational analysis using SHARE data. This effect is found to be significant only in the investigation of bridge employment in Lithuanian (Zitikytė 2020). Our regression results show that public sector employees (OR=1.67) are more likely to continue working even after retirement age compared to private sector employees. The elderly, who are self-employed, are also more likely to stay in the labor market compared to the private

Table 5: Regression models summary (with and without education variable)

Logistic Regression with country dummies				
	Model 1		Model 2	
	<i>Odds Ratio</i>	<i>Confidence Interval (95%)</i>	<i>Odds Ratio</i>	<i>Confidence Interval (95%)</i>
<i>Age</i>	0.81***	(0.78 – 0.83)	0.81***	(0.78 – 0.83)
<i>Gender (ref. - Male)</i>	0.86	(0.71 – 1.03)	0.86	(0.72 – 1.04)
<i>Partnership (ref. - With partner)</i>	1.08	(0.89 – 1.31)	1.07	(0.88 – 1.29)
<i>Education (ref. - Low Education)</i>				
<i>Medium Education</i>	1.05	(0.81 – 1.36)		
<i>High Education</i>	1.35*	(1.01 – 1.80)		
<i>CASP</i>	1.01	(0.99 – 1.03)	1.01	(0.99 – 1.03)
<i>IADL</i>	0.70**	(0.53 – 0.90)	0.70**	(0.53 – 0.90)
<i>Chronic</i>	0.93*	(0.87 – 0.99)	0.92*	(0.86 – 0.99)
<i>Personal traits</i>				
<i>Openness</i>	1.11*	(1.02 – 1.22)	1.13**	(1.04 – 1.24)
<i>Extraversion</i>	0.95	(0.87 – 1.04)	0.94	(0.86 – 1.03)
<i>Neuroticism</i>	0.94	(0.85 – 1.03)	0.94	(0.85 – 1.03)
<i>Conscientiousness</i>	1.14*	(1.02 – 1.27)	1.12*	(1.01 – 1.25)
<i>Agreeableness</i>	1.04	(0.93 – 1.16)	1.03	(0.92 – 1.16)
<i>Job satisfaction (ref. – not satisfied)</i>	1.82**	(1.24 – 2.72)	1.82**	(1.24 – 2.73)
<i>Occupation (ref. – elementary occupations)</i>				
<i>Managers and professionals</i>	1.35**	(1.08 – 1.69)	1.54***	(1.26 – 1.89)
<i>Other skilled workers</i>	0.90	(0.72 – 1.12)	0.94	(0.76 – 1.17)
<i>Sector of employment (ref. – private sector)</i>				
<i>Public sector</i>	1.67***	(1.37 – 2.04)	1.74***	(1.43 – 2.12)
<i>Self-employment</i>	3.03***	(2.42 – 3.79)	3.07***	(2.46 – 3.84)
<i>Grandchildren (ref. – no grandchildren)</i>	0.71***	(0.59 – 0.86)	0.69***	(0.57 – 0.83)
Observations	4,253		4,274	
AIC	3,691.3		3,700.8	
Log Likelihood	-1,808.6		-1,815.4	

Note: Country level variation is controlled for by including country dummies. We did not include them to keep the table short.

*. $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$*

Source: Authors' calculation using SHARE database, wave 7, 2017

sector employees with a higher odds ratio of 3.03. When we change the reference from private sector to public sector, the odds ratio for the self-employed changes from 3.03 to 1.81 (see Appendix 10). However, it is still a statistically significant predictor. This result shows that self-employed elderly are more likely to work beyond official retirement age compared to the elderly who are employees, regardless of their sector of employment. Additionally, the multivariate findings also show that elderly who have a grandchild or grandchildren are more likely to be in the retired group.

Discussion and conclusions

In this study, we represent the individual and institutional factors that stimulate the elderly to stay in the labor market after the official retirement age by using the data of 24 European countries from the SHARE database. We found out that being male, living without a partner, higher level of education, better health and well-being are positively associated with prolonged working even after retirement age. However, the effect of partnership is only statistically significant for women as found in the study of Dingemans and Möhring (2019). One of our key findings indicates that education has a stronger effect on women's working at later ages compared to men while it is a statistically significant predictor for both genders. The reason behind this trend can be due to "breadwinners" status of men in the household which makes them to be in the labor market regardless of their education status over their lifetime. However, the situation is different for women since higher educational attainment increases their probability to enter the labor force (Eckstein and Lifshitz 2011; Heath and Jayachandran 2018; Psacharopoulos and Tzannatos 1989; Schofer and W. Meyer 2005). We also found that the social and work environment of the elderly also play a crucial role in the transition process to retirement. Being employed in high occupational positions, such as being manager or professional, has a positive effect on continued working since they do not need to put much effort into work and have more favourable conditions compared to elementary professions and other

skilled workers (Wahrendorf et al. 2017a). Also being employed in high positions requires higher levels of education. Old-age employees working in the private sector have a tendency to retire earlier compared to the public sector. As high technology and innovations are adopted faster in the private sector to cope with high competition levels in the market, demand for older employees is dropping (Beckmann and Schauenberg 2007; Cankar and Petkovsek 2013). Moreover, private pension plans can be more generous in some cases which can stimulate those individuals to leave the labor market in the private sector (Aubert and Plouhinec 2017; Kotlikoff and Wise 1984). This requires further investigation to find the main reasons behind it. If it is mainly because of more generous pension systems in the private sector, there may be need for the policymakers to take some actions. We also found that having grandchildren has a negative relationship with the likelihood of working after the retirement age. As previous studies suggested elderly can be prone to retire to increase emotional well-being and life satisfaction by spending more time with their grandchildren (Carstensen et al. 2003; Szinovacz et al. 2001). The latest wave (7) of the SHARE questionnaire started to measure the Big Five personality traits of respondents which allowed us to investigate its effects on the elderly's retirement behavior the first time by using SHARE database. In previous literature, there are a few studies regarding the effect of personality traits on the retirement decision process of the elderly. Although, apart from extraversion, the directions of effects of these traits are in line with findings of Dominique Anxo et.al (2019), only conscientiousness is a statistically significant predictor even across different models. Similar to our result, conscientiousness was founded to be positively related to working after retirement age, and, regarding causality, it was found to stay unchanged during the transition period to retirement (Anxo et.al 2019; Schwaba and Bleidorn 2019).

At the institutional level, we investigated how differences in generosity of pension systems, normative support of societies influence the decision of the elderly to work after retirement age. Our findings show that higher levels of generosity in pension schemes have a negative effect on the employment level of the elderly, while higher levels of normative support for the working after retirement in society leads to higher levels of engagement of old people in the labor market. There is a higher ratio of employed people in Estonia, Lithuania and Latvia which can be due to financial necessity because of low levels of generosity. However, the similar trend of working ratio is also experienced in

Sweden and Denmark can be mainly because of higher levels of support in the society, although there were higher levels of generosity in the pension systems. It is more interesting to note that despite Romania experiencing low levels of generosity it also has one of the lowest percentage of working elderly across countries. The reason behind it can be the low rate of normative support in Romania which would indicate that normative support had more impact on the elderly's behavior towards retirement in this country. However, it is not possible to explain the whole variation for all countries with only these two variables. Thus, there is a need for further investigation to understand the reasons behind the cross-country differences. One can be the cultural differences since Latvia, Lithuania and Estonia are closer countries to each other in that sense.

Despite our study having several advantages such as large sample size, higher number of countries (24) compared to previous studies that have use the SHARE database (Table 1), more recent data, high levels of response rates, comprehensive assessment of explanatory variables from detailed questions (socio-demographic, health, psychological characteristics of individuals and their working conditions), it is worth to note also some limitations. First, despite some retired respondents being asked about their retirement years in the questionnaire, it was not available for the most of data. Thus, it did not allow us to limit our sample by cohorts according to the variation of the official retirement ages over years. Second, because of the less number of upper level units there can be omitted variable bias in the country-level. Furthermore, since it is hard to measure some variables such as cultural differences across countries, we could not control for those variables. Another limitation was the less data in work related variables which did not let us to include our main models. Especially, we could not analyse the work stress of individuals on their retirement behaviors which is a potential predictor due to previous studies. These variables were only available for some part of employed people beyond their retirement age and we recovered some part of missing data of retired people from previous waves, thus we only have a sample for some particular group of people as a result. In return, it may not represent the population well. As we mentioned earlier, since missingness is not at random for those variables it may cause biasedness in the results. Last but not least, there can be reverse causality in health related, well-being and personality trait variables since their labor activities (being retired or employed) can affect their quality of life, physical and psychological health status.

To conclude, the likelihood of working at later ages is affected by their socio-demographic characteristics, educational attainment levels, health, quality of life and physiological status. Elderly's decision to stay in the labor market is not only determined by their individual characteristics, also working conditions, generosity of the pension systems of corresponding countries and the approach to work at later ages in societies are strong factors.

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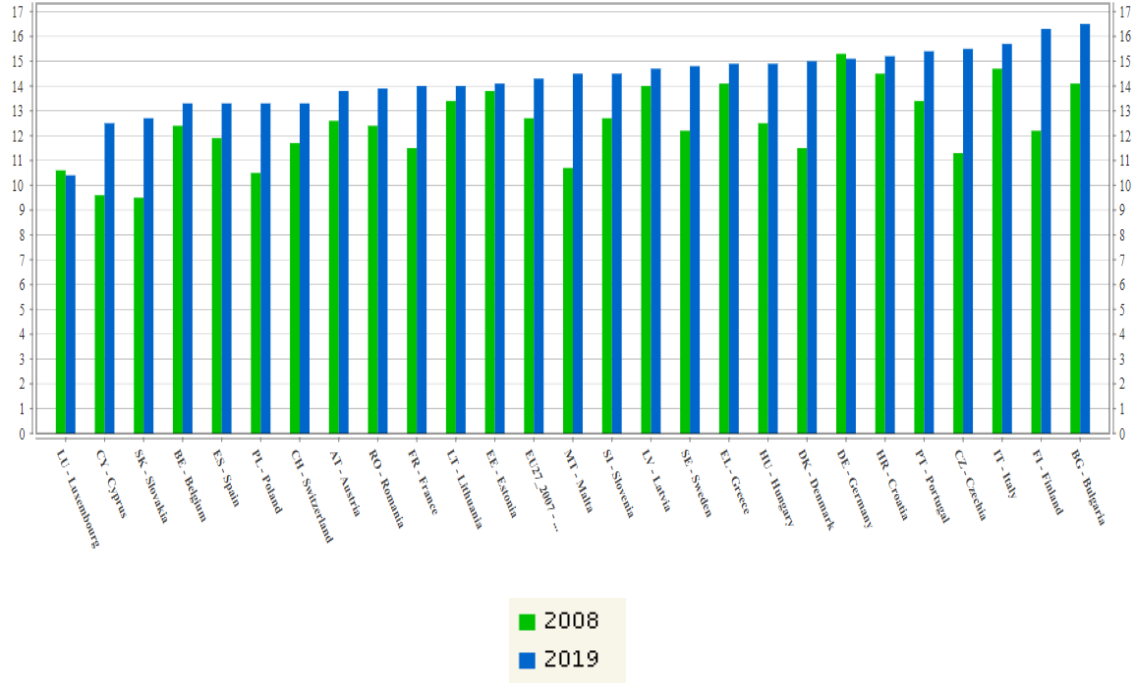
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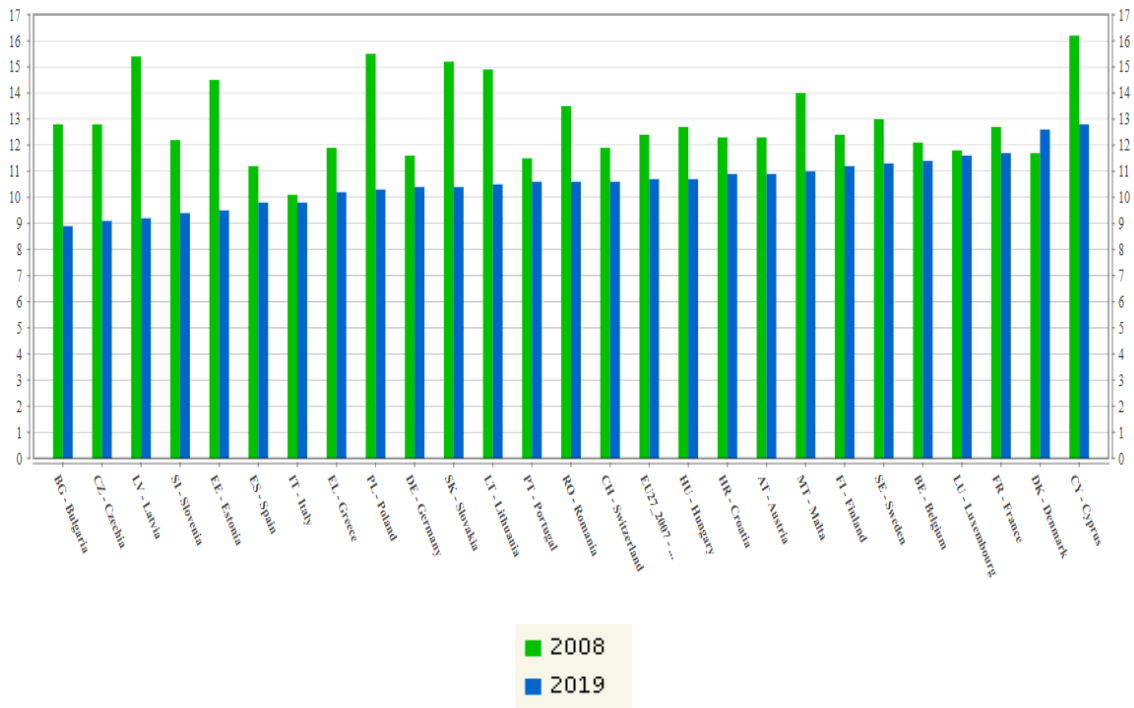
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Appendix

Appendix 1: The share of population aged between 15-24 years in total population



Appendix 2: The share of population aged between 25-49 years in total population



Appendix 3: Individual response rates of SHARE surveys in corresponding countries

Country	Individual response rate (Longitudinal sample)	Individual response rate (Baseline/Refreshment sample)
Austria	61.91 %	
Belgium (FR)	59.59 %	
Belgium (NL)	72.30 %	
Bulgaria		60.56 %
Switzerland	66.23 %	
Cyprus		42.87 %
Czech Republic	67.56 %	
Germany	70.86 %	
Denmark	66.69 %	
Estonia	77.72 %	
Spain - Region of Girona	71.05 %	
Spain	72.95 %	
Finland		52.68 %
France	51.56 %	
Greece	73.59 %	
Croatia	84.71 %	30.63 %
Hungary	57.50 %	
Italy	74.28 %	
Lithuania		56.87 %
Luxembourg	51.48 %	
Latvia		58.30 %

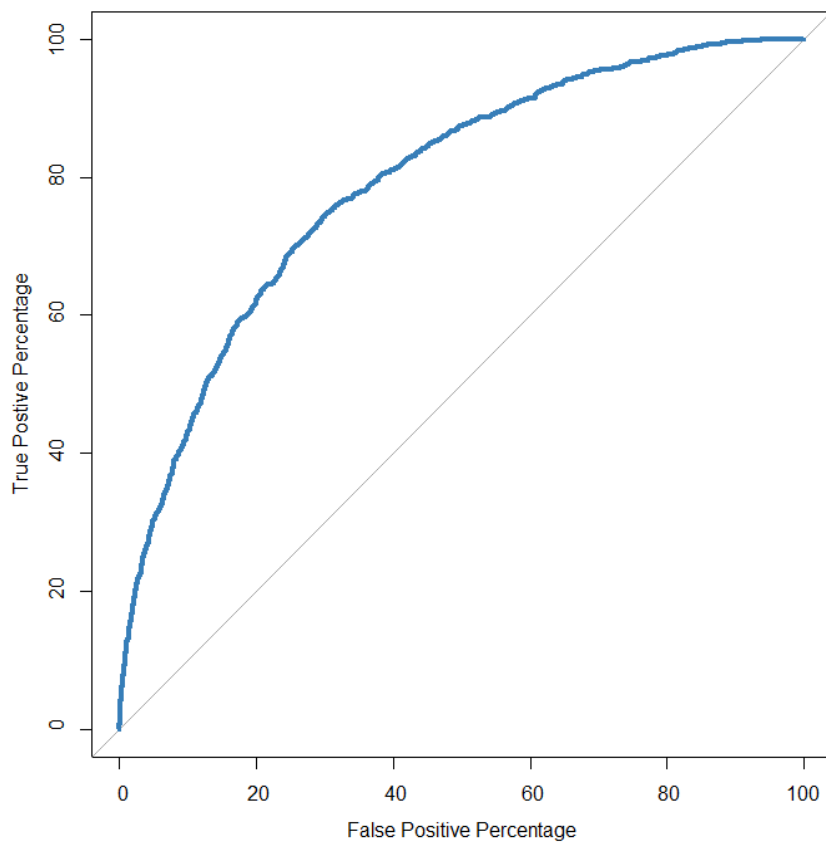
Malta		43.53 %
Poland	82.10 %	36.77 %
Romania		49.85 %
Sweden	61.78 %	
Slovenia	68.64 %	
Slovakia		39.01 %

Appendix 4: Summary statistics of explanatory variables

Statistics	Mean	St. Dev.	Min	Median	Max	N
Age	69.03	3.56	61	69	75	22,738
Gender						22,738
Male	0.45	0.50				
Female	0.55	0.50				
Partnership						22,738
With a partner	0.74	0.44				
Without a partner	0.26	0.44				
Education						22,738
Low	0.31	0.46				
Medium	0.46	0.50				
High	0.23	0.42				
CASP	37.68	6.08	20	38	48	22,738
IADL	0.26	0.90	0	0	9	22,738
Chronic	1.91	1.55	0	2	12	22,738
Personality traits						
Openness	3.31	0.93	1	3	5	22,738
Extraversion	3.53	0.92	1	3.5	5	22,738
Neuroticism	2.60	0.99	1	2.5	5	22,738
Conscientiousness	4.12	0.80	1	4	5	22,738
Agreeableness	3.66	0.83	1	3.5	5	22,738
Normative support	61.85	14.41	29	60	90	22,738
Generosity	41.41	8.34	27.03	42.48	56.69	22,738
Job satisfaction						4,253
Satisfied	0.94	0.24				
Not satisfied	0.06	0.24				
Occupational position						4,253
Elementary occupations	0.49	0.50				

Other skills workers	0.26	0.44	
Managers and professionals	0.25	0.44	
Sector of employment			4,253
Private	0.56	0.50	
Public	0.24	0.43	
Self-employment	0.20	0.40	
Grandchildren			4,253
Yes	0.74	0.44	
No	0.26	0.44	

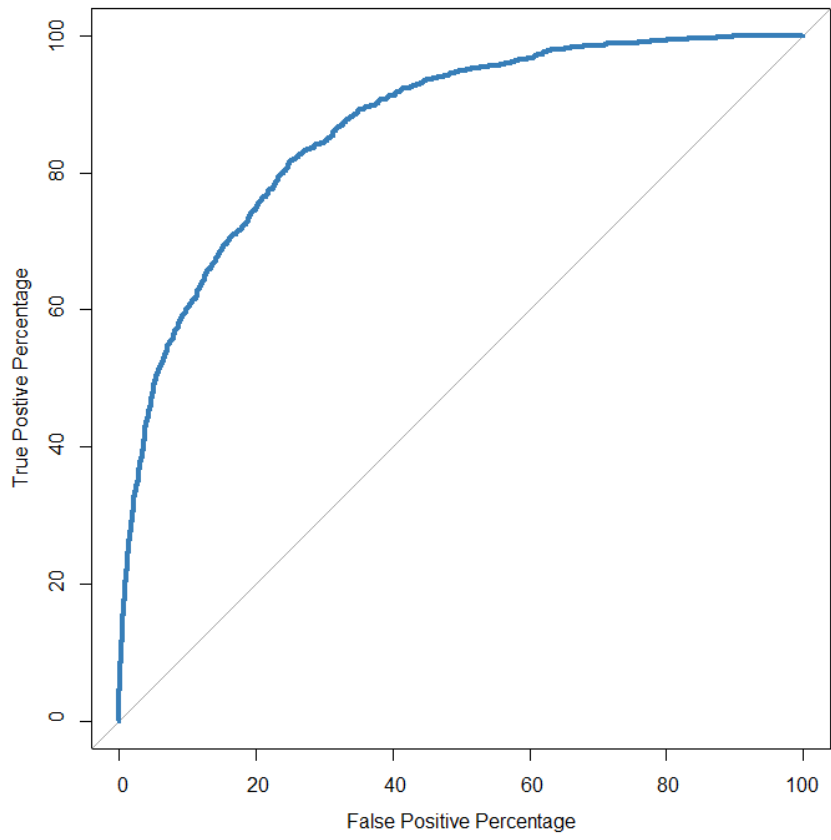
Appendix 5: ROC curve



1

¹ Area under the ROC curve for the model without country dummies is 79.08.

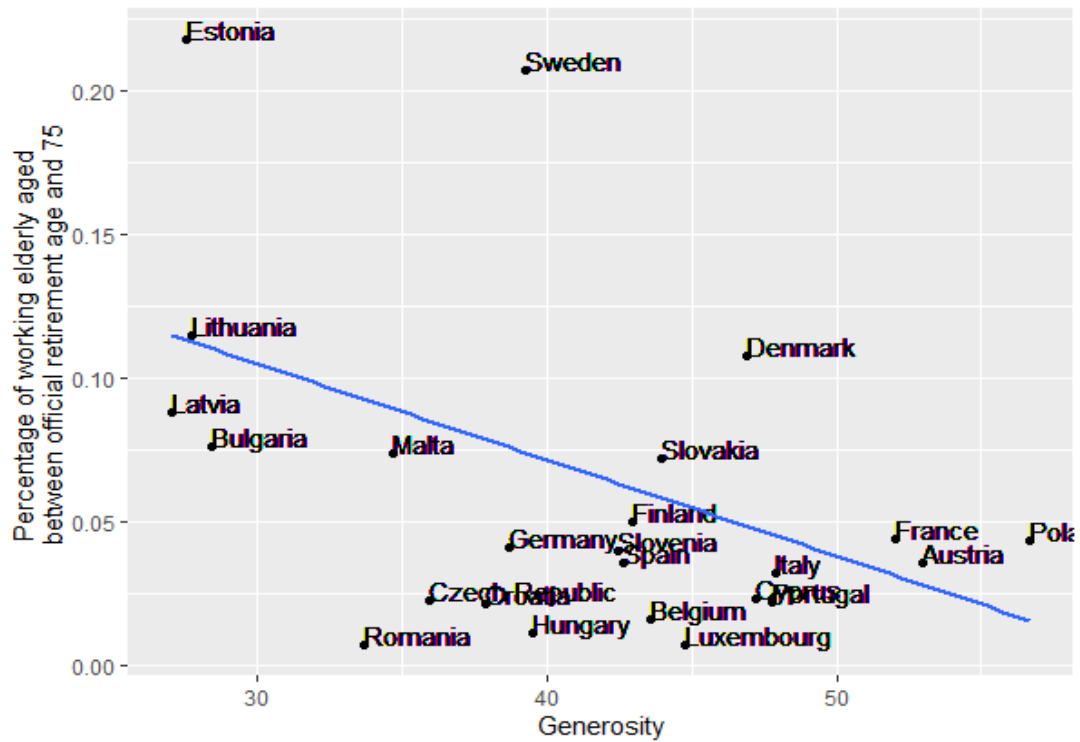
Appendix 6: ROC curve



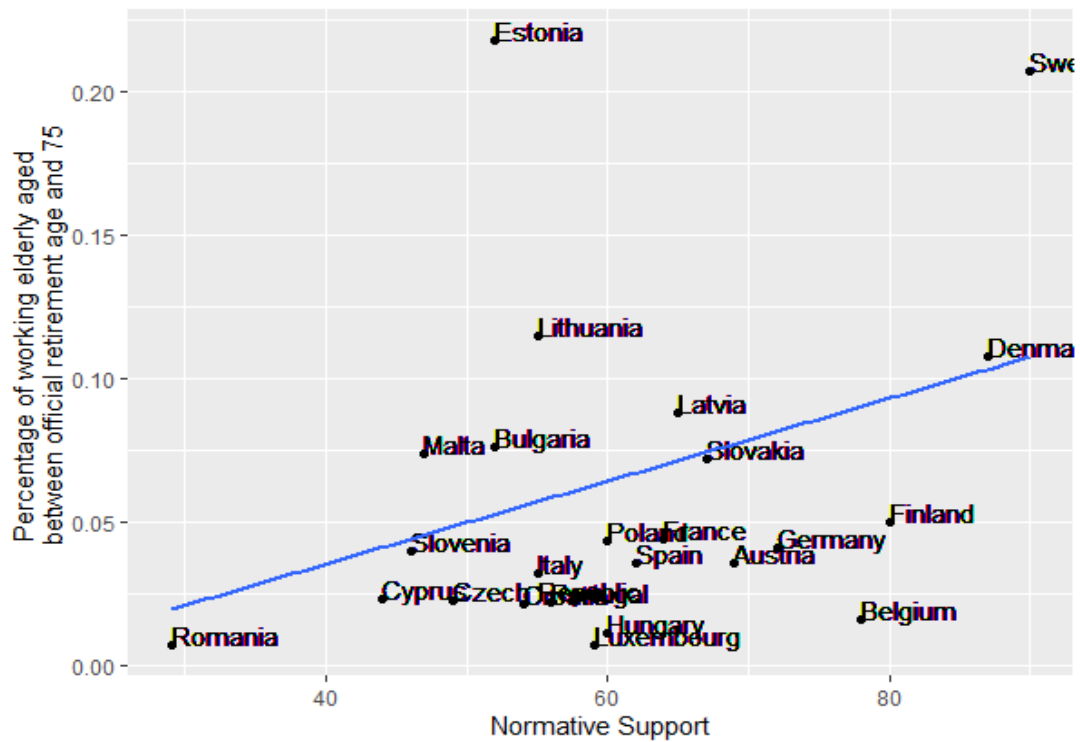
2

² Area under the ROC curve for the model with country dummies is 86.63.

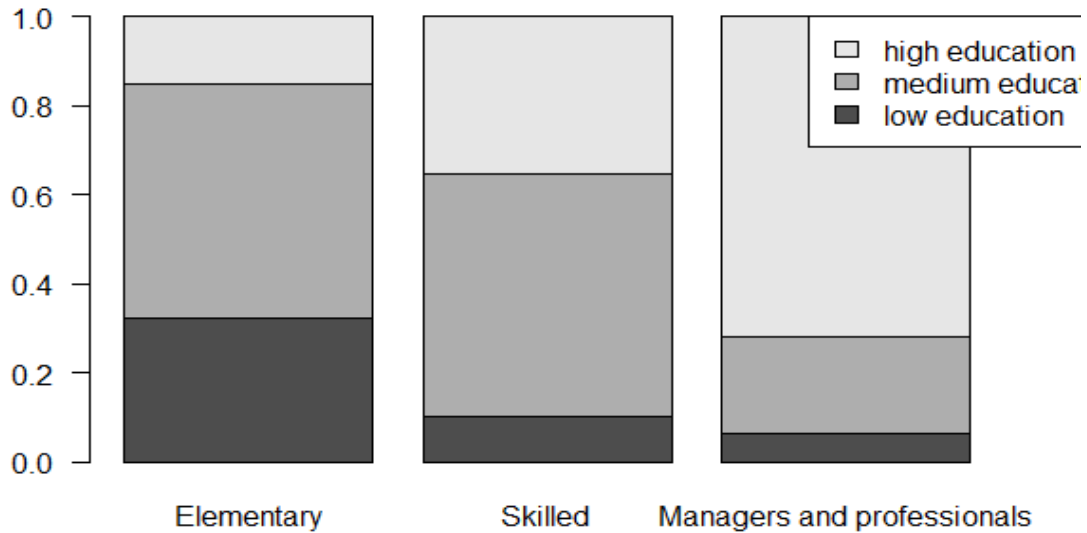
Appendix 7: Relationship between generosity of pension systems and percentage of working elderly



Appendix 8: Relationship between normative support and percentage of working elderly



Appendix 9: Distribution of levels of education among occupational positions



Appendix 10: Logistic regression (FE) model (where the reference for the "sector of employment" variable is the public sector)

Logistic Regression with country dummies		
	<i>Odds Ratio</i>	<i>Confidence Interval (95%)</i>
<i>Age</i>	0.81***	(0.78 – 0.83)
<i>Gender (ref. - Male)</i>	0.86 .	(0.71 – 1.03)
<i>Partnership (ref. - With partner)</i>	1.08	(0.89 – 1.31)
<i>Education (ref. - Low Education)</i>		
<i>Medium Education</i>	1.05	(0.81 – 1.36)
<i>High Education</i>	1.35*	(1.01 – 1.80)
<i>CASP</i>	1.01	(0.99 – 1.03)
<i>IADL</i>	0.70**	(0.53 – 0.90)
<i>Chronic</i>	0.93*	(0.87 – 0.99)
<i>Personal traits</i>		
<i>Openness</i>	1.11*	(1.02 – 1.22)
<i>Extraversion</i>	0.95	(0.87 – 1.04)
<i>Neuroticism</i>	0.94	(0.85 – 1.03)

<i>Conscientiousness</i>	1.14*	(1.02 – 1.27)
<i>Agreeableness</i>	1.04	(0.93 – 1.16)
<i>Job satisfaction (ref. – not satisfied)</i>	1.82**	(1.24 – 2.72)
<i>Occupation (ref. – elementary occupations)</i>		
<i>Managers and professionals</i>	1.35**	(1.08 – 1.69)
<i>Other skilled workers</i>	0.90	(0.72 – 1.12)
<i>Sector of employment (ref. – public sector)</i>		
<i>Private sector</i>	0.60***	(0.49 – 0.73)
<i>Self-employment</i>	1.81***	(1.41 – 2.33)
<i>Grandchildren (ref. – no grandchildren)</i>	0.71***	(0.59 – 0.86)
Observations	4,253	
AIC	3,691.3	

Note: Country level variation is controlled for by including country dummies. We did not include them to keep the table short.

*. p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001*

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