

# **Facing the demographic challenge**

The effect of effort-reward imbalance and control on self-rated health across EU countries

*Based on SHARE data wave 4*

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# 1. Introduction

Europe has been dealing with several crises over the last decade. Next to the current economic crisis, the overall ageing population is putting more pressure on the political systems. In the European Union it is expected that by 2020, people over 60 will comprise up to one third of the population. One result of this demographic challenge is that people will have to work longer in order to pay for the social services elderly people will need. The amount of people working in the age group 55-59 fluctuates in the European Union. Outside of the EU participation rates of elderly workers are much higher, for instance in Switzerland or Norway (Siegrist et al. 2006). Over the last couple of years most EU Member States have opted to increase the legislative pension age. To ensure that people will work longer they will have to be healthy in order to be able to work. In this paper one of the determinants of health, namely working conditions or quality of work, will be analyzed.

The main question is *to what extent does the quality of work done by elder workers influences their self-rated health?* To answer this question the SHARE (Survey on Health, Ageing and Retirement in Europe) database will be used. In this database information on health, socio-economic status and social and family networks of more than 85,000 individuals aged 50 or over is collected. My dependent variable will be self-rated health and my independent variables measuring quality of work will be effort-reward imbalance (ERI) and control at work. Sub questions are: *Does the relationship between health, effort-reward imbalance and control vary between countries?* and *Does the country of residence affect self-rated health?* First the influence the country has on my dependent variable, self-rated health, will be analyzed and later on the influence countries or groups of countries have on the effects of my independent variables, effort-reward imbalance and control, will be reflected upon.

The structure of the paper is as follows: First, the demographic challenge will be elaborated on as well as the role the EU plays in facing this challenge. Active ageing is one of these policies aimed at keeping the political system viable. One of the ways to ensure that employees are able to work longer is to make sure their health is in order. In the chapter on literature data the theoretical models on health and work will be discussed. In order to determine the influence of quality of work on self-rated health, it is also necessary to look at other factors determining self-rated health. By accounting for these factors in the data analysis, the direct influence of quality of work on self-rated health will be more apparent. After accounting for all the theory, the data and data analysis will be discussed. Finally, I will reflect and return to the demographic challenge in the EU and how keeping people working will help fight that challenge.

## 2. The issue: the demographic challenge

Europe's population is ageing, which affects the state's ability to raise revenue for its services. If the number of working-age adults decreases, and the number of people who retire increases, the income per head of the population declines. Fewer people will have to raise the revenue needed to support the increasingly older population. One of the measures to combat this upcoming demographic change is increasing the legislative pension age. Next to the demographic challenge gnawing at a state's ability to raise enough revenue, the current economic crisis serves as a catalyst for these issues.

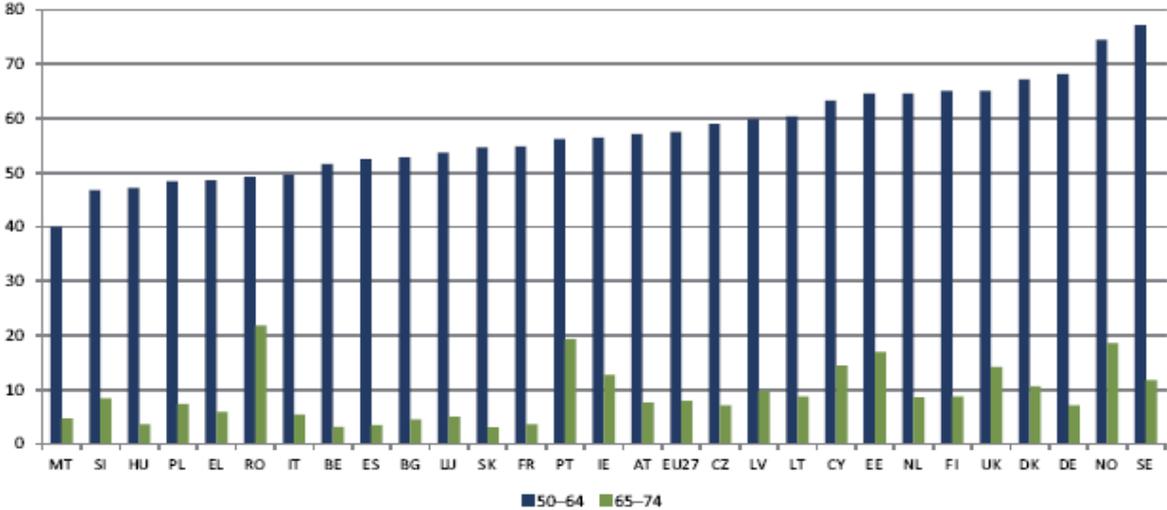
The economic crisis has affected social groups in the European countries, such as the youth (European Central Bank (ECB) 2013). The youth has had to deal with persistent unemployment. If this human capital is not cultivated, a country's future growth is at risk. This unemployment, like the demographic challenge, affects a country's ability to raise enough revenue for the welfare state services they provide. One of the major expenses is the

facilities a state provides for the older generation (ECB 2013). On the other hand the crisis has a positive impact on increasing the legislative retirement age. In times of crisis work provides security, therefore people cling to their work. Also, the crisis truly affects people's expectations on having to work longer. It has a bigger impact than the announced increase of retirement age by the government (Barrett and Mosca 2012).

At the European level the demographic challenge and the linked economic and budgetary issues were first addressed at the Stockholm European Council meeting in 2001. Member States were instigated to raise employment and productivity levels. The Commission published multiple communications on the effects of demographic change and stressed the need to extend the working lives of citizens. The health of the workers was also emphasized. In the Lisbon Strategy, for the period 2000-2010, a specific employment target for older workers was included (50% by 2010). Even though the target was not met in 2010, the specific target for older workers was no longer included in the 2020 Strategy (Eurofound 2013). Although an employment rate for the 55-64 age group of 60 percent was considered reasonable, the European Council (and thus the Member States) decided not to include them in the 2020 Strategy. Instead a more general employment target of 75 % for the whole working population (20-64) was included (Medeiros and Minty 2012:33).

In 2011, according to Eurostat, the employment rate in the EU amongst people aged 25-49 years was 78 %. The weakest link in meeting the 2020 target remains the 50-64 years group, as this group currently has a low employment rate of 47%. In the last decade its employment rate has been improving. From 2001 to 2010 the employment rate of people aged 50-64 years increased by 9 percent, from 37.7 to 46.3 % (European Commission 2012b) . According to Eurofound the increase in participation can be attributed to an increase in overall education, more participation of women and by setting stricter rules for retirement (Eurofound 2013).

**Graph 2.1 Employment of older workers in the EU 2011 in percentages**



Source: Eurostat

Source: Eurofound 2013, who have used Eurostat

The countries with the highest rates of employment for elder workers are the Nordic countries and the UK. Interestingly enough while the employment rate of people aged 50-64 in Romania is quite low, the employment rate in the 65 to 74 age group is large compared to other countries. Other countries that score low are Malta, Slovenia, Hungary, Poland and Greece.

The unemployment rate of the age group (55-64) is interesting as well. They have lower unemployment scores than younger age groups (respectively 6,9% and 9,7% in 2011). The differences within the EU with regards to this statistic are quite large. The unemployment rate of older workers in Austria, Belgium, Italy, Luxembourg, Malta, The Netherlands, Romania, Sweden and the UK are below 5% while Estonia, Greece, Latvia, Lithuania, Portugal, Slovakia and Spain have unemployment rates in the 50-64 age group of more than 10%. Unemployment is not so much the problem for this group, but reintegration into the labor market is. If you want people to work longer you have to be sure this is a possibility. People in this age group are often long-term unemployed (55,1% in 2011, for the whole working population this number is 4,1%). Long-term unemployment makes reintegration into the labor market difficult (Eurofound 2013).

It is expected that the employment rate of the 55-64 age group will keep increasing by continuing to make structural changes to the economy, such as the increase of the legislative retirement age. However, it is doubtful if this will be enough to combat the demographic change as well as the effects of the crisis. Merely increasing the legislative retirement age will not help people who are structurally unemployed. This group has to be enabled to work longer, for instance by giving them more flexible working times or by retraining them. These policies at the EU level are called “active ageing” policies.

### **3. The solution? Active ageing: measures proposed by the EU**

The term “active ageing” was brought forward by the World Health Organization (WHO) in the 1990s. It encompasses the process of enhancing the quality of life of ageing people by optimizing opportunities for health, participation and security. Put simply, if we want people to work longer, they will have to be in good health, both mentally and physically. For instance, better (healthier) working environments need to be developed. Also, people need to be enabled to continuously learn during their career and be more flexible with work arrangements (World Health Organization 2002).

Since the Treaty on European Union or the Maastricht Treaty (1992), more power has been given to the EU in the field of social policy and employment. The EU has been enabled to develop proposals for new policies aimed at helping the Member States to combat the demographic changes. The EU can stimulate Member States to adopt policies for age management by giving them financial support (via the European Social Fund). Also, the EU sets targets and goals for Member States in specific Country Recommendations. 2012 was declared the European Year of Active Ageing and Solidarity between the Generations. This declaration was meant to raise awareness for the essential contribution older people make to society and hopefully boost policymakers to be active in creating better policies for active ageing (Eurofound 2013).

Mainly, the Member States have extended the working life by adopting new pension rules and by increasing the legislative retirement ages. However, for the demographic and economic challenge these measures will not be enough. Governments will have to continue to promote longer and better quality working lives. There are five sets of measures that can be taken to stimulate active ageing:

- 1- *Comprehensive initiatives*: Member States need to facilitate longer careers by promoting active ageing in multiple policy fields;
- 2- *Employment and skills development*: older people need to be encouraged to keep learning by providing extra training or new education;
- 3- *Health and work environment improvement*: Member States need to adjust the workplaces for the physical and mental capabilities of older workers. Also, throughout people’s working life the work environment has to improve by easing mental and physical load and promoting health widely in the workplace;

4- *Work organization and working time*: for older workers working time arrangements have to become more flexible, they have to be able to ease or adapt workload as they get closer to retirement age;

5- *Changing attitudes*: older people are often stereotyped and discriminated against in the workplace. By raising awareness for the demographic change, government policies could change these attitudes (from Eurofound 2013).

The EU emphasizes the need to have healthy work lives in order for employees to keep working until they reach the legislative pension age. The relationship between health and work will be further analyzed in the next chapter.

## 4 Literature data

### 4.1 Theoretical models on health and work

In order to explain health, work and employment play an important part. Quality of work is very important for the health of the employees. People are defined and define themselves by the work that they do. Work is significant in providing purpose in life, adequate income, social support, structure in life and it provides the means to participate in society (Acheson ed. 1998). It provides for 'a core social identity outside the family'. The quality of work and the employment conditions (such as security and promotion possibilities) are important for the health and well-being of the employee (Siegrist and Theorell 2006). A lot of research on health and how differences in health come about focuses on the early life. However, the effect of exposure to difficulties at work in adult life is stronger than the effects of the early life circumstances (Siegrist and Theorell 2006). There are two major theoretical models used in this research looking at the role of work on health, namely the demand-control model and the effort-reward imbalance model.

#### *Demand-Control model (DC-model)*

For a long time physical demands of a job have played an important part in the health of the employee, although nowadays jobs are more defined by mental and emotional demands. The demand-control model, designed by Karasek, states that psychological demands and the degree of control the employee has over his task determine whether or not he or she will have a stressful experience at work. It is based on research that found a positive effect on mental health created by skill development and autonomy at work (Siegrist and Marmot 2004).

A low level of control is defined by two conditions: a lack of decision authority over your own tasks and a low level skill utilization. A combination of high demands and low control is stressful, because the individual does not have autonomy to determine how to handle the situation while he or she is under constant pressure to perform. (Siegrist and Theorell 2006). These jobs are characterized as high strain jobs, for example waitresses or assembly line workers. On the other hand, active jobs are expected to stimulate health. Active jobs are characterized by challenging demands, decision authority and learning opportunities. Active jobs provide positive stimulation, success and self-efficacy. Examples of active jobs are doctors, farmers or engineers. Furthermore, Karasek defined low strain jobs, the jobs with low work pressure and high control (such as janitors or nightwatchmen), and passive jobs, the ones where work pressure as well as control are low (for example artists or carpenters) (Karasek 1979 and University of California at Berkeley 1995: 451). Karasek and Theorell later on introduced a third dimension to the model, namely support at work. The jobs with the highest strain are expected to have high demand, low control and low support at work.

#### *Effort-Reward Imbalance model (ERI-model)*

Brought forward by Siegrist, this model focuses on the stressful aspects of the employment contract. The basis for the model is social reciprocity. This notion lies at the core of the

contract. The contract defines obligations and/or tasks to be performed by the employee in exchange for sufficient rewards (money, career opportunities etc). The reciprocity lies in exchanging work for the equitable rewards. An example of a job sector that often has an imbalance between high efforts and low rewards is the service sector, for instance health-care professionals (van Vegchel et al. 2002). A lack of reciprocity can occur if one of the following three conditions takes places: dependency, strategic choice and/or over commitment.

#### Dependency

Refers to the structural constraint that many unskilled, semi-skilled, elderly employees and short-term employees have in their contracts. These are the employees that are not at liberty to refuse a contract. The employers have a high incentive to pay rewards that are not equitable to the tasks performed because the employee will not easily reject an unfair contract.

#### Strategic choice

In this case people accept the high demands and low rewards condition because the job will improve their chances of career promotion later on. This will not be relevant for this thesis, because the research group is elderly, who are at the end of their career.

#### Over commitment

This refers to employees that have the tendency to overachieve, without getting the adequate rewards in return. They might strive too hard because they need approval or more self-esteem at work. Even if they do not get more rewards, over committed people will continue to stay involved (Siegrist and Theorell 2006).

#### *Similarities and differences between the two models*

The effort-reward imbalance model and demand control model have similarities as well as differences. The models are similar because at the center of both of them an interaction between job demands and the mechanisms how to cope with them takes place. When the balance is off in favor of demands this reflects negatively in the health of the employee. While the models share this central balance they differ in which characteristics are considered important. The ERI-model includes personal characteristics (such as job opportunities, salary etc), while the DC-model has a narrow point of view of work. The DC-model focuses on the situation in the workplace (van Vegchel 2005).

The models have a different view on what the main drive is for stress at work. In the DC model this is personal control, whether or not the employee has control over her or his work. For the ERI model this is social reward. This is based on fairness and reciprocity, as long as the rewards outweigh the input it will be worth it. Because of this different point of view on stress the models focus on different policies in the work place. For the DC model this is power or democracy and input for the employees, while for the ERI model this is distributive justice and fairness (van Vegchel 2005: 26-27; Siegrist et al 2004).

#### *Literature on country differences in health*

Research that trends upon country differences in health inequalities are the ones that measure the influence of the welfare state on self-rated health. Recently a lot of research has been done on the effect of different welfare types (Eikemo et al 2008) or different political traditions (Dahl et al 2006; Espelt 2008) on self-rated health, especially health inequalities. In Eikemo et al. the conclusion is that for people included in European Social Survey (ESS) above 25 years self-rated health is ninety percent determined by individual characteristics and ten percent by the welfare state. In other words, the state does not contribute a lot to one's self-rated health.

Concerning political variables, the studies focus on whether or not politics can influence a decrease in health inequalities. Dahl et al conclude that there are no significant or persistent differences in health inequalities between various welfare states (Dahl et al 2006). Espelt takes a different approach and instead of comparing between welfare states, a distinction is based on the political parties that have been in power. Expected is that the social democrats will be the most committed to redistributive policies and thereby to decreasing the health inequalities. However, in all three political traditions (social democracy, Christian democracy and late democracies) they found absolute and relative health inequalities by social class. The differences were most apparent in the late democracies (Espelt et al 2008).

All of the research above focused on health inequalities and often fall back on the welfare state typology brought forward by Esping-Andersen, but results do not seem to follow the reasoning of the theory. Esping-Andersen described three types of welfare regimes (liberal, corporatist and social-democratic). Based on his theory, the social-democratic welfare state should have the lowest health inequalities, because it promotes an equality of the highest standards, all citizens have similar rights, not depending on their class or market position, and thus this welfare state system is not based on minimal needs (Bambra 2011: 741). However, the results differ and there seems to be no real explanation as to why the results vary.

If the main theory is proven to be insufficient what other theories can provide an answer to country variation? Since social position is the most important indicator for health, and the welfare state actively orders the social relations the state (Esping-Andersen 1990:23) does affect social position and thus one's health. In this regard one of the important aspects of the welfare state is the educational structure because it is where the class structures evolve and were the mobility chance of an individual are determined (Esping-Andersen 1990: 58). However, for the group of people selected (age 50-65, still working) education is of less importance. In research where a larger age range has been used, it has been apparent that education creates a larger gap in health between youngsters rather than between older people. Most cross-sectional studies show that socioeconomic inequalities in health are largest in early adulthood (Beckett 2000). The phenomenon is difficult to explain. One possible interpretation is that higher socioeconomic groups postpone morbidity, but it does eventually catches up with them, decreasing the differences in later life. It is assumed that risk factors, such as smoking, drinking and exercise, account for some health inequalities but studies have shown that their predictability is limited (Lantz et al. 1998 from Beckett 2000). Research with a broader set of risk factors, including for instance social support and self-efficacy, have been more successful at explaining health inequalities (House et al. 1994, from Beckett 2000).

For health variations between elderly, the welfare state theory is insufficient. Research that focuses on psychosocial work factors (or quality of work) such as Siegrist and Wahrendorf (2008) discusses variance in quality of work in Europe. They found significant differences in quality of work within regions of Europe, a North-South divide as well as an East-West division. The regions that were performing worst were Eastern and Southern Europe. Furthermore, in each country there were variations in quality of work based on age, gender and socio-economic position. Especially the indicators education and income showed strong variations in quality of work. In every region analyzed low socio-economic position was associated with low quality of work (Siegrist and Wahrendorf 2008).

Studies that are also relevant are those that have set out to provide insight into the difference in exposure to psychosocial work factors between European countries. So far information on this subject remains limited. In a 2012 study by Niedhammer et al 31 European countries were compared concerning their scores on psychosocial work factors, such as job strain, low support and low decision latitude. Results showed three different groups of countries. In the first group, consisting of Denmark, Netherlands and Norway and Austria, Finland, Ireland,

Latvia, Slovakia, Spain and UK (women), at least four out of 12 factors for psychosocial work factors had a significantly lower prevalence of exposure. The second group of countries had a higher prevalence of exposure to at least four factors, being the Czech Republic, Greece, Lithuania and Turkey for both men and women and Bulgaria and Poland for women. The third group consisted of the remaining countries and did not display a significant higher or lower exposure to at least four factors (Niedhammer et al 2012).

For the relevant countries for this paper the following results were found:

- *Denmark*: low prevalence of low skill discretion, low reward, low decision authority and job strain, high prevalence of high effort.
- *Netherlands*: low prevalence of low skill discretion and low decision authority
- *Austria*: low job insecurity and not much low rewards, but high effort for men
- *Spain*: high prevalence to low skill discretion, low decision authority and low decision latitude, low prevalence to high effort
- *Czech Republic*: high prevalence to low skill discretion, low decision authority and job insecurity (Supplementary Data Niedhammer et al 2012)

#### 4.2 Other determinants of health

Health is determined by a complex interplay between social, economic, physical and cultural environment. The factors that are thought to have the dominant impact on health are the macro environmental factors, such as national socioeconomic factors, and the physical and social environment. All these factors contribute to the behavior an individual adopts, resulting in behavior that may influence their health such as smoking, drinking, lack of physical activity and a poor diet (Crombie et al 2005: 47-48).

During the 1970s, the term 'determinants of health' was introduced to pay more attention to the differences in health between populations rather than looking at it on an individual level. People had expected the widely available medical care to contribute to improvement in health, but research showed that it had contributed little to the major improvements in health through the late 19<sup>th</sup> and early 20<sup>th</sup> century. Public health policy should not devote its attention to health services and diseases, but rather to social policies and social determinants (Graham and Kelly 2004). With the UK's *Black Report* in 1980 the major inequalities between social groups was first put on the agenda. The report pointed out that the health inequalities had been increasing in the UK since the introduction of the National Health Service. It suggested that health inequalities did not result from the healthcare system, but were due to other factors, such as income and employment, education, housing quality, diet and working environment. Some of the determinants of health are out of the control of the citizen such as structural and environmental factors. Therefore, these had to be addressed by social policy (Crombie et al 2005: 6-7).

The major link between all health determinants is social position. Social position refers to a person's position on social hierarchies. A person can have multiple social positions. For instance an individual who is an immigrant, a heterosexual and works in a manual occupation, or a white person, a gay, a woman and works in a managerial occupation. So social position can include type of work, place of birth, sexuality and gender (Graham and Kelly 2004).

During the UK presidency of the European Union, research on health inequalities was conducted. The report, which was published in 2006, states that the effect socio-economic status has on health is 'likely to be largely indirect'. Machenback states that many risk factors (such as smoking, poor diet and excessive alcohol consumption) are more prevalent in the low socio-economic groups, these risk factors should be seen as the main explanations for health. He states that socio-economic status is determined by material and psychosocial

factors as well as behavior, which in their turn influence each other and health (Machenback 2006).

Machenback distinguishes between three main groups of factors. The first group, material factors, include income and physical environment. Financial limitations affects health through psychosocial stress about money, which in its turn may lead to risk-taking behavior such as substance abuse. It also limits the access a person has to health facilities. Physical work environment, such as working with chemicals has a very direct impact on health. The second group of determinants are psychosocial factors. People who have a low socio-economic position on average also have more psychosocial stress. This can mean more negative life events, such as loss or financial problems, but it can also refer to circumstances in their work. The third group is behavioral factors, such as diet and exercise. In many European countries it has been proven that lower educated groups are more likely to exhibit behavior that influences health in a bad way (Machenback 2006).

The three groups of variables are interlinked, which has caused a lot of discussion on how these factors can be included, if at all, in research on health. Factors that are often taken into account are education and income. People who are educated are more often aware of risky health behavior, preventive care and medical treatment (Tsimbos 2010). Also, education is associated with both income and occupation.

## 5 Research questions and hypotheses

*1. To what extent does the quality of work done by elder workers influences their self-rated health?*

On the basis of the literature it is expected that control will have a positive relationship with perceived health. The more control you have at your workplace the better your health will be. For the effort-reward imbalance it is expected that as the category increases the self-rated health of the employee will decrease. A low category of effort-reward imbalance will mean that an employee puts in a low amount of effort but gets rewarded considerably, expected to lead to a good perceived health.

Hypothesizing on the expected effects of the variables the following hypothesis are brought forward. The DC model will have a positive effect on health, if an employee has high control he or she will feel better. The ERI imbalance will have a negative effect on health, the higher the imbalance between effort and reward (which means more effort than rewards) the poorer the health of the employee will be.

Hypothesis 1: Effort-reward imbalance will influence health negatively, while control will influence health positively.

*2. Does the country of residence affect self-rated health?*

The influence of the country of residence will be researched in two ways. The first question is, what is the influence of the country on the outcome health. It is expected that the countries will cluster in similar ways as in the research of Espelt, the late democracies or the East European countries and South European countries will most likely perform worst and the Nordic countries will perform better.

Hypothesis 2: The East European and Southern European countries will be have a negative impact on SRH while the Western and Northern European countries will influence SRH positively.

*3. Does the relationship between self-rated health, effort-reward imbalance and control vary between countries?*

The second country question is: does the country of residence influence the effect of effort-reward imbalance and control on health. It is expected that results will be similar to Niedhammer's research. Similar to the first question a North-South and East-West division between the countries is expected. Based on the literature and earlier research it is not expected that control at work will be of importance to Denmark and the Netherlands. Although there is a high prevalence to high effort in these countries they have less prevalence to low reward and no significant difference in Effort-Reward Imbalance. It is expected that effort-reward imbalance will play a more important role for these countries than control. For the Southern states the opposite situation will most likely apply, high effort is not an issue but low control at work (decision authority and skill utilization) is. Most likely this will also reflect in the analysis of the relationship of the effect of country of residence on ERI and control's effect on health.

Hypothesis 3: There will be an North-South division and East-West division concerning the influence country of residence has on the effect of ERI and control on SRH.

Hypothesis 4: For the North, ERI will be more important than control, while for the South control will be more important than ERI.

## **6 Methods**

### **6.1 The source of the data: the SHARE survey**

The SHARE (Survey on Health, Ageing and Retirement in Europe) research collects information on health, socio-economic status and social and family networks of more than 85,000 individuals spread across 19 countries aged 50 or over. SHARE's aim is to facilitate the analyzing of economic and social problems associated with ageing and to allow the making of international comparisons. SHARE is partly inspired by American and English similar surveys (UK: ELSA (English Longitudinal Study of Ageing)). The data that is collected includes health, psychological, socio-economic and social support variables. Based on probability samples in each participant country, data is collected using computer-assisted personal interviews supplemented by two self-completion questionnaires (Addabbo, Fuscaldo & Maccagnan 2011). The first wave of the survey was collected in 2004 and it started with 11 European countries.

It is important to keep in mind some of the limitations the SHARE dataset holds. Samples can differ from country to country although the research is especially designed to deliver comparable data. By creating SHARE, researchers aim to reliably study differences in cultures, living conditions and policy approaches across Europe. The percentage of non-responsiveness was quite high, although there is no way of measuring whether this can be associated with the self-perceived health of the respondents and/or other demographic characteristics (Espelt 2008).

There are two ways to make use of the SHARE database. Firstly, by producing comparative statistics and secondly, by using the total dataset as a set of harmonized micro data. In the latter case, international variability is not the object of the measurement. International variability is merely an additional factor of variation, which could provide more understanding of the given issue (Blanchet & Debrand 2008: 6). The methods used in the present work will use a bit of both worlds, the micro-dimension will be used to test in detail the influence of working conditions on the self rated health of working elder people, while taking an interest in the differences between SRH and quality of work from one country to another. In the first analysis the data set will be used as a micro-data set, trying to analyze the relationship between the dependent variable and the independent variables. In the second part the data set will be used to analyze whether or not there is a significant variation country to country.

## 6.2 The dependent variable: self-rated health (SRH)

For this research the group which is still working will be selected (aged between 50-65). The elderly are especially interesting because the biggest disparities in mortality (and thus also in health) occur in middle adulthood (45-65) (Adler and Newman 2002). The SRH question has five possible answers ranging from poor, fair, good, very good to excellent.

**Table 6.2.1 Self-Rated Health of elder workers (50-65 years) from SHARE wave 4**

	Frequency	Percent
Excellent	911	10.46
Very good	2128	24.43
Good	3395	38.97
Fair	1964	22.54
Poor	314	3.60
Total	8712	100.0

*Source: Own calculations with SHARE dataset wave 4*

In total there are a 8712 cases in the fourth wave of SHARE of people between 50 and 65 who are employed. A lot of cases have been dropped because they did not provide information on the control variables, such as amount of years of full time education. Of the 8712 cases 3,6 % have said they are in poor health, a total of 314 cases, making it the smallest group. The largest group is in good health, with almost forty percent of the cases, a number of 3395.

For statistical analysis it is important to determine what kind of data one is working with. This determines which statistical tests can be used. The data from the SHARE research is ordinal, because the categories follow each other in a logical order. However, the distance between the various categories is not the same so it cannot be considered interval data. For instance the distance between fair and poor cannot be considered equal to the distance between excellent and very good. The other data in SHARE uses the categories strongly agree, agree, disagree and strongly disagree. Although this is also ordinal data, a lot of researchers will assume the data to be interval. When considering data to be ordinal, measurements such as mean and standard deviations cannot be used. Also, when using the statistical techniques for interval data a researcher can come to the wrong conclusions about, for instance, the significance of his or her research (Jamieson 2004). In order to diminish the chance of reaching false conclusions, statistical tests especially designed for ordinal data will be used.

## 6.3 The independent variables: control and effort-reward imbalance (ERI)

The following statements in SHARE are related to quality of work and all have the same answering possibilities ranging from strongly agree, agree, disagree and strongly disagree.

- All things considered I am satisfied with my job.
- My job is physically demanding.
- I am under constant pressure due to a heavy workload
- I have very little freedom to decide how I do my work
- I have an opportunity to develop new skills
- I receive adequate support in difficult situations
- I receive the recognition I deserve for my work

- Considering all my effort and achievements, my salary is adequate
- My job security is poor
- My job promotion prospects are poor.

Not all elements from the effort-reward imbalance and demand-control models have been included in the SHARE questionnaire. Siegrist et al (2006) state that the control dimension has been favored over the demand aspect in SHARE, because the predictive power of control by far exceeds that of demand. A lot of research has been done on the relationship between the DC model and cardiovascular disease. The consistency between control and disease is high, but results has been mixed for the full model, when combining control with demand (Siegrist and Marmot 2004).

Control at work in the SHARE questionnaire is measured by two questions: opportunity to develop new skills and the freedom to decide how to do my work. The control element can be measured as the sum of two Likert-scale items (ranging from 2 to 8). This is one variable of quality of work: the control element.

For effort-reward, two elements ranging effort and five elements ranging reward are included in SHARE, questions concerning a person's personality (for overcommitment) are not included in SHARE. In Siegrist effort-reward imbalance is defined by a ratio of the sum score of the 'effort' items (nominator) and of the sum score of the 'reward' items (adjusted for number or items, denominator) (Siegrist et al 2006: 63-64). This would be the other variable of quality of work: effort-reward imbalance.

The questions from SHARE can be divided into three dimensions of work quality: Effort, control and reward, see table 1.

**Table 6.3.1– Indicators of work quality**

Dimension	Item
Effort dimension	1- My job is physically demanding
	2- I am under constant pressure due to heavy workload
Control dimension	3- I have very little freedom to decide how to do my work
	4- I have an opportunity to develop new skills
Reward dimension	5- I receive the recognition I deserved for my work
	6- My job promotion prospects are poor.
	7- My job security is poor
	8- Considering all my effort and achievements, my salary is adequate
	9- I receive adequate support in difficult situations

On the basis of these questions two indicators are created. One for the demand control model and one for the effort-reward model.

The data in SHARE is saved in such a way that for all the above quality of work indicators 1 means strongly agree and 4 means strongly disagree. The numbers are reorganized so a

high number indicates strongly agreeing with the statement. Therefore all of the quality of work indicators are recoded. Also, the same has been done to my dependent variable, namely self-rated health in general, so now 1 equals poor health and 5 equals excellent self-rated health. After the recoding, the constructing of the independent variables can begin.

For control indicator 3 and indicator 4 are added up, which gives a new indicator which ranges from 2 to 8, in which 8 indicates the high control at work. For effort-reward imbalance it took a while longer to create an indicator. In first instance, the sum scores of effort and reward can be used separately to determine their impact on the health indicators. In certain professions, low reward in itself may already be associated with poor health. However, the theory points to the relationship between effort and reward, the imbalance between them as the most important matter (Siegrist et al 2004). So first compatible numbers for effort and reward are calculated:

Effort= (indicator 1+indicator 2)\*5/2

Reward= indicator 5+indicator 6+indicator 7+ indicator 8+ indicator 9

Both variables now have the same scale. In order to create an effort-reward ratio a new variable effort-reward ratio is created by dividing effort by reward. Now, in other papers two options are presented. The ratio can be transformed into a binary value, meaning a value for those employees that put in more effort than rewards that they receive, and those with more reward than effort, but the effort-reward ratio can also be logarithmically transformed into a continuous measure. This is done by placing the result 1.0 (so exactly the same amount of effort as reward) at the center of the scale. By treating the variable as a continuous measure more information is kept in the model and quartiles can be defined (Siegrist et al 2004). Effort-reward ratio in STATA has a reach from 0.25 to 4. Based on the explanation in Pikhart et al 2001, the following scale can be constructed. By placing inverse imbalance of the same magnitude (so for example 0.5 and 2) in the same distance as the center of the scale, which is 1.0 (Pikhart et al 2001: 625), four categories emerge, namely 1 (effort-reward ratio of 0.25 to 0.5) 2 (effort-reward ratio 0.5 to 1) 3 (effort-reward ratio 1 to 2) 4 (effort-reward ratio 2 to 4). The effort reward imbalance becomes stronger as the category increases. People at the end of the spectrum put in much more effort without receiving sufficient rewards.

## **6.4 Control variables**

As the earlier literature review on health determinants has indicated, there are a few important demographic control indicators that need to be included in the model in order to be better able to analyze the impact of work indicators on perceived health. The demographic indicators are: gender, age and amount of years of full time education. Gender is needed to analyze the differences in health between men and women. Age is obviously a factor on health, normally as we get older we will consider our health to be declining. The amount of years of full-time education completed is included because in many papers the relationship between education and health is considered to be very strong. The assumption is that a greater amount spent in education confers health protection and that every additional year contributes to better health outcomes (Avendano, Jürges and Mackenbach 2009:304). Also, as said earlier in the literature part, since education is associated with income and occupation it is an important indicator to include.

## **6.5 Interaction variables**

An interaction variable measures how much a change in one variable affect the effect of another variable. The interaction effect of country of residence on the effect of both effort-reward imbalance and control on health will be analyzed. The interaction variable will reveal whether or not the effect of effort-reward imbalance and control on health changes in the context of a different country. Whether or not there is a strong interaction will provide insight

into whether the country does in fact matter for the effect of effort-reward imbalance and control on self-rated health.

## 7 Results

### 7.1 The general model

For the analysis of the SHARE data logit regression will be used. Logit regression is a nonlinear regression model that forces the output to be either a whole number (one of the categories, which in my case range from 0 to 5). They estimate the probability of the dependent variable to be one of the possible outcomes. This is the probability that a certain event will happen. If a dependent variable has more than two categories (ergo it is not a binary variable) and the categories have a meaningful sequential order in which the steps are not necessarily the same in size (from 1 to 2 is not the same distance as from 2 to 3) then it is allowed to use an ordinal logit model.

A logit model differs from a linear model in the way that it estimates conditional means in terms of logits. It is a linear model in the log odds metric. It may appear to be linear, but it is not as straightforward to interpret. The log odds ratio stems from the probability. The probability can be transformed into an odd, for instance 0.4 probability with two outcomes equals a odd of 2 to 3. The odds are then transformed to log of odds.

The ordinal logit model is conducted to study the association between the control element and effort-reward imbalance and self-rated health, with adjusting for the demographic factors (education, gender and age). The program that I used for statistical analysis is STATA, because it provides more options for ordinal data than SPSS.

**Table 7.1.1 Ordered logistic regression with control variables and DC and ERI model, dependent variable being SRH**

<i>Variable</i>	<i>Coefficient</i>	<i>Z value</i>	<i>Significance</i>
Age	-0.0788	-14.63	0.000
Years education	0.0414	8.30	0.000
Gender	-0.2163	-5.50	0.000
Control	0.1522	10.05	0.000
Effort-reward Imbalance	-0.3892	-12.38	0.000

*Source: own calculations with SHARE data wave 4*

The coefficients in a log linear model tell the expected increase in log odds of the outcome health when the variable is increase with one unit, while keeping the other variables at a constant level. Which means that it is important to realize what kind of scale you have used. In the first model, age is used as a constant variable, where increasing it with one unit means one year, same goes for education. Control ranges from 2 to 8, while effort-reward imbalance ranges from 1 to 4. Let us take gender as an example. For gender 1 means female, being female decreases the log odds of health by 0.2163. While you can state that female has a stronger impact on health than control, one cannot state on the basis of logistic regression that the impact of control is 25 % less than of gender because the model is not linear. Furthermore, the output provides information on the z-test and whether these values are significant or not.

All variables included in the model can be considered to be highly significant. The factors that negatively influence self-perceived health are gender, age and effort-reward imbalance. In this case gender is a binary variable in which 0 equals male and 1 equals female, meaning that being a female has a negative effect on your self-perceived health. Females rate their health lower than men. Control and education have a positive impact on health.

In order to be certain that the above observations are correct, the underlying assumptions of the model need to be met. Underlying assumptions of an ordinal logit model are the proportional odds assumption or the parallel regression assumption. The relationship between each pair of outcome groups is considered to be the same. This means that the coefficients that describe the relationship between the lowest versus the higher categories are the same as those that describe the relationship between the next lowest category and all higher categories, etc.<sup>1</sup> In order to determine whether the parallel regression assumption was violated I conducted a Brant test (Appendix A). Since the Brant test was violated a different model had to be conducted in which the parallel lines assumption can be let go for the variables that violated the Brant test (which was only age). The following results ensued:

**Table 7.1.2 Generalized ordered logistic regression, relaxed parallel lines assumption for variable age**

<i>Variable</i>	<i>Coefficient</i>	<i>Z-value</i>	<i>Significance</i>
Age (1)	-0.0304	-1.96	0.050
Age (2)	-0.0804	-12.13	0.000
Age (3)	-0.0839	-12.80	0.000
Age (4)	-0.0705	-6.79	0.000
Years education	0.0416	8.31	0.000
Gender	-0.2173	-5.52	0.000
Control	0.1525	10.06	0.000
Effort-reward Imbalance	-0.3895	-12.38	0.000

*Source: Own calculations with SHARE dataset wave 4*

This model determines different coefficients for each variable at each possible outcome for the dependent variable, which ranges from 1 to 5. In the model, only age has various coefficients because for this variable the parallel lines assumption has been relaxed. All other factors have the same coefficient for all possible outcomes of the dependent variable. The coefficients are the same as the ones given in the ordinal logit model. already in poor self-rated health age does not have a large impact anymore and the impact is also smaller for the ones with better health as the last coefficient shows (-.00705). So age does not so much impact the extremes of the dependent variable but rather the middle section. Again all effects of these variables can be considered significant as the highest significance is still 0.05. With the model in place we can take a closer look at the impact the variables have on the probability that self-rated health increases or decreases.

## **7.2 The influence of the independent variables: control and effort-reward imbalance at work**

In the general model it cannot be determined what the strength of the independent variables is. The coefficients are not comparable to one another. In order to determine the strength of ERI and control the discrete change in the categories of the dependent variable were computed as the various variables (including the control variables) are changed from lowest to highest category, whilst keeping all other variables at their means. This gives the following results.

**Table 7.2.1 Changes in probabilities when the independent or control variables are changed from lowest to highest category while all other variables are kept at their mean**

<i>SRH</i>	<i>Poor</i>	<i>Fair</i>	<i>Good</i>	<i>Very good</i>	<i>Excellent</i>
Control	-0.0325	-0.1461	-0.0170	0.1220	0.0736

<sup>1</sup> <http://www.ats.ucla.edu/stat/stata/dae/ologit.htm>

Effort-reward imbalance	0.0399	0.1810	0.0325	-0.1535	-0.0999
Age	0.0157	0.2316	0.0057	-0.1745	-0.0786
Years education	-0.0336	-0.1588	-0.0373	0.1379	0.0918

Source: Own calculations with SHARE dataset wave 4

The table above is meant to display all predictive variables, both control and independent, in such a way that they are easily comparable. The difference in probability of the various outcomes of self-rated health are computed when changing the variable from highest to lowest value. The variable that has the strongest impact on the outer categories is effort-reward imbalance. In the remaining three categories effort-reward imbalance has the second strongest impact, after either age or years of education. In every category ERI has a stronger impact than control at work. Also, from this table we can see that the effect of having many years of full time education on health is similar to having high control at work. The variable which varies the most is age, this is to be expected as this is the one variable for which the parallel lines assumption has been let go. It seems to have the most impact on the category fair.

As for independent variables the results show that for all the categories of the dependent variable the effect of effort-reward imbalance is larger than the effect of control in probabilities. Hence, it can be concluded that effort-reward imbalance is the strongest predictor for SRH of elderly working people in this particular model. Only in the categories fair and very good is effort-reward imbalance outshined by the effect of age.

The next table will show whether or not the effect of ERI and control on health varies between genders.

**Table 7.2.2 Changes in probabilities for male and female when the independent variables are changed from lowest to highest category**

SRH	Poor	Fair	Good	Very good	Excellent
Control (male)	-0.0294	-0.1403	-0.0331	0.1224	0.0803
Control (female)	-0.0359	-0.1510	-0.0009	0.1205	0.0673
Effort-reward imbalance (male)	0.0360	0.1736	0.0521	-0.1528	-0.1089
Effort-reward imbalance (female)	0.0440	0.1875	0.0129	-0.1527	-0.0916

Source: Own calculations with SHARE dataset wave 4

The differences between the genders are not large. For both control and effort-reward imbalance the biggest difference is the middle category, good. In all of the other categories the difference is very small. The impact of effort-reward imbalance and control on the health of females and males does not seem to differ much. Overall, females keep saying they are in worse health than men, but it does not seem that the effect of effort-reward imbalance or control differs much across the genders.

### 7.3 Country analysis: descriptive statistics

Before the countries are included in the main model, the descriptive statistics will be analyzed. The respondents are divided by country in the following way.

**Table 7.3.1 Amount of respondents per country**

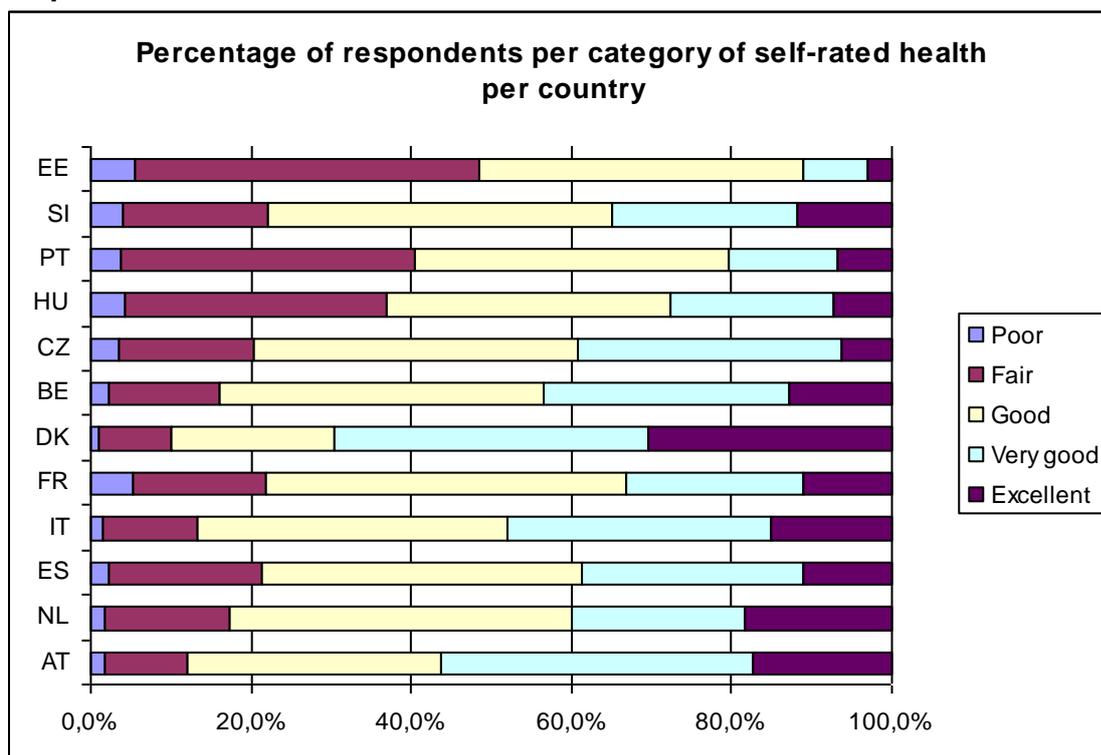
	Frequency	Percent
Austria	916	10.5%
Germany	6	0.07%

Sweden	23	0.26%
Netherlands	327	3.8%
Spain	411	4.7%
Italy	402	4.6%
France	977	11.2%
Denmark	339	3.9%
Belgium	982	11.3%
Czech Republic	1133	13.0%
Poland	10	0.11%
Hungary	556	6.4%
Portugal	413	4.7%
Slovenia	468	5.4%
Estonia	1749	20.1%

Source: Own calculations with SHARE dataset wave 4

Note that some countries have a very low rate of respondents, namely Germany, Sweden and Poland. After deselecting the cases that did not include information on the amount of years of full-time education a lot of cases from these countries were dropped. Because of the low amount of respondents these three countries were not included in the next part of the country analysis.

**Graph 7.3.1**



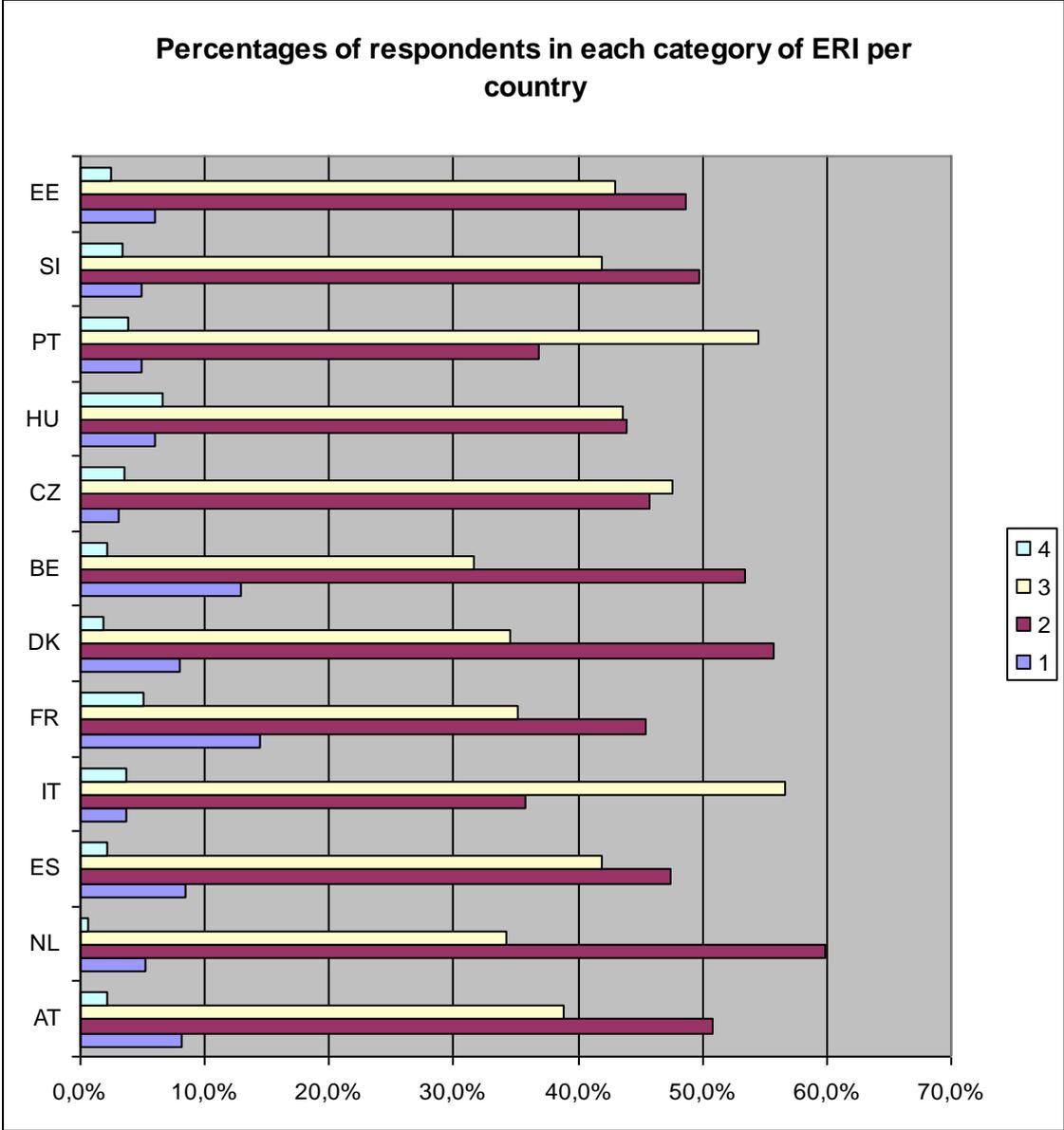
Source: Own calculations with SHARE dataset wave 4

The country with the highest amount of people who feel they are in excellent physical condition is Denmark, followed by the Netherlands and Austria. Both Denmark and Austria also score very high on people who consider themselves to be in very good condition. Other countries that score well in that category are Italy and the Czech Republic. Countries that score poorly in the last category are Estonia, the Czech Republic and Portugal. Especially Estonia also scores poorly in the category very good.

The countries that have the highest scores in the category poor health are Estonia, France and Hungary. The countries with the lowest scores in that category are Denmark, Italy, the Netherlands and Austria.

For the different categories of effort-reward imbalance the descriptive statistic is as follows

**Graph 7.3.2**



Source: Own calculations with SHARE dataset wave 4

The countries with the highest scores in the category with the most effort-reward imbalance, too much effort and too few rewards (cat 4) are Hungary, France and Portugal. Countries that have the lowest scores in this category are the Netherlands, Austria and Belgium. Countries with the most people who have the best effort-reward imbalance, so few effort but lots of reward (cat 1) are France, Belgium and Spain. Countries with the fewest amount of people in this category are the Czech Republic, Italy, Slovenia and Portugal.

For control the statistic is as follows:

**Table 7.3.2 Percentage of respondents per category of control per country**

	2	3	4	5	6	7	8
Austria	2,7%	4,6%	10,5%	27,0%	26,4%	17,2%	11,6%
Netherlands	0,9%	0,3%	7,0%	13,5%	38,8%	23,9%	15,6%
Spain	2,7%	4,1%	14,1%	24,8%	26,8%	19,0%	8,5%
Italy	2,7%	6,5%	14,9%	30,6%	25,1%	11,4%	8,7%
France	4,2%	4,5%	12,3%	23,8%	23,5%	18,5%	13,1%
Denmark	1,2%	2,7%	5,3%	11,5%	33,9%	26,8%	18,6%
Belgium	1,6%	3,7%	11,5%	21,6%	28,2%	20,8%	12,6%
Czech Republic	1,6%	3,3%	13,2%	29,5%	33,6%	11,9%	7,0%
Hungary	10,8%	8,1%	12,9%	21,4%	19,1%	12,1%	15,6%
Portugal	1,0%	4,6%	9,9%	30,3%	29,8%	15,7%	8,7%
Slovenia	2,1%	2,6%	10,3%	25,6%	35,7%	14,1%	9,6%
Estonia	1,8%	3,4%	12,9%	25,6%	33,7%	14,6%	8,0%

Source: Own calculations with SHARE dataset wave 4

The countries in which employees are the most in control are Denmark followed by the Netherlands and Hungary. At the same time Hungary has the highest score in the lowest category of control at work, followed by much lower percentages of France and tied in third place Austria, Spain and Italy. The countries that have the highest percentage of people with average control at work, middle category 5, are Italy, closely followed by Portugal and the Czech Republic.

To sum up, on the basis of these descriptive statistics of the countries and the amount of respondents that fall into each category of effort-reward imbalance, control and self-rated health good results are expected from Denmark, the Netherlands and Austria. Countries that are more likely to score poorly are Hungary and Estonia. In the statistical analysis groups of countries will be also analyzed by cluster, in order to determine which cluster varies significantly from one another.

#### 7.4 The influence of the country of residence on self-rated health

For the specific country analysis I include dummy variables for the countries. Because of the small amount of cases Germany, Sweden and Poland were deselected. First, the countries are analyzed separately. In order for the model to work one country has to be left out of the equation, the so called zero line or baseline. It is best to select a country which is expected to perform averagely, in order to determine whether some countries differ significantly, both in the positive sense as well as in the negative sense.

Belgium is used as the baseline. This country is expected to have somewhat medium results, in the above descriptive statistics Belgium did not stand out, neither negatively or positively, in any of the statistics. The results of this model have to be considered as variations vice versa the performance of Belgium. The ordered logistic regression analysis gives the following results for each country.

**Table 7.4.1 Ordered logistic regression of quality of work and SRH (including countries) with Belgium as baseline**

	<i>Coefficient</i>	<i>Significance</i>
Austria	0.818	0.000
The Netherlands	-0.072	0.547
Spain	0.017	0.878
Italy	0.542	0.000
France	-0.297	0.000

Denmark	0.912	0.000
Czech Republic	-0.091	0.251
Hungary	-0.619	0.000
Portugal	-0.604	0.000
Slovenia	-0.182	0.081
Estonia	-1.39	0.000

Source: Own calculations with SHARE dataset wave 4

The results are not significant for the countries that have a higher score than 0.05 in the second column. These countries are the Netherlands, Spain, the Czech Republic and Slovenia. Compared to Belgium these four countries do not differ significantly in their impact on health. The other countries do have a significant difference compared to Belgium. The countries that have significantly better self-rated health amongst their elder workers than Belgium are Denmark, Austria and Italy. The countries that have significantly worse self-rated health compared to Belgium are Estonia, Hungary, Portugal and France. When looking at the three groups that emerge from the comparison to Belgium, some East European countries such as the Czech Republic and Slovenia score relatively well, while other West European countries, such as France, score poorly. Also, Italy performs surprisingly better than Belgium.

### 7.5 The influence of country of residence on the effect of ERI and control on self-rated health

On to the model of interaction between the countries and the independent variables, effort-reward imbalance and control. Does the country of residence affect the effect of the independent variables on the dependent variable self-rated health? In order to answer this question an interaction model needs to be devised. For interaction models it is better (or easier to interpret) to work with binary variables, therefore the three main variables, self-rated health, effort-reward imbalance and control are computed into binary variables in which 1 means health is good, there is effort-reward imbalance and one has control over their own work. The model of choice also changes, since binary variables have more options. Here, logit models are used.

The first model does not include country interactions, but works with the countries in different groups that are expected to perform from best to worst. The countries are divided into four categories: Northern, Western, Southern and Eastern Europe. Between these it is expected to find the biggest differences. The Nordic countries are Denmark and Sweden, the Western countries are France, the Netherlands, Austria, Germany, Belgium, the South is represented by Italy, Spain, Portugal and Slovenia, and finally Eastern Europe constitutes of Hungary, Poland, the Czech Republic and Estonia. Since all countries are included into larger groups, the countries with very few cases are included again.

**Table 7.5.1 Logistic regression with groups of countries with country group North as baseline**

Variable	Coefficient	Significance
<i>Effort-reward Imbalance</i>	-0.525	0.000
<i>Control</i>	0.247	0.000
<i>Age</i>	-0.057	0.000
<i>Years Education</i>	0.077	0.000
<i>Gender (Female)</i>	-0.242	0.000
<i>Country group West</i>	-0.358	0.054
<i>Country group South</i>	-0.624	0.001
<i>Country group East</i>	-1.400	0.000

Source: Own calculations with SHARE dataset wave 4

Almost all of the results are significant, except for the category West compared to the baseline North. Both country groups South and East have a significant negative effect on health, compared to being in country group North. The directions are as expected, for the independent variables having effort-reward imbalance has a negative effect, while having control at work has a positive effect on health. For the control variables expectations are also met, more years of education is positive for your health, while a higher age has a negative effect on health. The effect of gender is significant as well, females will be in poorer SRH than males. Not much can be stated on the basis of the coefficients, to look at the differences between groups of countries in more depth predicted probabilities need to be analyzed.

Let's take a closer look at the impact of the groups of countries by computing the marginal effect of that specific category. The marginal effect for ordinal data show how being in good health changes as the ordinal data changes from 0 to 1 (Williams 2013). The following table gives insight in how high the probability is that in a country group self-rated health will be good.

**Table 7.5.2 Marginal effects of groups of countries (all other data kept at mean, accounting for binary variables)**

Variable	Margin	95% Confidence Interval	Significance
<i>Country group North</i>	0.878	0.840 - 0.916	0.000
<i>Country group West</i>	0.834	0.821 – 0.848	0.000
<i>Country group South</i>	0.794	0.775 – 0.814	0.000
<i>Country group East</i>	0.640	0.623 – 0.657	0.000

Source: Own calculations with SHARE dataset wave 4

In this table all results are significant. The above table tells us that in the Nordic countries the chance of being in good health is 88 % and in the other groups of countries respectively 83, 79 and 64 percent chance of being in good health. The confidence interval of North and West overlap a little bit (0.840 lowest for North, 0.848 highest for West) but other than that even in the confidence intervals the division in country groups is clear.

Next, the interaction variables are included in the model.

**Table 7.5.3 Logistic regression with SRH as dependent variable including interaction country group x effort-reward and country group x control (North as baseline)**

Variable	Coefficient	Significance
<i>Country group West</i>	0.203	0.699
<i>Country group South</i>	0.264	0.621
<i>Country group East</i>	-0.765	0.141
<i>Effort-reward Imbalance</i>	-0.189	0.614
<i>Interaction West x ERI</i>	-0.292	0.453
<i>Interaction South x ERI</i>	-0.348	0.376
<i>Interaction East x ERI</i>	-0.357	0.351
<i>Control</i>	0.841	0.089
<i>Interaction West x Control</i>	-0.496	0.328
<i>Interaction South x Control</i>	-0.881	0.087
<i>Interaction East x Control</i>	-0.555	0.269
<i>Age</i>	-0.057	0.000
<i>Gender (Female)</i>	-0.246	0.000
<i>Years Education</i>	0.077	0.000

Source: Own calculations with SHARE dataset wave 4

Upon including interaction variables things change concerning the significance of the independent variables control and effort-reward imbalance, in this model they are not significant in their current relationship. Notice that the variables that have not been interacted (Age, gender and years education) have the same coefficient as in table 7.5.1, but the coefficients for effort-reward imbalance and control have changed (ERI now -0.189, earlier -0.525, control now 0.841 earlier 0.247). Also the results for ERI and control are no longer significant. This changes because in non-linear models interaction variables are not as straightforward interpretable as in linear models. Working with interaction variables in a nonlinear model such as logit is fraught with problems (Norton, Wang and Ai 2004; Buis 2010).

There are multiple ways to define interaction effects in non-linear models. We can interpret them based on their marginal effects, odds ratios or incidence-rate ratios. In a nonlinear model, contrast to a linear model, the marginal effect of a change in both interacted variables is not equal to the marginal effect of just the interaction variable. Also, the direction of the interaction does not become clear from the information we get from the model. The significance of the interaction effect cannot be derived from the regression output Stata provides (Norton, Wang and Ai 2004). Or in other terms the method for interpreting 'regular' variables cannot be used for interpreting interaction variables.

Although in most journal articles the emphasis will be on the sign (either negative or positive) and whether or not the variable is significant, often what is missing is the substantive and practical significance of the interaction (Williams 2013). Therefore, the statistical significance is not what will be analyzed, but what matters is how the predicted probabilities of being in good health change across the four groups of countries with changing the binary predictors effort-reward imbalance and control. Because the question remains, how the effect of one variable, in this case effort-reward imbalance and control, changes across country groups. The following table shows the results. Note the differences in predicted probability of being in good health when changing each combination of effort-reward imbalance and control.

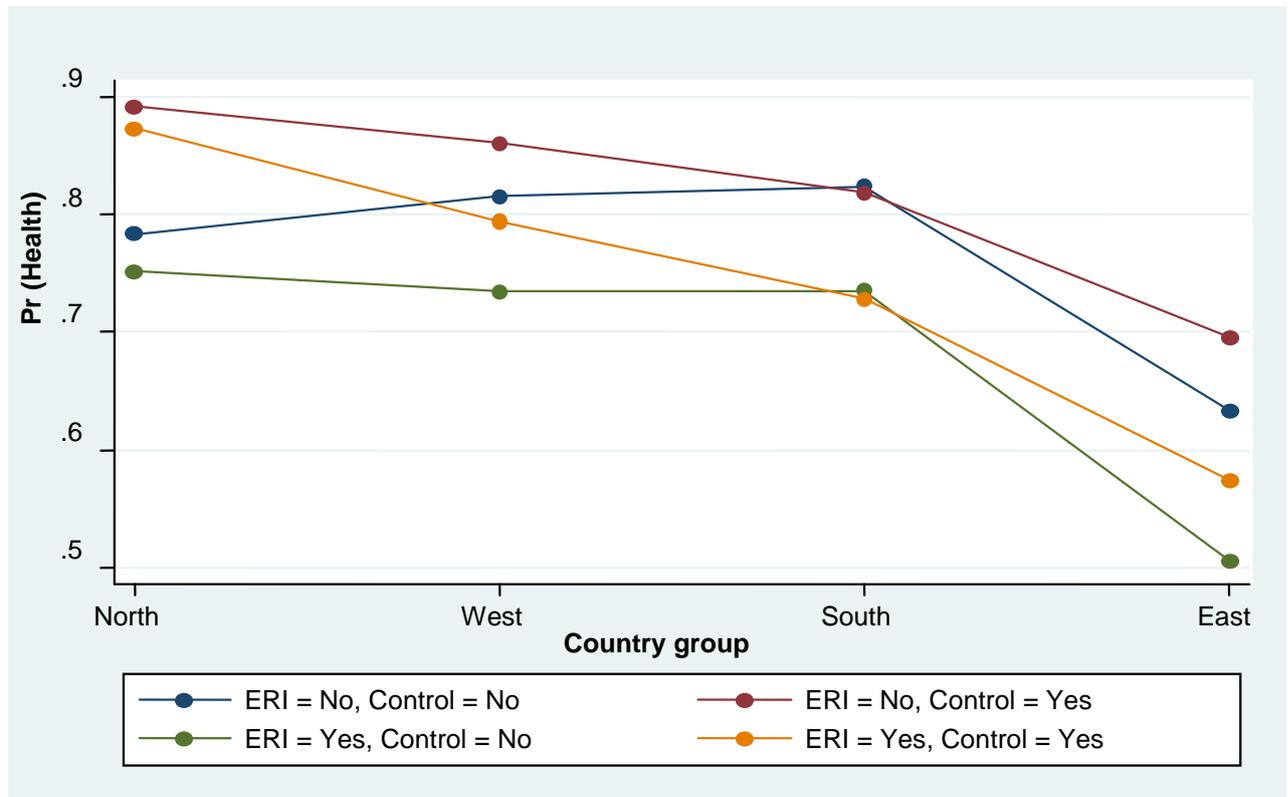
**Table 7.5.4 Marginal effects of effort-reward imbalance and control per group of countries**

Country group	ERI	Control	Margin	95% CI	Significance
North	No	No	0.784	0.612 – 0.949	0.000
North	No	Yes	0.892	0.848 – 0.937	0.000
North	Yes	No	0.751	0.593 – 0.910	0.000
North	Yes	Yes	0.873	0.807 – 0.939	0.000
West	No	No	0.816	0.781 – 0.851	0.000
West	No	Yes	0.861	0.846 – 0.876	0.000
West	Yes	No	0.735	0.696 – 0.774	0.000
West	Yes	Yes	0.795	0.768 – 0.822	0.000
South	No	No	0.825	0.782 – 0.867	0.000
South	No	Yes	0.819	0.793 – 0.845	0.000
South	Yes	No	0.736	0.685 – 0.786	0.000
South	Yes	Yes	0.728	0.695 – 0.761	0.000
East	No	No	0.634	0.593 – 0.674	0.000
East	No	Yes	0.695	0.674 – 0.717	0.000
East	Yes	No	0.506	0.467 – 0.544	0.000
East	Yes	Yes	0.574	0.547 – 0.601	0.000

Source: Own calculations with SHARE dataset wave 4

Of which the results are easier to interpret in a graph:

**Graph 7.5.1 Predictive Margins of Effort-reward Imbalance x control for each country group**



Source: Own calculations with SHARE dataset wave 4

So here we see the four groups of countries. Overall the health is better in the Nordic countries. We would expect the combination no effort-reward imbalance and control at work or the Red line to have the best predicted probabilities in having good health. This is the case in almost all of the groups of countries described above. Only in the Southern countries does control at work not have a strong impact on health. In the South effort-reward imbalance has a stronger impact on the predictor being in good health.

In the East European countries the overall probability of being in good health is much lower than in the other areas. However, the lines are in the order you would expect them to be. In Eastern Europe you have the best chance of being in good health if you have no effort-reward imbalance and are in control of your work life. The worst prediction of good health is in a situation where there is effort-reward imbalance and no control. In comparison to the Nordic countries the blue and yellow line have switched places. In Northern Europe having effort-reward imbalance at work has less impact on being in good health than being in control.

In the graph, the confidence intervals of the predicted probabilities are not included. When taking a closer look at table 7.5.4 the relationship between country groups North and South become more clear. The difference between in predicted probability of being in good health while having no ERI and control at work is significant between North and South. The confidence interval of no/yes in the North is 0.848 - 0.937, while for the South this is 0.793-0.845. They do not overlap, which means the difference is significant. The same can be said of the yes/yes line. In the North the CI of that line is 0.807 - 0.939 and in the South the CI is

0.695 - 0.761. Or, in other words, the relationship between ERI and health at work differs significantly between North and South Europe. In cases where there is no control at work in Northern Europe, the confidence interval of the predicted probability fluctuates a lot. For instance, the CI of the no/no line in the North is 0.612 – 0.949. No assumptions can be made on the basis of such a large fluctuation in predicted probability of being in good health.

To summarize the groups West and East have the order of lines that we would expect based on earlier results. For South Europe having control at work does not influence the predicted probability of being in good health much compared to whether or not a person has effort-reward imbalance at work. In Northern Europe the situation seems opposite, but it has to be noted that the confidence interval when having no control at work has a very large range.

## **8 Discussion**

### **8.1 The general model and the influence of the independent variables**

For the first part of the analysis the relationship between quality of work and self-rated health was analyzed. The main purpose of this paper was to determine the influence of quality of work, measured by effort-reward imbalance and control, on the self-rated health of elder workers. Both effort-reward imbalance and control had the expected effect on self-rated health. Control at work has a positive impact on self-rated health, while effort-reward imbalance has a negative effect on self-rated health. The first hypothesis was confirmed.

Of the two independent variables effort-reward imbalance seems to have a stronger relationship with self-rated health. Other research have found similar results concerning the predictive quality of effort-reward imbalance versus that of control. In the research by de Jonge et al (2000) it is noted that job control had less predictive power than effort-reward imbalance on health. They state that their results are in line with the current changes in the nature of work. Flexibility, globalization and the technological revolution have all had their impact on work. Life-time employment has been decreasing and a growth in short-term contracts has taken place. All of these developments have lead to more job insecurity. Knowing this, it seems understandable that rewards are, nowadays, more important than job control for someone's health.

The demand-control model was not particularly meant to include the job characteristics needed to explain the work/health relationship. The DC model has a narrow view on work and only includes characteristics of the workplace. Multiple researchers have suggested that more characteristics are needed to include the psychosocial job characteristics, since emotional contact at work is left out of the DC model (for example Karasek et al 1998).

Also, it needs to be noted that not all aspects of the demand-control model are incorporated into the SHARE dataset. As said earlier, the predictive quality of demand had mixed results in previous research and was not included into the SHARE questionnaire. This likely leaves out part of the puzzle. Perhaps it needs to be reassessed whether some questions on demand should be included.

As for the control variables, in the models other health determinants, such as age, the amount of years of full-time education and gender, were accounted for. For gender, females will answer on average that they are in worse health than men. The effect of effort-reward imbalance and control on health does not change much between the genders. Overall it seems that having high control at work changes the likelihood that females will answer very good or excellent more than for men. The effect of age differed a lot across the categories of self-rated health, in some categories it had more impact on self-rated health than effort-reward imbalance. Having no education or 25 years of full-time education had the same effect on being in good health as having control at work. The impact of education on health

can still be considered relatively large, even though in earlier research it has been said that education is considered to be of less relevance to the health of an older person than to that of a youngster (Beckett 2000). It is difficult to really state something about whether or not education is more important to the health of a youngster, because this group was not analyzed in this thesis.

## **8.2 The influence of country of residence on self-rated health**

In the second part of the analysis the differences between countries were closely analyzed. The first research question was which country had the strongest impact on the outcome of health. Three groups of countries emerged. The best scoring countries were Denmark, Austria and Italy. A large middle group consisted of Spain, Belgium, the Netherlands, the Czech Republic and Slovenia. And the last group was France, Portugal, Hungary and Estonia. These results were not consistent with the hypothesis of a clear North-South and West-East divide. The hypothesis was disproved.

It was expected that the Nordic countries would have a positive impact on SRH and while the only included Nordic country did score well, the other two countries came from West and South Europe. The poorer scoring countries that were surprising were France and Portugal. Looking at data on life satisfaction across European countries, based on the European Social Survey data of 2010, these countries also performed poorly. Slovenia is one of the Eastern European countries that scores relatively well in that statistic, although the Czech Republic does not (Rodrigues, Huber and Lamura 2012: 57). Unfortunately, data on the well scoring countries, Austria and Italy, are missing.

Some of the differences in the life satisfaction data are explained by the effects of social and institutional context. The paper by Helliwell (2009) elaborates on the importance of the social context. Helliwell claims that social context matters as much as income in explaining international differences in well-being. Social context variables are for example having friends to count on, freedom to choose, doing volunteer work, helping strangers, church involvement etc. In the SHARE database data on social networks is also included. For future research it might be interesting to include this data in the analysis, in order to see whether it correlates with health and how different countries score on the subject. It could explain the variance in how the countries performed on self-rated health.

In this part of the analysis the SHARE dataset was used to its full abilities, binary variables were not yet computed, because it could interfere with the results of the analysis. The found variance in the groups of countries could be linked to how the respondents answer the questions from country to country. There have been papers that have stated results can be skewed based on the cultural differences between the categories poor, fair, good, very good and excellent (Jürges 2006). Some results show that the Nordic countries are more likely to overrate their self-rated health, while the West and Southern European countries are more likely to underrate their self-rated health (Jürges 2006). If this part of the analysis would have been done with binary variables, the order of countries might have been more aligned with the hypothesis.

## **8.3 The influence of country of residence on the effect of ERI and control on self-rated health**

In the second part of the country analysis binary variables were computed for health, effort-reward imbalance and control. This part of the analysis was aimed at whether or not the relationship between self-rated health and effort-reward imbalance and control changes across various groups of countries. The country groups West and East had the expected order of lines, based on the earlier results of this paper. When having no ERI at work and control is the most positive situation. Since being in control at work had less of an impact

than ERI the next line would most logically be control, but no ERI. In West and East Europe graph 7.5.1 follows that logic.

The first hypothesis for this part of the research was correct. There was a North-South division and East-West division concerning the influence country of residence had on the effect of ERI and control on SRH . Graph 7.5.1 clearly shows that the Nordic countries perform best followed by West, South and East. In other research, however, the regional factor scored low as an explanatory variable for stress. In the research of de Smet et al (2005) job title explained the variance of stress at work more than the regional factor. Analyzing the type of jobs, which are also included in SHARE, and their impact on self-rated health would be an interesting addition to the current paper.

For Southern and Northern Europe differences were found. While in Southern Europe having control at work marginally influences being in good health, for Northern Europe the same can be said of effort-reward imbalance. In other words control is of importance in North Europe, while in the South ERI is more important. In the discussed research by Niedhammer et al (2012) a different distinction between North and South was found. The lack of control at work in the South was more apparent and people did not often complain of high effort, in the North people put more effort into their work and having low control was not an issue. On the basis of this research the hypothesis was that for the North, ERI will be more important than control, while for the South control will be more important than ERI. The situation is exactly opposite, so the hypothesis is wrong. This could be due to the fact that having low control at work in the North, or in Denmark especially, is not likely. Therefore, it can be assumed that not many cases in SHARE for Denmark have low control which is probably why the CI of the predicted probability fluctuates so much. However, this is not the case for Spain which has low prevalence to high effort at work (Niedhammer et al 2012). Perhaps the situation is different in the other South European countries. Keep in mind that this thesis and the research of Niedhammer differ in including health as a variable.

Some of the dissimilarities can possibly be explained by the differently organized labor markets the regions have. The Northern model is characterized by strong trade unions and centralized collective bargaining empowering the employee to take control over their work. The labor market in this region is flexible and has active employment policies. In the South there are weak trade unions and centralized bargaining is only about traditional issues, often leading to poor protection of the more vulnerable groups (Cerdeira and Kovacs 2008). This would mean that the Nordic employee would often feel more in control than in the South. It could also entail that when one's personal situation differs substantively from the norm it has a very strong impact on one's health.

#### **8.4 Policy implications**

While the first part of the analysis only confirmed the hypotheses, the results of the country analysis are quite interesting. The results of the country analysis could have an impact on how to promote active ageing within the European Union. The policy proposals were:

- 1- *Comprehensive initiatives*: member states need to facilitate longer careers by promoting active ageing in multiple policy fields, this needs to be done in coordination with social partners;
- 2- *Employment and skills development*: older people need to be encouraged to keep learning by providing for extra training or new education;
- 3- *Health and work environment improvement*: member states need to adjust the workplaces for the physical and mental capabilities of older workers. Also, throughout the whole of the working life the working environment has to improve by easing mental and physical load and promoting health widely in the workplace;

4- *Work organization and working time*: for older workers work time arrangements have to become more flexible, they have to be enabled to ease or adapt workload as they get closer to retirement age;

5- *Changing attitudes*: older people are often stereotyped and discriminated against in the workplace. By raising awareness for the demographic change, government policies could change these attitudes (from Eurofound 2013).

The policy points are related to the questions included in SHARE in the following way. Point 2 concerning skills development is related to the control dimension (opportunity to develop new skills). Improving the health and work environment, point 3, is related to effort (heavy workload/physically demanding). And finally point four on work organization and working time is also related to control (freedom to decide how to do my work). Based on this assessment point 2 and 4 are less relevant for the Southern European countries because control is not as strongly associated with self-rated health than in other countries. In Northern Europe it is exactly opposite and point 3 is less relevant. The policies need to be prioritized per country in order to have the most impact. In times where government budget is limited it might prove effective to look at which policies will have the most impact in which countries. Further research might be needed to address the underlying reasons of these differences between the groups of countries, but it is a good starting point for further research.

## 9 Conclusion

The following three questions were posed at the beginning of this paper: *To what extent does the quality of work done by elder workers influence their self-rated health? Does the relationship between health, effort-reward imbalance and control vary between countries? and Does the country of residence affect self-rated health?* Three important conclusions can be drawn from the analysis. First, effort-reward imbalance has a stronger impact on self-rated health than control at work. Also, it almost always had a stronger impact than education, age or gender. Second, the order of the countries from strongest to weakest impact on self-rated health was different than expected. Some countries performed worst than expected, France and Portugal. While others performed better than expected, Italy, Czech Republic and Slovenia. Third, in the Southern countries having ERI at work has a much stronger impact on health than being in control. It differed considerably from the situation in the other European regions.

This paper would benefit from additional research on why the differences between certain groups of countries appear. Various explanations and further research points have been brought forward in the discussion. Social context, such as social networks and family ties, or different types of jobs might possibly explain the variation in the influence a country of residence has on health and the impact it has on the relationship between ERI and control on health. The SHARE database holds enough data to explore both options and hopefully more research will be done in the future.

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## Appendix A: Brant test for ordered logistic regression model

```
. brant, detail
```

```
Estimated coefficients from j-1 binary regressions
```

```

                y>1      y>2      y>3      y>4
    age  -.03044649  -.08295739  -.08447302  -.07031019
    dn041_ .04318153  .0493446  .03984119  .02839138
    dn042_ -.1176248  -.28073861  -.17771646  -.15670356
    control .16109701  .13101014  .15295502  .19507774
    effort_reward_cat -.53152538  -.41414648  -.36304422  -.37218021
    _cons  5.1063419  5.7095727  3.7281153  1.2569568

```

```
Brant Test of Parallel Regression Assumption
```

Variable	chi2	p>chi2	df
All	31.46	0.008	15
age	14.42	0.002	3
dn041_	4.42	0.219	3
dn042_	5.73	0.125	3
control	4.58	0.205	3
effort_rew~t	3.41	0.333	3

```
A significant test statistic provides evidence that the parallel
regression assumption has been violated.
```

The Brant test is to check whether the assumption can be made that the relationships between the independent variables and the logits are the same for all the logits. Or, in other words the results can be considered as a set of parallel lines, one for each category of the dependent variable. The chi square variable tells you the difference between the two log likelihood variables. In case the lines can be considered parallel the significance level should be large. Unfortunately in my case one of the variables is diverting from the parallel line, namely the variable age. Therefore, I have to reject the assumption that all lines are parallel and move on to a different model for ordered data, namely the partial proportional odds model for ordinal dependent variables developed by R. Williams. The partial proportional odds model can overcome the limitations of the ordinal logit model by relaxing the parallel lines assumption for certain variables. The variable that I would have to relax is age.