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# Population Ageing and Average Retirement Age

A cross-sectional analysis of OECD countries

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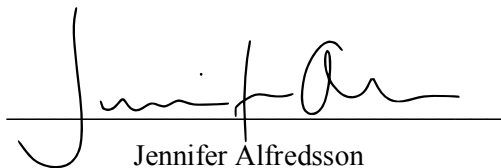
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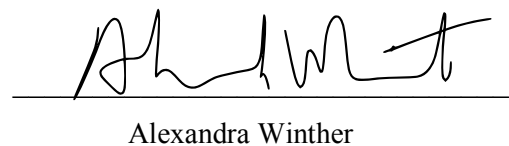
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## **Bachelor Thesis in Economics**

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### **Abstract**

The issue of population ageing becomes more prominent, countries will see a change in the population structure where a majority will belong to the cohort aged 65 and over. This shift in the population structure raises challenges which in turn will affect a country's economic growth. In the future a larger share of people will enter retirement than ever before, and being able to keep individuals to stay in the labour force is one attempt which can increase the economic growth. Today, elderly tend to retire before the withdrawal age which in many countries is set to 65. The purpose of this research is to identify which factors affect individual's average age at which they tend to retire. This is conducted by the use of a cross-sectional analysis based upon the 36 member countries of OECD where data has been collected from the year 2016. By the use of an Ordinary Least Squares method, results show that factors such as education, old-age dependency ratio, and average salaries are significant factors which all impacts the average retirement age negatively.

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# 1 Introduction

Continuously ageing populations across the world have recently become a more urgent problem with greater cohorts entering retirement each year. Many developed countries are facing increasing life expectancies and decreasing fertility rates (Gapminder, 2018a-b), altering the ratio of older to younger cohorts in the labour force. Even though workers aged 55-64 have on average experienced an increase in employment over the past years, the average retirement age has in many developed countries declined between the years 1970 and 2000 (OECD, 2017b). This creates a greater need for workers to stay longer in the workforce and continue to contribute to the economic growth of countries. Prettnner and Prskawetz (2010) examine Solow's (1956) model of economic growth and introduce the old-age dependency ratio as a measure of an ageing population and a factor of economic growth. OECD (2017b) explains the old-age dependency ratio as the ratio of elderly to working age population and is defined as people aged 65 and over per 100 people of working age, where working age are those aged between 20 and 64 years old. Factors that influence and affect the dependency ratio are mortality rates, fertility rates and migration flows. OECD (2017b) gives further insight into how the increase in population ageing has urged countries to perform major pension reforms and upgrade their pension schemes in the past years.

The changes in population structures have affected the financial sustainability and adequacy of pension systems. Many developed countries have pension systems that are based on the assumption that all individuals retire around the age of 65. This is however not realistic nor sustainable with the current trends of ageing. If retirement ages remain constant and life expectancy continues to increase, individuals will spend more time in retirement. This coupled with low fertility rates and fewer individuals entering the workforce urges for continuous pension system reforms (OECD, 2017b). Another factor that supports this is the net replacement rate which is projected to decline (European Commission, 2015). This reflects the individual's disposable income and is determined by factors such as the size of the labour force, average salaries, and size of retiring cohorts, all affected negatively by population ageing. To improve the negative projections, policymakers would have to boost labour force participation amongst older workers through financial and social incentives (OECD, 2017b).

The purpose of this study is to investigate which factors, and to what extent, they affect the average retirement age in developed countries. These factors include, but are not limited to, pension replacement rates, working conditions, education, and salaries. By investigating these factors, this paper hopes to provide a foundation for policymakers in prolonging working life and boosting the labour force. Previous research within this field have analysed current pension systems as well as factors which help individuals to prepare for retirement. However, no previous research has further investigated which factors influence the average retirement age in developed countries, which is what we hope to contribute with through our thesis.

The thesis will use previous studies as well as theories in order to provide an understanding of the basic concepts regarding pension systems and retirement patterns. A major key contribution in previous research is the OECD (2017b) report *Pensions at a Glance 2017*, where many concepts regarding retirement are addressed which are further used in this thesis. Authors Barr & Diamond (2006) further explain the composition of pension systems, which is a major determinant in deciding when to exit the labour force. The Transamerica Institute (2016) gives insight on the positive impact education has on retirement readiness and decision making throughout working life, in order to ensure pension adequacy. Humphrey et al. (2003) discuss early retirement and the problem of solely relying on a public pension plan.

The thesis will use a cross-sectional sample of 36 developed OECD member states worldwide (OECD, 2019) with data from the OECD Statistics database (OECD, n.d). The economic and demographic similarities among the developed countries make them suitable for comparison in terms of working patterns and retirement of workers. Moreover, developed countries with greater economic resources are better equipped to measure and provide relevant data compared to less developed countries. Using a sample of developed OECD countries will therefore not only ease the data collection process but also provide a more solid ground for result interpretation and justified conclusions. The data collected will be regressed with average retirement age as the dependent variable, testing the various factors as independent variables through an Ordinary Least Squares method.

Results from the regression conclude that there are many factors which affects the average retirement age in OECD. The factors that showed significance were old-age dependency ratio, average salaries, net-pension replacement rates and education. Most of all, the decision to leave the labour force is highly dependent on how well prepared an individual is for retirement, considering that preparing for retirement is a process which take time. Being prepared for

retirement highly depends on the type of pension plan an individual hold, where the optimal is to have both a public and a private pension plan. The factor which is believed to have the greatest impact on retirement readiness is the level of educational attainment. Higher education is believed to give greater opportunities to access a higher level of occupational positions, which in turn can result in higher salaries and give opportunity to private pension accumulations.

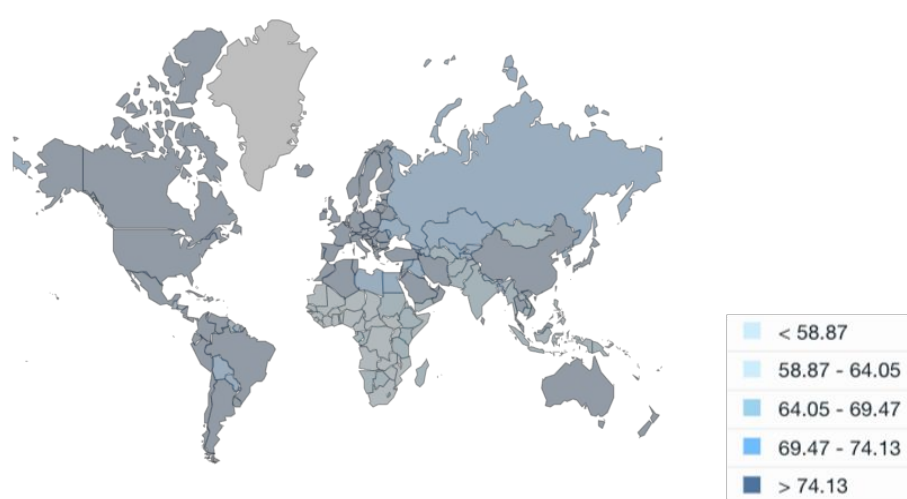
For policy makers, the challenge is how to create an attractive labour force in order to maintain economic growth and encourage older individuals to postpone retirement. This can, for example, be done by offering part-time work solutions in combination with retirement. Another solution is to increase the level of work satisfaction of older individuals, where improvements can be made by offering flexible working hours, the opportunity to work from home and a change in work tasks which can be challenging at an older age.

## 2 Background

The purpose of this section is to provide the reader with a background to increasing life expectancies and the consequences of this, as well as an introduction to the various pension systems that are in place within the OECD member states.

### 2.1 Life expectancy

Health conditions and life expectancy has increased substantially over the past decades for developed countries (Anxo et al., 2017). As Figure 1 shows, the average life expectancy in the world is well above 70 years in many regions, and in only 50 years the average life expectancy has increased from 52 to 72 years (The World Bank, 2019a). We are approaching a scenario in which, for the first time in history, there will be fewer younger people than older people in the world (WHO, 2010). According to findings from the United Nations World Population Prospects (2017), the total elderly share of the population aged 60 and above is projected to double by year 2050 and triple by year 2100. Looking at the more developed OECD countries, we can see that the average life expectancy is currently 79 years (The World Bank, 2019b), showing an even more severe ageing problem for these countries compared to the rest of the world. The elderly share of the population, individuals aged 65 and over, averaged at 17.45% for all developed countries in 2017, ranging from 6.9% in Mexico to 27% in Japan (The World Bank, 2019c).



*Figure 1. Life expectancy at birth (The World Bank, 2019a).*



Increasing life expectancies and healthier living conditions thus enables individuals to work longer compared to fifty years ago. Despite this, the labour force participation has decreased with about 4% globally over the past 25 years (The World Bank, 2018) and the dependency ratio has more than doubled in 50 years (The World Bank, 2017). The most severe dependency ratios changes are seen in Greece and Japan where the ratios have multiplied by 2.9 and 5.1 times since 1960. If we compare the average elderly dependency ratio for developed countries, 26, to that of the world, 13, it can clearly be seen that developed countries are more far-gone in population ageing and therefore in need of rapid and effective solutions to increase their labour forces (The World Bank, 2017). These solutions should aim at increase the working life for individuals, where a solution could be that older individuals can be able to choose tasks which are less demanding. Another solution could be to focus on senior entrepreneurship which has proven to create more independence for individuals, as it allows them to create more jobs for themselves and others. This gives more freedom for older individuals to determine their working conditions while they still contribute to the labour force (Isele & Rogoff, 2014). However, all solutions should not solely be focused on retaining older individuals in the work force, but could also be aimed to motivate younger individuals to take part of the work force.

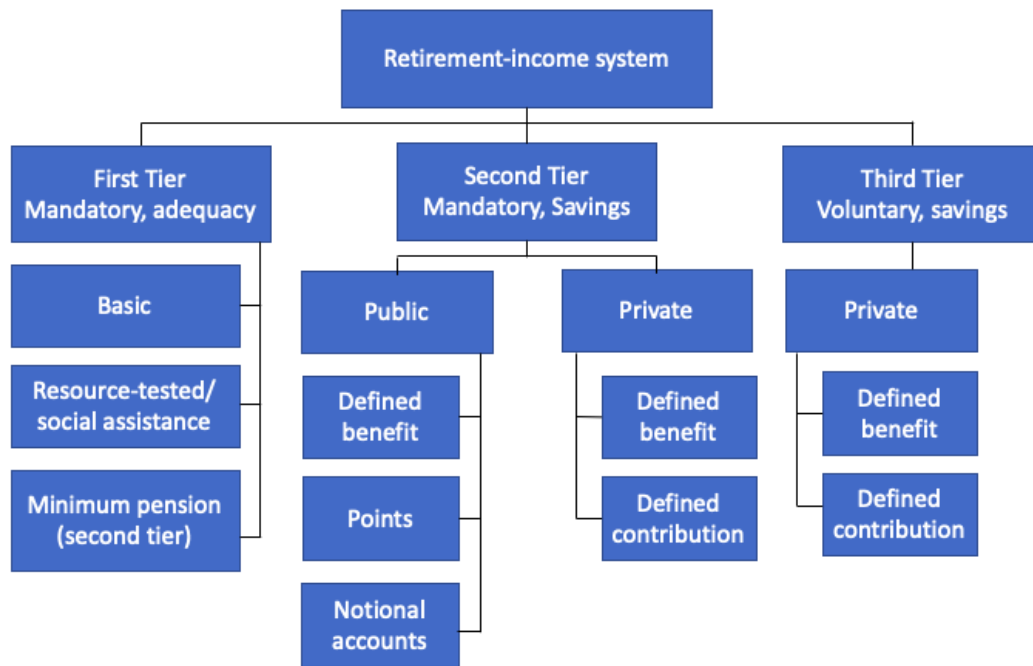
## **2.2 Pension systems**

The structure of work at older ages and the pathway to retirement look different among developed countries. Beehr (2014) describes retirement as an ongoing process rather than something which occurs at a single point in people's lives. Nicholas Barr and Peter Diamond (2006) define a pension system as income security at old age based on two components, a mechanism for consumption smoothing and a mean of insurance when one enters retirement. These two components are important to individuals since the reason we save today is to be able to consume more in the future, in this case during retirement. The level of uncertainty is according to Barr and Diamond (2006) also something that encourages individuals to keep on saving and preparing for retirement. In their study, they present and discuss various different constellations of pension systems and how they are arranged. The types of pensions that the authors bring up are fully-funded, partially funded and pay-as-you-go pensions. The fully-funded pension plans are contributions which have been built up over a period of time in a fund, and are paid out when individuals are in retirement. This can be seen as being based on savings which have been invested in financial assets, accumulating over time. The pay-as-you-go

pension plan is organized and run by the state, where it is the current working population who funds the retiree's pension plans through taxes collected by the state. Partially-funded plans are a continuity between the two previously mentioned plans (Barr & Diamond, 2006). The most common pension plan used in OECD depends on if one holds a public- or private pension plan. Defined benefit scheme is most common among public pension plans and defined contribution scheme is the most used in private pension plans (OECD, 2017b).

OECD (2017b) explains the basic structure of a pension system and the various compositions of private- and public pension plans. It is represented in Figure 2, where the pension system is divided into different tiers. Each country designs their own pension system in order to prevent individuals from ending up in poverty when entering retirement. The first tier includes a basic pension scheme or a minimum pension scheme, which is present in the majority of the members in OECD. It provides individuals with a minimum standard of living, and is a mandatory part of the system. However, individuals cannot solely rely on the state to ensure pension income. This is why individuals have their own responsibility to save up for retirement, as represented by the second and third tier (OECD, 2017b).

There are several different pension schemes present in the OECD countries, where the most common ones are defined benefit scheme and defined contributions scheme. The defined benefit scheme is when the retirement income is based on the number of years that an individual has contributed with in the workforce, as well as individual earnings. Whereas the defined contributions scheme is when each individual contributes with funds during their time in the workforce. These contributions and its investments are converted into pension-income and later paid out during retirement. Finally, individuals are able to further secure their retirement income by voluntary contributions, which is the third tier. This is where private savings are of importance, and the individuals own responsibility is essential (OECD, 2017b).



*Figure 2. A representation of the composition of pension systems within the OECD, where defined benefit scheme, defined contribution scheme, fully funded-, partially funded- and pay-as-you-go plans are the most common pension plans across the OECD (OECD, 2017b).*

Understanding pension systems and how they are organized can be a complex matter, considering the different variations that exist across the world. Most pension systems are as mentioned composed of public and private pensions (OECD, 2017b). Contributions made by the state largely influence the income security for retirees, examples being the opportunities to part-time jobs and contributions to public pension fund assets. The contributions made by the state generally consist of about one-fourth to one-third of the total public expenditure in these countries. There have been both increases and reductions in this share among the countries, where reductions have highlighted the importance of occupational and private pension expenditures (OECD, 2017b). The level of mandatory pension contributions, contributions to the pension system made by each worker in the labour force, vary among the OECD member states. Countries with higher pension contributions often have higher pension benefits or longer retirement durations, compared to countries with lower contributions (OECD, 2017b).

- Role of GDP level/growth

Most countries encourage private pensions while some have even made it mandatory in order to counteract the reductions in public pension expenditure (OECD, 2017b). Private pension plans highly affect the average retirement age, since these give individuals more freedom to

decide when to enter retirement, compared to solely relying on public pension plans (Humphrey et al., 2003). Hence, it is important for this paper to comprehend how a pension system can be composed, and that it lies in each individual's interest to prepare for a good life after exiting the labour force.

### **2.3 Average retirement age**

Continued population ageing coupled with developments in work characteristics has put pressure on the financial sustainability and retirement adequacy of pension systems among the OECD countries (OECD, 2017b). Larger retirement cohorts have shifted the distribution of resources, increasing the risk of old-age inequality. These challenges urge for extensive pension reforms where various measures can be taken to improve the sustainability of pension systems. Public contributions to pension systems can be raised, pension benefits can be lowered and taxes on old-age income can be decreased to encourage old workers to stay in the workforce. While these measures might put pressure on retirement adequacy, raising the retirement age seems like a good solution as this increases labour force participation of older workers and helps keep the pension system intact. (OECD, 2017b)

Many OECD countries have introduced pension reforms to improve their pension systems, these reforms have however become fewer and more widespread over the past years. During the past years, multiple OECD countries have taken action to gradually raise retirement ages. Denmark will increase their retirement to 68 in 2030 with gradual steps while Finland has introduced a three month stepwise increase from 63 to 65 years. Based on these and various other legislative changes, the normal retirement age in OECD countries will increase with 1.5 years for men and 2.1 years for women. This results in an average retirement age of about 66 years for the upcoming years, ranging from 59 years in Turkey to 60 years in Luxembourg and 74 years in Denmark. (OECD, 2017b)

Raising the retirement age has different potential outcomes for the various pension systems that the OECD member states have adopted. In the defined benefit system, the financial balance of the pension system tends to improve as contributions are increased and total pension expenditure is lowered due to shorter retirements. The defined contribution system does not experience the same problems with financial sustainability but since increasing life

expectancies tends to reduce pension income levels and puts pressure on public finance, raising the retirement age could be a solution to this. (OECD, 2017b)

There have also been reforms regarding early retirement in the OECD countries. Between the year 2002 and 2016, average early retirement ages increased by 14 months. Comparing this to the mere 8 month increase in normal retirement age for the same time period, the gap between early and normal retirement has narrowed. This gap will due to legislation remain constant in the near future, with the exception of some OECD countries in which reforms are still being finalised. Even if the size of the gap remains the same for some time, both early and normal retirement ages are expected to rise because of policies being implemented which links retirement to life expectancy. If changes in retirement ages are made in accordance with the projected increases in life expectancy, the normal retirement for entrants to the labour markets today in Italy and the Netherlands would be above 70 within 50 years (OECD, 2017b).

### **3 Theoretical framework**

The challenge of maintaining attractiveness in the labour market goes beyond the increasing longevity and lower fertility rates (Onder & Pestieau, 2014). There are far more factors and variables which may be underlying reasons and therefore contribute to why elderly decide to leave the labour force prior to the withdrawal age. Our research will be examined with the help of previous research and studies within the field, to get a better understanding of the relevant concepts in order to justify any conclusions based upon results from the empirical analysis. The following sections will lay the foundation for the empirical model and the variables of interest.

#### **3.1 Pension Replacement Rates**

Most countries have pension schemes in place to ensure that workers will have a source of income when entering retirement. Pension replacement rates are often used to compare pension entitlements to final earnings before exiting the workforce. As explained by OECD (2017b), pension replacement rates are used to measure pension income adequacy and the efficiency of the pension system.

While gross pension replacement rates reflect the design of the pension system, net pension replacement rates reflect the individual's disposable income when entering retirement (OECD, 2017b; Barr & Diamond, 2006). Because of this, net replacement rates have a greater impact on the individual's decision to exit the labour force and are therefore considered important for this paper. These will be included as a variable in the regression model to help reflect the financial setting of retirement decisions.

In some OECD countries, individuals are able to follow the development of their future pension benefits and are able to make informed decisions of how long they want to continue working (Swedish Pension Agency, 2019). Palmer (2000) shows how an individual's replacement rate increase with the number of years present in the labour force, which could encourage workers who wish to increase their pension benefits to continue working. The author presents evidence that individual replacement rate can increase from 35% at 62 years old, to 50% at 68 years old (Palmer, 2000). Improving replacement rates are part of the default contribution rate mechanism that has been introduced in some OECD countries (OECD, 2018b). These are meant to simplify the decision of pension plans for individuals and work as automatic enrolment contributions

until individuals opt to exit their pension plan. Changing the default option to participate in pension schemes instead of having individuals signing up to be part of the pension system has increased pension system coverage. These changes have currently been implemented in eight OECD countries both for self-employed workers and employees.<sup>1</sup> The objective is to increase pension scheme participation among workers to increase coverage, maintain pension system sustainability and help ensure retirement adequacy (OECD, 2018b).

Chybalski and Marcinkiewicz (2015) argue that pension replacement rates only cover one dimension of pensions - consumption smoothing - and highlight another relevant factor of retirement, hindering pension income inadequacy. The authors address the problem of how pension adequacy is measured, which is now solely based on the individual's income over a lifetime. This creates a problem as it does not consider the individual's consumption level, which if taken into account, would give a more accurate view of the pension adequacy (Chybalski & Marcinkiewicz, 2015).

### **3.2 Education**

The structure of work at older ages and the pathway to retirement look different among developed countries. There are some countries in which high-educated prime-age workers work more compared to low-educated workers. When reaching older ages close to retirement, multiple developed countries experience that low-educated workers work more compared to high-educated individuals. This suggests that high-educated workers either reduce their working hours more quickly or enter full retirement at an earlier age compared to low-educated workers (OECD, 2017b). The impact of education is present when it comes to determining how well prepared an individual is for retirement. Since low levels of financial knowledge contribute to the problem of irrational retirement decisions, measures have been adopted by policy makers to improve the financial knowledge of individuals and sustainability of pension systems. These measures include financial education initiatives and aim to help workers make more informed retirement decisions throughout their working lives to ensure retirement adequacy. The OECD International Network on Financial Education has developed guidelines and frameworks to promote financial education and improve financial well-being of individuals. (OECD 2018b)

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<sup>1</sup> Canada, Chile (self-employed workers). Germany, Italy, New Zealand, Turkey, United Kingdom and the United states (employees)

The Transamerica Institute (2016) presents evidence that people who have been attending college in the U.S are more ready to enter retirement. This is as they have greater access to retirement benefits and also contribute more than non-college students, which increases their lifetime savings. Hence, being educated gives financial stability which also affects one's retirement income. Another important aspect of the survey is that individuals who had a higher level of educational attainment also believed they would live longer. Hence, the level of education is believed to be positively related to retiring more comfortably (Transamerica Institute, 2016).

Another aspect of education is the ability to reach a higher level of occupation, something which Humphrey et al. (2003) address as a great factor of early retirement. In their study they found evidence of early retirement to have characteristics of similar nature, such as having a degree, having a higher-level occupation such as managerial or professional occupation, and the last characteristics were that many had their own private pension plan (Humphrey et al., 2003). Education indicates some form of financial stability, compared to individuals with no education at all. This indicates a greater ability for individuals' to be able to retire prior to the withdrawal age. The ability to educate oneself on financial sustainability is highly dependent on the institutional setting in a country and the opportunities that exist. The availability of general education as well as financial education has a great impact on retirement readiness and helps to maintain a well-functioning pension system (OECD, 2018b). Hence, the institutional settings in a country highly affects average retirement ages as well as the individual's ability to prepare for retirement. Based on this, the regression model will include a level of education attainment which corresponds to a common financial knowledge across all OECD member states.

### **3.3 Retirement ages**

Pension policies and norms differ among the OECD member states. Some OECD countries allow workers to withdraw from their pension plans before the normal retirement age, at the so called withdrawal age. Other countries have introduced mandatory retirement ages, allowing employers to set an age at which employees have to retire (OECD, 2017b). Considering the different compositions of national pension systems, it is hard to determine universal measurements for withdrawal and mandatory retirement ages.

Mandatory retirement ages give employers the option to terminate contracts of older workers,



even though the workers might want to remain in the workforce. Seven OECD member states<sup>2</sup> have abolished mandatory retirement while the rest still have some form of it present in their current pension systems. In those OECD countries where mandatory retirement ages still exist, new or extended employment contracts then have to be constructed to allow the worker to remain in the workplace. This is something that hinders older workers from working beyond normal retirement ages even though they might be physically able to do so (OECD, 2017b).

OECD (2017b) investigate the different variations in withdrawal ages among the member states, as well as the differences between men and women. Some countries do not allow early retirement in any mandatory part of the pension system, while other countries allow early retirement in the private or earnings-related pension systems. In Sweden for example, workers can access their earnings-related pensions from age 61 but do not receive their public pension before age of 65 (OECD, 2017b). In 2016, early retirement ages spanned from 50 to 65 years across the OECD countries whereas the normal retirement age spanned from 58 to 67 years. Some countries show no difference between the early retirement age and the normal retirement age but in most countries they differ by a few years. The countries with higher normal retirement ages also display a higher withdrawal age, suggesting a positive relationship between the two. Worth noticing however is that a lower early retirement age does not always result in a lower normal retirement age, both Australia and Japan have a normal retirement age of 65 while their early retirement ages equals 55 and 60 respectively (OECD, 2017b). Considering that the withdrawal age is merely a benchmark for when workers can start taking out their pension, it cannot operate as the sole determinant for the actual retirement age. The paper highlights private pension plans as another major factor determining the possible pension age for workers (OECD, 2017b).

Humphrey et al. (2003) give further insight into individual pension plans and how these affect the retirement age. In their empirical study of workers aged 50-69, the authors found that 40 percent expect to retire at the normal retirement age while 25 percent expected to retire earlier. The authors found that the people most prominent to expect early retirement to be those highly educated, those in higher professional positions and those with some form of private pension plan, whether in a scheme or through private savings. They also found that men were more likely than women to be expecting to retire before the normal retirement age (Humphrey et al.,

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<sup>2</sup> These countries are Poland, Denmark, United Kingdom, Australia, Canada, New Zealand and the United States

2003).

The age of retirement age represents the institutional setting in a country, considering it displays how well-functioning a pension system is as well as individual's ability to enter retirement. A vital question for policy makers who wish to extend working lives is therefore how to construct restrictions and flexibilities in the pension system to increase the labour force participation of older workers. Offering a greater flexibility might motivate workers to continue working part-time while receiving some pension benefits while it could also encourage those who currently retire late to decrease their working hours. Some countries have already introduced part-time retirement in which older workers are encouraged to continue working part-time while receiving some pension benefits. This mechanism is in place to further encourage older workers to remain in the workforce and help postpone full retirement to keep the pension system intact with growing retirement cohorts (OECD, 2017b).

### **3.4 Work characteristics**

A highly important aspect when it comes to retirement decision is the working conditions of elderly. As Böckerman and Ilmakunnas (2017) states, being unsatisfied at work made 61.8 percent consider entering retirement prior to the withdrawal age. Among individuals satisfied at work, only 21 percent thought about entering retirement prior to the withdrawal age. The authors continue to prove that job satisfaction and retirement age are related considering it may induce individuals to retire earlier than if one is satisfied with their work (Böckerman & Ilmakunnas, 2017).

As del Mar Salinas-Jiménez, Artés and Salinas-Jiménez (2010) addresses, there are many factors which can work as motivation and increase our satisfaction with life. Two of those factors which are believed to be positively related to greater satisfaction of life is income and health (del Mar Salinas-Jiménez, Artés & Salinas-Jiménez, 2010). These factors give us an indication of why an individual would keep on working, or not keep on working. Since a greater level of income can help increase retirement income it is believed to, to a certain extent, improve life satisfaction and standard of living. OECD (2017b) addresses the fact that income levels of older people are on average lower than the rest of the population. In 2014, Estonia had the lowest income of older people with a value of 66.5 percent while France had the highest value of 103.4 per cent for elderly aged over 65 years old (OECD, 2017b). However, measuring

working characteristics and their impact on the retirement of elderly is difficult. Due to this limitation, there won't be a variable which represents working characteristics in the regression. However, the impact of working characteristics will be taken into consideration when interpreting the results and drawing conclusions.

A variable which will be taken into account in the regression is the average income of the working age population. This will be an indicator of an individual's financial stability as well as the financial setting in a country, and hopefully give an understanding if there is a relationship between average income and average retirement ages. The level of financial stability has proven to be a major determinant when it comes to the age at which one exists the labour force, considering it highly affects the choice of pension plan. This in turn translates working income and gives a view of pension adequacy (Barr & Diamond, 2006; Humphrey et al., 2003). However, there is no clear indication of how a higher income affects the average retirement age. What can be noted however, is that an increase in income often leads to an increase in access to retirement benefits which in turn can affect the average retirement age negatively (Transamerica Institute, 2016). As most pension systems within the OECD also encourage private pension plans or private pension savings (OECD, 2017b), higher levels of income will help increase the opportunities to participate in these.

### **3.5 Health conditions**

Increases in life expectancies source from health improvements during the industrialization, such as personal hygiene and developments of public health systems (Cutler et al., 2006; Soares, 2007). Anxo et al. (2017) discuss how overall improvements in life expectancies have resulted in better health for elderly, more precisely individuals above age 65. They argue that these elderly therefore have a higher work capacity compared to previously and a larger share of elderly should be able to work after the "natural" age of retirement, previously at 65 years for developed countries. Current trends show that the natural retirement age seems to move towards 68 for the cohorts born after the Second World War. Deciding at which age to retire can now be argued to depend more on the health of the individual worker as compared to a few decades ago (Anxo et al., 2017). Since the old-age dependency ratio reflects the proportion of elderly to the working age population in a country (OECD, 2017b), this measurement is used to capture the demographic shifts that comes with improved health of elderly.

Albin, Bodin, and Wadensjö (2017) highlight that health affects retirement ages and is one of the major factors behind early retirement. Health improvements and increased longevity are therefore of importance to ensure that workers are able to work longer. They conclude that workability is strongly correlated to the age at which workers exit the labour force. Hence, working conditions for older workers must, therefore, be adjusted according to their abilities in order to raise average retirement ages (Albin et al., 2017). OECD (2018b) further investigate the linkage between pension policies and demographic changes. They found that both Sweden and Germany have adopted balancing mechanism meant to adjust benefit levels according to developments in longevity. This has been implemented to help maintain a sustainable pension system evolves with the increased well-being of older workers and encourages further participation in the labour force. Life expectancy is therefore a vital measurement in analysing pension systems and deciding on pension policies to boost labour force participation of older workers (OECD, 2018b).

## **4 Methodology**

In this section of the thesis, we will present the data set used in the model, the empirical model and the econometric methods which will help us further explain our results. In order for the reader to fully understand the scope of the model, we will explain and discuss the variables in terms of relevance, source of data and also the expected effect the data will have on our dependent variable. For the reader to understand the mechanisms of retirement, the variables will be grouped accordingly to the mechanism they are thought to represent.

### **4.1 Data and summary statistics**

In order to obtain a better understanding of what factors might affect the average retirement age, the following section will include a brief explanation of the chosen variables for this study. The sample consists of 36 OECD countries, displayed in Table 1 along with early and normal retirement ages for 2016. This gives the reader an indication of the current retirement ages across the OECD. The data used for the regression model was gathered from the OECD Statistics Database (OECD, n.d.), with 2016 as the base year as that is the latest year with data available. The motivation for using a cross-sectional sample is as the data for the various independent variable vary greatly over time. To be able to spot trends, one would have to use a very large time span that dates back 30 to 50 years. Due to the limitation in data, this was not possible as the sample would experience many fall-outs for many variables. Some variables lacked complete information for the year 2016, the data for these have instead been taken from other years. Table 2 presents the various variables and descriptive statistics for their respective data sets.

*Table 1. Earliest and normal retirement ages in 2016 (OECD, 2017b).*

	Earliest	Normal		Earliest	Normal
Australia	55	65	Korea	57	61
Austria	59.9	60	Latvia	60.75	62.75
Belgium	62	65	Lithuania		
Canada	60	65	Luxembourg	60	60
Chile		60	Mexico	60	65
Czech Republic	60	62.3	Netherlands		65.5
Denmark	60	65	New Zealand		65
Estonia	60	63	Norway	62	67
Finland	63	65	Poland		61
France	56.7	61.6	Portugal	65	66.2
Germany	65	65	Slovak Republic		58.25
Greece	62	62	Slovenia		59.3
Hungary		63	Spain	61	65
Iceland	65	67	Sweden	61	65
Ireland	50	66	Switzerland	62	64
Israel		62	Turkey		58
Italy	61.8	65.6	United Kingdom		63
Japan	60	65	United States	62	65

#### **4.1.1 Dependent variable**

##### **Average retirement age (AVEAGE)**

The dependent variable of this study is the Average retirement age for all countries within the OECD for the year 2016. It is measured as the sum of all individuals age who entered retirement

in 2016 and then divided by the total number of individuals who entered retirement in 2016 (OECD, 2017b). The average retirement age has a mean of 65.025 and a median of 64.05, suggesting that many developed countries have a current retirement age below 65. The range of retirement ages during the year 2016 was between 60.3 and 72.2, showing that there is still a large difference between the various developed countries. Worth noticing here is that Japan (70.2) only came in fourth place, after both Korea (72.2), Mexico (71.6), and Chile (71.3).

#### **4.1.2 Financial settings**

##### **Average Salaries (AVESAL)**

One of the independent variables is Average salaries for the working age population, **representing the financial wellbeing of workers who are present in the labour force**. The variable is measured during 2017 in constant prices at 2017 USD PPPs. This variable has a large spread around the mean \$39636.139, ranging from \$15407 to \$62370. The median \$41417.5 suggests that a majority of the sampled countries have average salaries above the mean. Considering that a greater level of income will create greater financial stability for the individual, it is believed that this variable will have a negative effect on the Average Retirement Age.

##### **Net Pension Replacement Rates (PRR)**

The Net Pension Replacement rate is the total net individual pension entitlement divided by the net earned income per individual. The variable is a ratio and shows the relationship between how an individuals' income transfers into pension entitlements.

The pension replacement rates for developed countries is over 60% with a median of around 58%, pointing towards a good spread in the sample. The standard deviation of 0.2 is fairly large compared to the size of the data, which is also reflected in the large spread. The values range from 28.65% in Mexico to 106% in the Netherlands, suggesting that there is a great difference in retirement safety and adequacy among developed countries. Considering that this ratio represents an individual's' pension entitlements, if this variable increases it is believed that it will have a negative impact on the dependent variable.

### **4.1.3 Institutional settings**

#### **Education (EDUC)**

The variable education is a ratio which measures how many individuals in a country have completed upper secondary education, where secondary education usually begins when individuals are between 15 or 16 years of age (OECD, 2018a). The variable is represented in the regression model as the number of individuals that have attained upper secondary education compared to the total population. Education varies greatly between the countries in the sample. Education attainment levels range from 19.3% in Turkey to 69.9% in the Czech Republic. With an average of 43.0% and a median of 41.9%, it can, however, be seen that a majority of the developed countries have relatively high levels of education attainment amongst their populations. The data for this variable is taken from the year 2017 as it was collected for the 2017 Education at a Glance report by OECD (2017a). Considering previous research regarding education, it is believed that this variable will have a negative effect on the dependent variable. This is because higher levels of education should increase retirement readiness as well as provide opportunities to access higher occupational levels, which in turn will help improve retirement adequacy and provide more freedom in deciding when to retire.

#### **Pension fund assets as share of GDP (PFASS)**

This variable represents the total amount of assets located in pension funds, in relation to the country's GDP. Based on this, individuals can make a decision on when to retire and how life in retirement will look like. Pension fund assets as a share of GDP has a large range from a low 0.007 to a high of 2.09. The value 0.007 represents Italy and suggests that their pension fund assets are very low compared to the OECD average of 0.511. The median 0.165 shows that a majority of the countries have values far below the average and the standard deviation of 0.598 suggests a widespread in the values. An increasing Pension Fund Assets in relation to a country's GDP is believed to create greater financial stability for individuals in retirement. Hence, we believe that this variable will negatively impact the dependent variable, as the opposite would indicate problems.

#### **Withdrawal age (WITAGE)**

This variable differs from the dependent variable as it represents the current state pension age in the OECD countries. There is a trend in many nations that the withdrawal age will increase over the years, hence it is also believed to negatively impact the dependent variable. This



variable averaged at 64.04 which is slightly above the average retirement age. This might seem odd considering that the withdrawal age often sets the lower limit for retirement (OECD, 2017b). This could however be explained by the other retirement possibilities such as early retirement. The range 59-67, compared to the range for the retirement age, however, suggests that the withdrawal age is lower than the retirement age for many of the sampled countries.

#### **4.1.4 Demographic settings**

##### **Old-Age Dependency Ratio (DEPRAT)**

This variable measures the ratio of elderly to the working age population, where the share of elderly is aged 65 and above and the working age population is defined as individuals between the age of 20-64 (OECD, 2017b). The average values for the variable old-age dependency ratio were in the year 2016 0.262 for developed countries. Although this seems low, the range from 0.1 to 0.439 shows that the situation is far worse for some of the countries. The median 0.279 also suggests that many of the countries have a higher dependency ratio than the average. As previous studies raise the problem of the world's share of elderly compared to the working age population will increase, it is believed that this variable will negatively affect the dependent variable. Considering that an increase in this ratio indicates that a larger share of the population are above 65 years old, the probability of entering retirement increases which could affect the average retirement age.

However, what needs to be addressed is that the old-age dependency ratio will not directly affect the individual's decision to stay or leave the labour force. It is a measure which helps present the population structure, and therefore lays the foundation for what actions needs to be taken in order to maintain attractiveness in the labour force for older workers (OECD, 2017b; Onder & Pestieau, 2014).

##### **Life Expectancy at Birth (LIFEXP)**

Life expectancy at birth, representing the wellbeing and health of the population, showed an average of about 80 years for the sampled countries. Compared to the world average of 72.0 (The World Bank, 2019a), it can be shown that developed countries have much older populations than the rest of the world. The median of 81.5 years suggests that most of the countries have life expectancies even above 80 years. The range from 74.7 to 84.1 also suggests that all developed countries have high life expectancies compared to the rest of the world. As we are believed to live longer and longer, we also believe that this will induce individuals to

keep on working longer. Therefore, we believe that this variable will positively impact the dependent variable.

#### 4.1.5 Excluded variables

There are some variables discussed in the theory section that are not listed above but can be argued to have some effect on the dependent variable. Such variables are for example the type of occupational position, the type of pension plan an individual holds, and satisfaction at work. These variables were either difficult to measure, there was no data available or difficulties in aggregating the data. For example, occupational position is hard to measure on an aggregate level considering there is no universal measure for occupational positions. GDP growth per capita was excluded from the model due to its correlation to pension fund assets as a share of GDP, and also as PFASS was believed to better reflect the pension system in a country. An increase in GDP growth per capita does not necessarily translate to an increase in pension spending or the well-being of retirees. Therefore, these variables have been excluded from the regression model but are factors which may still affect the average retirement age.

*Table 2. Descriptive statistics*

	AVEAGE	AVESAL	DEPRAT	EDUC	LIFEXP	PFASS	PRR	WITAGE
Average	64.025	39636.139	0.262	0.430	80.630	0.511	0.630	64.041
Median	64.05	41417.5	0.279	0.419	81.5	0.1655	0.58725	65
Std. Dev	3.322	12991.047	0.066	0.120	2.581	0.598	0.213	2.0002
Highest	72.2	62370	0.439	0.699	84.1	2.09	1.06	67
Lowest	60.3	15407	0.1	0.193	74.7	0.007	0.2865	59

#### 4.2 Model

The following regression model is used to obtain a view of the relationship between average retirement age and various macroeconomic factors:

$$\text{AVEAGE}_i = \beta_0 + \beta_1 \text{AVESAL}_i + \beta_2 \text{DEPRAT}_i + \beta_3 \text{EDUC}_i + \beta_4 \text{LIFEXP}_i + \beta_5 \text{PFASS}_i + \beta_6 \text{PRR}_i + \beta_7 \text{WITAGE}_i + \mu_i$$

*(Equation 1)*

Table 3 presents the expected impact of the explanatory variables on the dependent variable, based on findings from previous literature and theory.

*Table 3. Abbreviations, definitions and expected effect of variables.*

Abbreviations	Definitions	Expected effect
AVEAGE (Y)	Average retirement age	
AVESAL	Average salaries	-
DEPRAT	Old-Age Dependency Ratio	-
EDUC	Education, completed upper secondary education	-
LIFEXP	Life expectancy at birth	+
PFASS	Pension fund assets	-
PRR	Pension Replacement Rates	-
WITAGE	Withdrawal Age	+

The average retirement age is studied for all OECD countries during the year 2016 using a cross-sectional regression analysis. Ordinary least squares (OLS) is the method chosen to perform a standard linear multiple regression model where the subscript “i” represents each sampled country. The model consists of one variable of interest AVEAGE and seven explanatory variables AVESAL, DEPRAT, EDUC, LIFEXP, PFASS, PRR and WITAGE. The model has been tested using a series of diagnostic tests to avoid the model violating the classical OLS assumptions. Considering that the model contains many independent variables, the problem of multicollinearity could be present. Therefore, correlation tests were conducted in order to ensure that results from the model are not biased or inconsistent. Other tests such as the Durbin-Watson Test and Breusch-Pagan Godfrey were conducted to ensure that no autocorrelation or heteroscedasticity was present in the model (Gujarati & Porter, 2009). The result from the Breusch-Pagan Godfrey test can be found in Appendix 1, and the test for autocorrelation in Table 6.

## 5 Empirical Analysis

The purpose of this section is to provide the reader with an analysis of the outcome of the performed regression model and other econometric tests.

### 5.1 Correlation analysis

In many regressions there are cases where the independent variables are either correlated with other independent variables, or where they are correlated to the dependent variable. This is known as the problem of multicollinearity, and commonly exists in many regression models. Considering that multicollinearity often is present in regression models, it is more about testing for the degree of multicollinearity, than testing for having no multicollinearity at all (Gujarati & Porter, 2009). When establishing the regression model, it was therefore known that multicollinearity would exist to some extent, considering the high amount of independent variables. Tests for multicollinearity was therefore conducted in order to investigate to what extent the model variables are related and to examine if this would have any major effects on the regression results. The results are presented in Table 4.

*Table 4. Results from multicollinearity test*

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
Intercept	730.7467	4068.3830	NA
AVESAL	0.0000	23.7798	2.2487
DEPRAT	73.3472	29.7241	1.7404
EDUC	19.9104	22.0613	1.5598
LIFEXP	0.0631	2289.1320	2.2782
PFASS	0.9261	3.1417	1.7931
PRR	4.6806	11.4832	1.1502
WITAGE	0.0741	1695.7870	1.6101

When interpreting the values in the above table, the Centered VIF should be below close to 0 for all variables to ensure low multicollinearity. A value of 10 indicates high multicollinearity (Gujarati & Porter, 2009) but by looking at the results we can conclude that none of the independent variables suffers from this problem. Since all values are above 0 we can, however,

assume that there is some multicollinearity among the variables but not enough to have a serious effect on the regression results.

For regression models containing multiple independent variables, it is also important to assess the level of correlation between them. This is done through a correlation matrix in which the results show how much each variable is being explained by another, holding all other variables constant (Gujarati & Porter, 2009). Results are displayed in Table 5.

*Table 5. Correlation Matrix*

	AVEAGE	AVESAL	DEPRAT	EDUC	LIFEXP	PFASS	PRR	WITAGE
AVEAGE	1							
AVESAL	-0.074	1						
DEPRAT	-0.387	0.047	1					
EDUC	-0.438	-0.280	0.317	1				
LIFEXP	0.078	0.627	0.325	-0.301	1			
PFASS	0.193	0.524	0.027	-0.194	0.303	1		
PRR	-0.394	0.115	0.117	-0.048	0.008	0.004	1	
WITAGE	0.289	0.171	0.224	-0.199	0.197	0.477	-0.180	1

As the results show, there is an overall low level of correlation between the independent variables. There are however two values that are worth noticing, 0.627 represents the relationship between AVESAL and LIFEXP while 0.524 shows the correlation between AVESAL and PFASS. Due to these values being relatively higher than other values, two additional regression models were constructed, one excluding the variable AVESAL and one excluding LIFEXP. The results from these can be viewed in Appendix 1, tables 7 & 8. As can be seen, both regression models received lower  $R^2$  values than the original model, resulting in the decision to proceed with the original model. Relatively high correlation values are according to Gujarati & Porter (2009) not necessarily a problem for the regression model.

## 5.2 Regression results

To examine the relationship between average retirement age and the various explanatory variable, Equation 1 was used for the regression analysis. Considering that there were no fall-outs for any of the variables and that the data is fairly well distributed around the variable means as shown in Table 2. The relatively small sample of 36 can be argued to provide insufficient results combined with our small degrees of freedom of 28, however, as the sample size is still greater than our degrees of freedom we can still obtain accurate results (Anderson et al., 2017). The results from the OLS estimation are shown in Table 6.

*Table 6. Results from OLS regression*

Variables	Coefficients	Standard error
Intercept	30.0622	27.0232
AVESAL	-0.0001**	-0.00005
DEPRAT	-19.3184**	8.5643
EDUC	-7.8670*	4.4621
LIFEXP	0.3652	0.2513
PFASS	1.0515	0.9623
PRR	-4.4256**	2.1634
WITAGE	0.3184	0.2723
R <sup>2</sup>	0.5312	
Adjusted R <sup>2</sup>	0.4140	
Durbin-Watson	2.1405	
F-statistic	4.5333	
N	36	
*p-value < 0.1		
** p-value < 0.05		

The overall model is shown significant based on the F-statistic, which compared to the F-distribution table rejects the null hypothesis that the overall model is insignificant. The R<sup>2</sup> has a value of 0.53 which shows that the dependent variable is fairly highly explained by the independent variables in the model. The tests for autocorrelation, multicollinearity and

heteroscedasticity (see Appendix 1) confirm this as they did not show any signs of non-normality in the model and the results can, therefore, be viewed as consistent and unbiased. Since the model includes a relatively high amount of independent variables, the results from the multicollinearity test will be discussed further in later sections.

As presented in Table 4, the regression results show that four of the seven explanatory variables are significant. These variables – AVESAL, DEPRAT, PRR and EDUC - also turned out to have the same coefficient sign and effect as predicted. All significant variables were shown to have a negative relationship with the dependent variable AVEAGE, meaning that an increase in any of these would lead to a decrease in the average retirement age. The variable AVESAL showed a rather small explanatory effect on the dependent variable. A one unit increase in average salaries would only result in a 0.0001 unit decrease in the average retirement age. The opposite can be said for the variable DEPRAT, where a one unit increase in the dependency ratio would indicate a -19.3184 unit change in the average retirement age. As for the variables EDUC and PRR, a one unit increase in the variables would lead to a -7.8670 and -4.4256 change, respectively, in the dependent variable.

According to the results from the regression model, life expectancy, pension fund assets as a share of GDP and withdrawal ages do not have an effect on the average retirement in developed countries.

### **5.3 Analysis**

The purpose of this paper was to investigate and determine which factors affect the average retirement age in the OECD countries. Results will be analyzed according to previous theory and studies.

The result from the regression show that average salaries negatively impact the dependent variable, as supported by previous research (Transamerica Institute, 2016; del Mar Salinas-Jiménez, Artés & Salinas-Jiménez, 2010; Böckerman & Ilmakunnas, 2017; Barr & Diamond, 2006). An increase in income boosts individuals capability to prepare for retirement and the ability to retire prior to the withdrawal age increases. Individuals are, to a greater extent, able to choose between different pension schemes, have their own pension plan or able to combine pension and a part time job with a higher salary. All factors which have proven to be present in

the cases of early retirement (Barr & Diamond, 2006; Humphrey et al., 2003; OECD, 2017b). However, an increase in income can increase the level of work satisfaction, which can induce individuals to keep on working. But, being satisfied with your work isn't limited to your salary, and previous studies prove that being unsatisfied increases chances of retiring prior to the withdrawal age (Böckerman & Ilmakunnas, 2017).

The results from the regression model proved that the educational attainment level an individual hold is negatively related to the average retirement age. Previous studies support this as a higher level of education will make individuals enter retirement earlier than low-educated workers (OECD, 2017b; Transamerica Institute, 2016). Having a higher level of education increases individuals' opportunities to access a higher level of occupational positions, a higher salary and therefore greater access to retirement benefits (Humphrey et al., 2003). As supported by Transamerica Institute (2016), being educated increases the individual's retirement readiness. However, this creates a problem for policy makers as they have to find ways to maintain high-educated workers in the labour force for a longer period of time. The issue lies in the ability to ensure an attractive labour force and to establish a preference to keep on working, rather than entering retirement. However, it may be a difficult task considering that high-educated workers most likely have private pension plans and can decide for themselves when to retire. Instead, it may be a more likely debate to raise the withdrawal age in order to maintain high-educated workers in the labour force.

The old-age dependency ratio proved to be significant in the regression with a negative relationship to the dependent variable. The negative sign of the variable displays that an increase in the variable, will decrease the average retirement age. This relationship is self-explanatory considering that individuals aged 65 and over, are also believed to either be in retirement or enter retirement at that age. Hence, the result further proves the importance of addressing the population structure, how it affects retirement ages and the economic growth (Prettner & Prskawetz, 2010; OECD, 2017b; Solow, 1956).

Net pension replacement rates and pension fund assets as share of GDP represent two aspects of the pension system. While pension fund assets show the involvement of the state, hence, helps determine the well-being of the pension system, the net pension replacement rate is an indicator of how well an individual has prepared for retirement. Net pension replacement rates received the same sign as predicted by the theory. This is because an increase here should give



the individual more freedom in deciding when to retire, most often resulting in an earlier exit from the labour force (Humphrey et al., 2003). As discussed by Chybalski & Marcinkiewicz (2015), net pension replacement rate can be argued to not fully represent the retirement possibilities of an individual, considering that it only represents consumption smoothing, and not pension adequacy. Since the level of disposable income is not the sole determinant of the individual's choice to retire, net pension replacement rate could be argued to not have an overall effect on the average retirement age (Chybalski & Marcinkiewicz, 2015; Barr & Diamond, 2006).

Pension fund assets as share of GDP on the other hand resulted in a positive sign, suggesting that an increase would postpone the average retirement age. The contributions made by the state help determine the well-being of the public pension system and to what extent private pension plans are needed. Higher pension fund assets could suggest a more stable public pension system, not urging for private pension plans (OECD, 2017b). Relying heavier on the public pension system instead of private pension savings often require working longer to ensure proper retirement adequacy. OECD (2017b) mention that countries with higher public pension contributions often have higher pension benefits or longer retirement durations. Pension systems with lower public contributions often encourage the importance of private pension plans to create a better balance and ensure retirement adequacy. It could therefore be argued that pension funds assets might not have an effect on average retirement ages since the regulations here are directly counteracted by changes in private pensions.

In analysing the variable life expectancy, both the regression results and theory agree that life expectancy should have a positive effect on the average retirement age. Anxo et al. (2017) argue that better health and life longevity have enabled older workers to work longer and that workability is strongly correlated to the age at which workers exit the labour force. This is supported by the increased employment of workers aged 55-64 over the past years (OECD, 2017b). Looking at the results from the regression analysis, life expectancy turned out to be statistically insignificant, despite the strong theoretical argumentation for its correlation to retirement ages. What can be discussed based on the theory presented is that increased longevity affects older workers ability to work but might not affect their decision whether to do so. The decision to exit the labour force depends on many other factors other than simply the physical ability to do so, as explained by OECD (2017b), Palmer (2000), Humphrey et al. (2003), and del Mar Salinas-Jiménez, Artés and Salinas-Jiménez (2010).

Since the withdrawal age determines from what age workers are allowed to withdraw from their pension funds (OECD, 2017b), this factor should have some effect on the average retirement age. Based on OECD (2017b), the variable withdrawal age was predicted to have a positive relationship with the dependent variable. For those OECD countries with higher normal retirement ages, the withdrawal age was also higher compared to other countries. The regression results agree with the theory presented and indicate a positive relationship between the two variables. Humphrey et al. (2003) and OECD (2017b) both bring up the importance of a private pension plan and its effect on the normal retirement age. This factor is in both papers argued to largely influence the possibility for workers to determine their retirement age. Since the withdrawal age only determines from what age workers can withdraw their pension fund assets, it could be argued to not have an actual effect on the retirement age (Humphrey et al., 2003; OECD, 2017b).

## 6 Conclusion

When it comes to the decision to leave the labour force and enter retirement, the decision highly depends on how well prepared one is for life in retirement. Considering that it is a process which takes time, workers must start preparing early in order to ensure retirement adequacy when exiting the workforce. The age at which individuals tend to retire is therefore determined by how well informed and prepared workers are for retirement. This is largely dependent on the composition of one's pension plan, which should include both a public pension plan as well as a private pension plan.

This paper investigates factors affecting the average retirement age in developed countries and how they might relate to the dependent variable. Using an ordinary least squares model, results were conducted based on a sample of the 36 OECD members for the year 2016. A highly relevant factor, which influences many other factors, is the level of educational attainment. Individuals with a higher level of educational attainment will have a greater ability to obtain a higher occupational level and increase their salaries. This will provide more funds for private pension savings that can be used to help ensure a greater level of retirement adequacy. Highly educated individuals are also argued to have a greater understanding of retirement opportunities and the importance of pension accumulation, making them better equipped to prepare for retirement.

Further research within this subject which would be of interest would be to investigate the type of pension plans in place in different countries and see how that affects the age at one decides to retire. Conducting a panel data analysis where more years are included would also be of interest, then one can display the changes and trends in population ageing and how changes in pension systems affect retirement ages. Further research could also be conducted with a greater focus on factors which affect the individual's choice to stay in the labour force, or on state level and factors which prolong the work life. Comparisons can also be made with more similarities between countries than just being developed as the case in this study.

Policymakers should continue to make the labour force attractive by offering part time solutions in combination with retirement, and maintaining a high level of work satisfaction. The level of educational attainment should always be positively enforced considering the benefits it provides, both during work life and the ability to prepare for retirement. However, the great

challenge for policy makers is therefore how to maintain highly educated workers in the labour force considering their increased ability to retire early. Private savings are of importance considering that retirees today unfortunately may face poverty when one enters retirement. The results from this paper provides an insight to what factors influences the decision to enter retirement, and when one desires to do so.

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## Appendix 1

*Table 7. Results from OLS regression without variable AVESAL*

Variables	Coefficients	Standard error
Intercept	47.3557 *	27.3122
DEPRAT	-16.2305 *	8.9408
EDUC	-7.9357	4.7263
LIFEXP	0.0607	0.2190
PFASS	0.1559	0.9169
PRR	-5.1579 **	2.2625
WITAGE	0.3685	0.2874
R <sup>2</sup>	0.4552	
Adjusted R <sup>2</sup>	0.3425	
Durbin-Watson	1.8953	
F-statistic	4.0397	
N	36	
*p-value < 0.1		
** p-value < 0.05		

*Table 8. Results from OLS regression without variable LIFEXP*

Variables	Coefficients	Standard error
Intercept	59.6312 **	18.1319
AVESAL	-0.00006	-0.00005
DEPRAT	-13.2520 *	7.6197
EDUC	-10.2470 **	4.2294
PFASS	1.0001	0.9799
PRR	-5.0144 **	2.1655
WITAGE	0.2885	0.2767
R <sup>2</sup>	0.4959	
Adjusted R <sup>2</sup>	0.3916	
Durbin-Watson	2.0522	
F-statistic	4.7548	
N	36	
*p-value < 0.1		
** p-value < 0.05		

*Table 9. Breusch-Pagan-Godfrey Heteroscedasticity test*

Breusch-Pagan-Godfrey heteroscedasticity test			
F-statistic	1.934675	Prob. F(7,28)	0.1013
Obs*R-squared	11.73583	Prob. Chi-square (7)	0.1096
Scaled explained SS	9.597566	Prob. Chi-square (7)	0.2195