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Expected Longevity – A Study of the Norwegian Pension System

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Abstract

The growing concern about the increasing age wave caused the Norwegian government to change their pension system in 2011, into a more flexible pension system. One of the reasons for this is the increase in expected longevity for every birth cohort. This paper examines how the claiming behaviour is affected by individuals' expected longevity after the implementation of the new pension system in Norway. The results reveal that having a higher expected longevity causes individuals to delay their pension claiming. However, we find no evidence that individuals will act on the knowledge about their own expected longevity in choosing when to claim pensions. Moreover, we find evidence that different socioeconomic and demographic variables cause individuals to act differently in choosing when to claim pensions. Lastly, we find that labour market participation, among those aged 62, has improved after the new pension system was introduced, creating a more mature labour force.

Keywords: Age wave, expected longevity, pension claiming behaviour, labour market participation

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1.0 Introduction

1.1 Motivation

The purpose of this paper is to examine the pension claiming behaviour of the Norwegian population in the new flexible pension system introduced in 2011. Our paper aims to discover whether expected longevity affects individuals' claiming behaviour. With a flexible pension system, there exists possibilities to combine work and pension pay-out in order to utilize the system based on ones expected longevity.

Our paper is motivated by the paper: Life expectancy and claiming behaviour in a flexible pension system written by Christian N. Brinch, Dennis Fredriksen, and Ola L. Vestad (2018). They had access to data up until 2011 for their research in pension claiming. We will use the same research method but use data ranging from 2011 - 2015. Thus, we have access to estimating the effect of expected longevity on claiming behaviour four years after the introduction of the new system. Providing deeper insight in how the new pension system has changed the claiming behaviour among the Norwegian population.

1.2 Background

There has been a growing concern among the OECD countries regarding the aging populations, resulting in unprecedented high levels of pension costs. The number of citizens in Norway aged 70 and above, amount to 12% of the Norwegian population. This figure is expected to be 21% within the year of 2060 (SSB, 2018). The fertility rate has been decreasing since 2009, and the most substantial reduction was from 2016 to 2017, where the rate went from 1,71 to 1,62 (SSB, 2018). These trends explain some of the reasons why Norway and many OECD countries are experiencing the consequence of a lower growth rate in the population (OECD.org, 2012).

Another essential demographic aspect affecting the pension cost is the expected longevity that is increasing with every birth cohort. As a consequence, the length of the retirement for an individual will last longer if he or she is born today, rather than during the 1980s. From these observations, it is fair to argue that the future labour force will decrease in size while the elderly population grows proportionally larger, consequently increasing the pension cost significantly (Whitehouse, D'addio, Chomik & Reilly, 2009).

With the old pension system in Norway (before 2011) an individual could not receive a full annual pension pay-out before reaching the age of 67. However, if the individual was part of "avtalefestet pensjon" (AFP), the individual could retire at age 62 and receive a full annual pension pay-out covered by AFP until reaching 67 years of age. After the individual turns 67 years of age, the old-age pension would cover the pension pay-out (AFP, 2018).

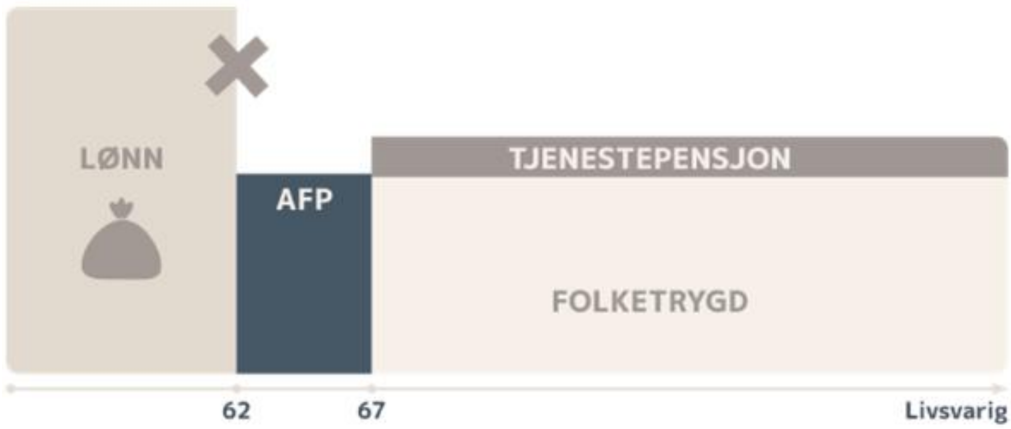


Figure 1.2.1: The old AFP system and pension system (AFP, 2018)

If Norway were to keep the old pension pay-out system, it would cause several problems for the Norwegian economy. With the increasing age wave and increasing pension costs, the mainland economy would need to cover 18% of the costs related to pensions while it today only covers roughly 9% (Regjeringen, 2018). With the old pension pay-out system, the growing age wave would have caused an increase in the taxable income of the labour workforce in order to cover the increasing costs related to pension pay-out. The old pension system would not be sustainable with the development in the Norwegian demographic structure (Regjeringen, 2018).

The critical difference between the new and the old pension system is the flexibility. In the new system an individual is free to combine both work and pension claiming without causing a reduction in the pension amount (NAV, 2018). Pensions can be claimed when a person becomes 62 years of age, but the individual can also delay claiming until the age of 75. Another essential part of the new pension system is that it will calculate the annual pension pay-out one person will have by using the life expectancy for their birth cohort. Regardless of when the average individual chooses to claim their pensions, the present value of the total pension amount will be the same. However, by choosing to delay claiming, the annual pension pay-out will be higher in the remaining years. Thus, creating an incentive to delay claiming for as long as possible for individuals with higher life expectancy. A higher annual pension pay-out will increase their present value as they have more years left to live. On the contrary, individuals with lower life expectancy will increase their present value by claiming pensions earlier.

There have also been changes to the AFP system in the private sector, introduced in 2011. In the new system, the AFP will cover a small part of the pensions lasting for the entirety of the individuals' life (figure 1.2.2), rather than to have full coverage from age 62 up to 67 as in the old system (figure 1.2.1). However, the AFP system in public sector remains unchanged, as it was before the new pension reform.

Figure 1.2.2: The new AFP system and new pension system (AFP, 2018)

There are two main motives behind the implementation of the new pension reform. One purpose has a macroeconomic perspective, and the other one has a microeconomic perspective. The macroeconomic viewpoint is to implement a more sustainable pay-out system, as well as not to punish the younger labour force with higher taxes. This is where the annually calculated pension pay-out with life expectancy for each birth cohort comes to into play.

The crucial microeconomic aspect of the new system is to create incentives for the elderly population to work for as long as possible before retiring (Regjeringen, 2018). The new system allows the individuals to claim pension regardless of their work situation. This means that they can claim pension and work at the same time. If the elderly population chooses to be part of the labour force for a longer time, it will dampen the many problems concerning the growing age wave.

1.3 Thesis walk-through

Our aim is to identify the claiming behaviour of the individuals in the new flexible pension system. We are mainly focusing on discovering if an individual with a high expected longevity will postpone their claiming and/or work for a longer period of time, compared to another individual with a lower expected longevity.

In this thesis we will firstly describe the data we have collected and how we have used the data in the analyses, especially how we have used Microdata.no in our process. Secondly, we will explain how we have filtrated the data. We also intend to add theory and give reasons for the choice of analysis.

After the data collection is described, the intention is to explain the methodology of our thesis. The key part of our analysis will be to create a model for 62-year olds expected longevity and see how this variable affects claiming behaviour. The analyses will consist of three parts. Firstly, providing a logistical regression analysis where we discover the probability of mortality during the next year. We will use the variables gender, education, wealth and residence in an urban area (Appendix 7). The regressors are filtered as dummy variables. This will be done for ages 62 up to 89.

$$Mortailty_i = \beta_0 + \beta_1 \times Gender_i + \beta_2 \times Education_i + \beta_3 \times Wealth_i + \beta_4 \times UrbanArea_i$$

We will use the different percentages for every age cohort to estimate the expected longevity. This will be a variable in the last regression. The second part of the analysis is our main regression, providing the likelihood of claiming pensions early. The independent variables are expected longevity, civil status, wage, acquisition of children, employment status and profession (Appendix 7). All of the variables are categorised as dummy variables except for expected longevity, which is the key variable in this regression. We will try to answer whether an individual with a higher expected longevity will delay pension claiming longer, and how significant the impact of the variable is on claiming behaviour.

$$EarlyClaiming_i = \beta_0 + \beta_1 \times HighLineOfWork_i + \beta_2 \times HighWage_i + \beta_3 \times CivilStatus_i + \beta_4 \times Children_i + \beta_5 \times EmploymentStatus_i + \beta_6 \times InWork_i + \beta_7 \times ExpectedLongevity_i$$

The last topic will consist of a regression analysis where the dependent variable is labour market participation. The reason for this analysis is to see whether expected longevity has an impact on labour market participation after the implementation of the new pension system. The independent variables are profession, wage, civil status, children, gender and expected longevity.

$$InWork_i = \beta_0 + \beta_1 \times HighWork_i + \beta_2 \times HighWage_i + \beta_3 \times CivilStatus_i + \beta_4 \times Children_i + \beta_5 \times Gender_i + \beta_6 \times ExpectedLongevity_i$$

The last part of our thesis will be to analyse and discuss the different results from the regression models and answer our research questions and whether the different hypotheses are correct.

2.0 Literature Review

Our literature review is going to contain all the relevant theories concerning our subject of research. This literature review will seek to give a brief overview of the most renowned and commonly accepted literature relevant to our subject of research. We will first give a brief overview of the Norwegian demographic and how it is expected to change with the new age wave. Secondly, we will give a brief overview of previous literature regarding pension claiming and identify their results on this matter.

2.1 The changing Norwegian demographic and future challenges

As mentioned shortly in the introduction, there are several challenges for the future Norwegian economy due to the age wave. This is a well-known challenge for the OECD countries where the fertility rate has decreased, and the expected longevity has increased for each generation (Whiteford & Whitehouse, 2006). The mortality rate has decreased significantly over the past hundred years in Norway. The combination of a declining fertility rate and increased life expectancy has changed the age-structure of the population. Thirty years ago, the elderly population (above 80 years of age) was roughly 105 200, but in 2006 it had increased to 215 900. The younger generation (below 20 years of age) has decreased from 31 % of the population to 26 % in 2006. The most significant population growth was the generation born after the second world war. The period between 1955-1968 was called the "baby boom period" (Amlo, 2006), contributing together with the declining fertility rate to the age wave problem.

Even though there are demographic difficulties in Norway, the problem is more severe and abrupt in the rest of Europe. Norway has several young workers and has by percentage fewer citizens in the population who are retiring in the near future. It is estimated that the Norwegian population will continue to grow up until 2020, which is not the case in the rest of Europe. These facts indicate that the demographic problem is modest in Norway relative to Europe (Østby, 2004). Another difficulty that has changed in the Norwegian working culture is the consumption of leisure. Consumption of leisure in Norway has increased in the years 1971 to 2000. It has increased by more than one hour for both genders. The decrease in working hours for men is the most significant contributor to the increase in leisure. The decrease in working hours is related to elderly men, aged 67-74, not being part of the labour force, is where the increase in leisure is the highest (Vaage, 2006).

Even though there are problems related to the age wave, there are also some researchers that provide optimistic forecasts. Vaage (2015) wrote an article stating the fact that the elderly generation is more physically active than before. 57% of men over the age of 80 are physically active three or more times a week, whereas only 37% of women have the same number of workouts. There is also an insignificant difference between early 80-year-olds and the individuals that are close to 90 years in physical activeness. Another important aspect of the health of the elderly is that they have a healthy diet. The generations above 67 years of age eat more fruit and vegetables than any other age groups. The elderly generation is better to eat regularly during the day, and nine out of ten eat breakfast and dinner every day (Kjelvik, 2006).

In 2005 there was a survey showing that 67% of elderly people (above 67 years old) describe their health as being "pretty good". Twenty years prior to this survey, it was at 57 % (Ellingsen, 2004). A healthier and more active generation will increase the expected longevity of the Norwegian population. Meaning that the elderly generation is capable of working for several more years before retiring and claiming their pensions, they also need less care at an early pension stage. Only 4% of the elderly labour workers (aged between 50-66 years) had any problem with their work tasks due to the old age (Lohne & Normann, 2006).

The changes in the Norwegian demographic is causing a growing age wave, and this will lead to a significant increase in future health care - and pension costs. Whiteford & Whitehouse (2006), stated that these demographic changes have a significant impact on public policy. Using data from OECD countries, they show that old-age pension expenditures can rise to 3-4% of gross domestic product (GDP) by the year 2050, from 7.5 % in the year 2000. Increasing pension expenditures will also affect fiscal policy in other areas. Spending on education and family benefits are expected to decrease by 1 % of GDP on average in OECD countries (Whiteford & Whitehouse, 2006).

A slowly growing labour force or a decreasing one will affect the economic growth in the country. An indirect effect will be that the labour force must pay higher taxes in order to fund the growing healthcare costs. Hence, it will impact the living standards of the individuals in the labour force (Whiteford & Whitehouse, 2006).

There are several successful responses to the different challenges regarding the age wave. Østby (2004) concludes that it is vital to establish a pension system that will adapt to the age wave. Stating that it is vital to uncover what effects small contributions such as; immigration, increased productivity among workers, decreasing unnecessary absence from work and reducing social security has on the problem of the growing age wave. This is also supported by Whiteford & Whitehouse, (2006). They argue that there must be a multidimensional response to solve the problem of the age wave and future pension costs for the OECD countries. An obvious solution to solving the demographic problem is to increase the labour force population, i.e. more tax contributors. Another important measure is to increase the employment age among the elderly. This will give a double benefit, with increased tax contribution and a reduction in individuals in need of public benefits.

Several OECD countries have already made modifications in the pension system by changing pension benefit formulas, connecting the expected longevity in pension claiming and increasing incentives for a later retirement. They further argue that it is not enough to only make changes in the public pension system. Governments should encourage women, immigrants and disabled individuals to become a part of the labour force (Whiteford & Whitehouse, 2006).

2.2 Claiming behaviour and previous findings

Claiming behaviour regarding pensions is a widely discussed theme. Using data from the American population ranging from the 1950s, Wolfe (1983) argues that individuals with higher expected mortality are more likely to claim their pensions earlier than those with lower expected mortality. Wolfe (1983) studies the individuals who have retired from the labour force and are receiving social security retirement benefits. The individuals who claim their pensions early are more prone to acquiring leisure than the acquisition of prolonged health. The result of an increase in leisure is followed by a decrease in the pensioner's income, which is correlated with the mortality rate (Wolfe, 1983). In his paper, Wolfe finds that individuals receiving their pension benefits at age 62 have a 40% higher probability of mortality, compared to those individuals claiming their pension at the age of 65. Individuals with higher expected mortality will increase their utility by claiming their pension early. Wolfe approximated the expected mortality by using variables such as personal characteristics (which was argued to be associated with greater or lesser longevity), age of an individual and the age when the pension was claimed.

Socioeconomic and demographic variables such as gender, education, marital status line of work, earnings and savings, account for some variation in claiming behaviour (Chan & Stevens, 2002). In Chan and Stevens probability regression model, using data on the American population from 1982, they find that men have a 28% probability of delaying their claiming until after the age of 63. The study also finds that having a college degree, high wage and having a white-collar occupation leads to a higher probability of delayed claiming. "Having some college education delays retirement, possibly because the more educated have more favourable working conditions." (Chan & Stevens, 2002). Whereas being married increases the probability of claiming pensions early.

Coile, Diamond, Gruber and Josten's (2001) article seeks to prove that delaying pension claiming for a period of time is optimal. They assume that there is a relationship between claiming behaviour and retirement decisions. They identify the number of months, which is the most optimal claiming delay for different individuals. Through their regression analysis|, they find that single individuals with low mortality risk, have a 23 month optimal delay period, whereas the high mortality risk individuals have a zero month optimal delay period. Apart from the aspect of mortality risk, their findings support the claim that it is more optimal to delay pension claiming. They also find that married men have a stronger incentive to delay claiming compared to single men, especially when the age gap to the man's wife is high. They conclude that "delays are optimal in a wide variety of cases and that gains are often significant" (Coile et al., 2001).

Hurd et al. (2004), analyses the relationship between mortality risk and the propensity to take earlier retirement. They distinguish between retirement and

claiming behaviour. Retiring early and claiming pensions are not necessarily the same action. Using data from the United States, they find that among those who retired at the age of 61, 91 % claim their pensions within the first year, while only 3 % delay claiming until reaching the age of 65. They also find that highly educated individuals delay claiming, which could be partly due to more favourable working conditions and more knowledge regarding personal economy (Hurd et al., 2004).
Furthermore, Hurd et al. (2004) used a Health and Retirement Study (HRS) in order to study retirement behaviour, health status, economic status and work incentives. The study had 12,652 respondents in the year 1992, where the respondents told what their chances of surviving was, between the ages of 75-85 years. This information was used to predict actual expected mortality for a person.

In the paper published by Brinch et al. (2018) they make a mortality model to estimate expected longevity at age 62 for Norwegian individuals. They used observable characteristics (education, civil status, disability history and children) as well as time and county, which was separated between men and women to establish a logistic regression analysis. This was used to estimate the expected longevity of a person. The regression analysis was simulated in the year 2010, starting with the full birth cohort of 1949. The regression is run forward year-by-year in order to simulate the probability of survival. The simulation was run 900 times to estimate expected longevity at the age of 62 years. They use this mortality model to measure to what extent expected longevity affects pension claiming. The article expects to capture individuals who claim their pensions, as well as those who claim their pensions but still have not retired yet. In their regression model, they find that men have a higher probability of claiming early, as well as lower educated individuals. Being married and employed leads to a higher probability of delaying claiming. They also find that for every year an individual is expected to live beyond the age of 62, the probability of early claiming declines with roughly 4 percentage points (Brinch et al., 2018).

2.3 Subjective life expectancy

Several factors come to play when an individual is considering their subjective life expectancy. Mirowsky & Ross (2000). stated that achieved socio-economic status affects the subjective life expectancy, where education had a clear influence. By working hard and achieving some sort of education degree will give an individual the expectation of a healthy, secure and a long future. It is the opposite for people with low education since they expect a riskier future, i.e. lower life expectancy. Another interesting statement from Mirowsky & Ross (2000) is that individuals who are hopeful in a problematic environment will anticipate living for a longer period of time than of those who have lost all hope.

Van Solinge & Henkens (2009) argue that subjective life expectancy affects an individual's retirement intention and behaviour. Higher life expectancy leads an individual to an intention to retire later. However, when it came to the actual retirement behaviour, there was no evidence of older workers with high subjective life expectancy retiring any later than of those who had a short life expectancy.

3.0 Research Questions and Hypotheses

3.1 Research Questions

This part starts with a presentation of the two main research questions, followed by four hypothesises regarding claiming behaviour and labour force participation. As mentioned earlier in the introduction, our thesis will be based on Christian N. Brinch, Dennis Fredriksen, and Ola L. Vestad (2018) article. The main objective in this thesis is to elaborate on whether individuals who claim early pension have lower expected longevity compared to individuals with higher expected longevity.

1) *How will expected longevity affect an individual's propensity to claim pensions early in the new pension system?*

2) *To what extent are individuals acting on their knowledge about their expected longevity, and how is this affecting the claiming behaviour?*

3.2 Research hypotheses

In order to give an adequate answer to our research question, we have created two possible hypotheses based on previous literatures findings and results. Our hypotheses are:

Hypothesis 1. *Individuals claiming pensions early will have lower expected longevity.*

Hypothesis 2. *Individuals will act on their knowledge about their own life expectancy in choosing when to claim their pensions.*

In addition, we wish to go more in-depth on which variables that affect an individuals' claiming behaviour. We have therefore devised a hypothesis that aims to answer whether:

Hypothesis 3. *Individuals with a higher level of wage, profession, being married, and the acquisition of children causes individuals to delay their pension claiming.*

Lastly, we wish to analyse how the new pension system is working and whether it has changed work behaviour among the Norwegian citizens. Our last hypothesis will be in regard to this:

Hypothesis 4. *The new pension system has caused individuals to stay in the labour market for a longer period of time.*

Our strategy is to use the same analysis methods as the discussion paper, where we are planning to see the effect from the year 2012 to 2015. The main goal is to see whether our analysis will provide different results from the discussion paper by Brinch et al. (2018).

4. Data Collection

In order to create a model for expected longevity and analyse what effect it has on pension claiming, we require demographic data from the Norwegian population. Our data has mainly been gathered from Microdata.no. This is a service from Statistisk Sentralbyrå (SSB) and Norsk Senter for Forskningsdata (NSD) where the data is anonymised, but can be used for research (Microdata.no, 2018). By using this website, we will have access to the registered data from SSB. Microdata.no covers a lot of the demographic data from Norway, which is highly relevant for our topic of research. The data can be processed and analysed within the web-based programming tool provided by SSB and NSD.

4.1 Filtration of the Data

In order to analyse the individuals who are eligible for claiming pensions, we first had to filter out these individuals by age. We created 28 different data sets, and in each data set, we controlled for the specific age cohorts ranging from 62-89 years of age. The values from these calculations were used in order to create our logistical regression model on expected longevity.

In the linear regression analyses, we filtered out individuals at 62 years of age (the age at one is first eligible for claiming pensions). We did this for the years 2010 (one year prior to the change in pension system), 2012 (one year after the change in the pension system) and in 2015 (four years after the change in the pension system).

Another filtration method that we used was filtering out “missing values”. Some of the variables used in the different regressions contained “missing values”, which meant that some observations could not be measured. For instance, in the variable employment status, some missing values occurred, mainly due to the fact children were not registered as either employed or unemployed but as “missing values”. This affected our regression analysis by presenting us with numbers that did not give any meaning or providing highly irrational numbers. By eliminating these values from the analysis, we had more control over the types of individuals in our sample and were able only to present the analytically relevant observations. By filtering out the "missing values" we were able to create more precise estimates.

4.2 Source Criticism

Microdata.no has been our primary data collection tool. As previously mentioned, microdata.no is a new statistical programming tool created by SSB and NSD. Though it contains much relevant demographic data on the Norwegian population, it is still limited in some ways as a programming tool.

When creating our different dummy variables, problems occurred due to "missing values". Missing values were given the value zero, creating irrational results. In order to prevent these issues, we had to filter out all the missing values. This created more precise estimates, but at the same time, we had to remove many observations from the dataset. The problem with removing observations from one variable meant that these observations also were removed from other variables. The observations that we removed could have had a significant impact on other variables. Take for example a Norwegian individual living and working in London, this individual would be registered as a "missing value" in our urban area variable, and by removing this variable, we are also removing this observation from our regression analysis. Hence, losing valuable information from the analysis.

Another restraint from using the web-based programming tool was the lack of variety in analytical tools. Microdata.no is still under development, and there are many analytical instruments that we were not able to use. In some cases, this led to a lot of manual and tedious work, often time-consuming. An example of this was when we wanted to identify all the logistical values from our regression, a simple command in other programming tools, but very manual and time-consuming in microdata.no.

4.3 Data Theory

When making the expected longevity model, we chose to use a logistical regression model. We needed to find the probability of survival for individuals aged 62-89 in order to create our model for expected longevity. A logistical regression creates output following the cumulative distribution function of the logistic distribution.

The logistic distribution is easier to interpret, as the probability model's normal distribution is more numerically complicated. The models differ when it comes to the S-shaped curve used to limit the $[0,1]$ interval. (Hill, Griffiths & Lim, 2011).

In order to create a logistical regression analysis, we had to categorise all independent variables as dummy variables (Microdata.no). Using dummy variables in a regression model has its benefits. By breaking down a variable into components and estimating the value of these components on the regression model, it is easier to interpret the variables (Hill, Griffiths & Lim, 2011). We categorised one of the variables as high education and low education, and could thereby clearly interpret how high education affected the probability of survival.

One important aspect regarding regression analyses is to see whether the independent variables have a statistically significant effect on the dependent variable. We make a null hypothesis were $b_k = 0$, and an alternative hypothesis where $b_k \neq 0$. To discover the significance of the variables we use a t-test, $t = \frac{b_k}{se(b_k)}$ where $se(b_k)$ is the standard error of b_k. The levels of significance are 10%, 5% and 1%. If we chose a significance level of 1 % and the t-value of b_k is higher, in absolute value, than the critical value of the significance level , we can reject the null hypothesis, and conclude that b_k is statistically significant. Hence, it has an effect on the dependent variable (Gujarati, 2015).

Another aspect that needs to be considered is the measure of "goodness of fit" on the estimated regression, R^2. A models "goodness of fit" indicates how much of the total variation in the dependent variable is explained by all the independent variables (Gujarati, 2015). In a socioeconomic analysis, it is not unusual that R^2 is about 18% (Microdata.no, 2018).

5.0 Methodology

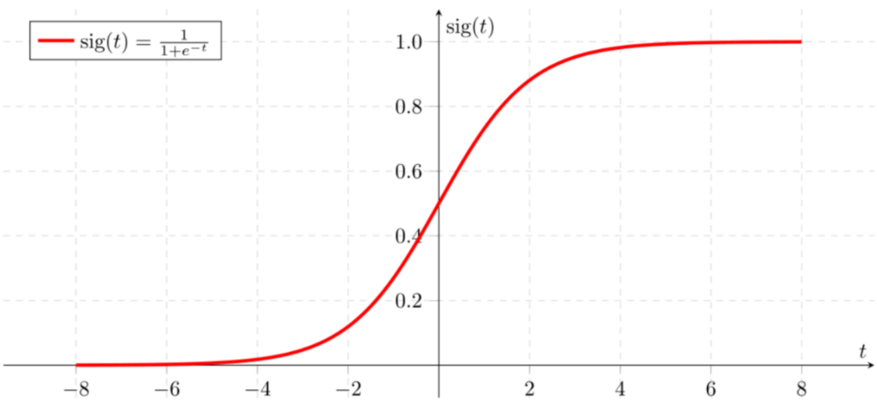
The methodology section is divided into three sections. The first section describes how we created a model for expected longevity for 62-year olds. The second section analyses what effect expected longevity has on the individual's propensity to claim their pensions within the first year of eligibility. The third section is an analysis of how different socio-economic variables affect an individual's likelihood of continuing to be a part of the labour market.

5.1 Expected Longevity

In order to make a model for expected longevity for 62-year olds, one needs to make a logistic regression model for each of the age cohorts. The logistic regression model contains the following dummy variables: gender, education, wealth and resident in an urban area (Appendix 7). The dependent variable in this logistic regression is mortality. The regression was run 28 times for age cohorts 62-89. The regression had to be run in 28 different datasets in order to control for the conditional expectation of surviving the previous year(s). By controlling for specific age cohorts in each dataset, we were able to generate logistic values for each specific age cohort.

$$Mortality_i = \beta_0 + \beta_1 \times Gender_i + \beta_2 \times Education_i + \beta_3 \times Wealth_i + \beta_4 \times UrbanArea_i \tag{6.1}$$

The output from each regression model generates a number along the X-axis of a standard logistic function σ(t).



$(Figure: 6.1)$,

Source: Towards Data Science (2018)

The logistic function is what is known as a "sigmoid" function and takes the real input value from the regression above, and outputs a value between 0 and 1 (a value from the y-axis ($\mathbb{R} \in (0,1)$). In other words, the standard logistic function is a function that converts input log-odds and outputs a probability (Hosmer, Lemeshow & Sturdivant, 2013). The standard logistic function for our regression is defined as follows:

$$ProbDying_i = \frac{e^{\beta_0+\beta_1\times Gender_i+\beta_2\times Education_i+\beta_3\times HighWealth_i+\beta_4\times UrbanArea_i}}{e^{\beta_0+\beta_1\times Gender_i+\beta_2\times Education_i+\beta_3\times HighWealth_i+\beta_4\times UrbanArea_i}+1}$$
$$= \frac{1}{1+e^{-(\beta_0+\beta_1\times Gender_i+\beta_2\times Education_i+\beta_3\times HighWealth_i+\beta_4\times UrbanArea_i)}} \quad (6.2)$$

The equation above calculates an individual's probability of dying, and not the probability of surviving the current age cohort, which we need to make a model for expected longevity. In order to calculate the individual's probability of surviving, we need to rephrase the equation above:

$$ProbSurviving_i = 1 - \frac{e^{\beta_0+\beta_1\times Gender_i+\beta_2\times Education_i+\beta_3\times HighWealth_i+\beta_4\times UrbanArea_i}}{e^{\beta_0+\beta_1\times Gender_i+\beta_2\times Education_i+\beta_3\times HighWealth_i+\beta_4\times UrbanArea_i}+1}$$
$$= \frac{1}{1+e^{(\beta_0+\beta_1\times Gender_i+\beta_2\times Education_i+\beta_3\times HighWealth_i+\beta_4\times UrbanArea_i)}} \quad (6.3)$$

Calculating the probability of surviving the current age cohort, conditioned on the fact that they survived the previous year(s), for every age cohort between 62- 89 years of age, takes us one step closer to finding the expected longevity of a 62-year-old. In order to find the expected longevity for 62-year olds, we use the following formula:

$$Expected\ Longevity_{62} = ProbSurviving_{62} + (ProbSurviving_{62} \times ProbSurviving_{63}) + (ProbSurviving_{62} \times ProbSurviving_{63} \times ProbSurviving_{64}) + \cdots + (ProbSurviving_{62} \times ProbSurviving_{63} \times ProbSurviving_{64} \times ProbSurviving_{65} \times ProbSurviving_{66} \times ProbSurviving_{67} \times ProbSurviving_{68} \times ProbSurviving_{69} \times ProbSurviving_{70} \times ProbSurviving_{71} \times ProbSurviving_{72} \times ProbSurviving_{73} \times ProbSurviving_{74} \times ProbSurviving_{75} \times ProbSurviving_{76} \times ProbSurviving_{77} \times ProbSurviving_{78} \times ProbSurviving_{79} \times ProbSurviving_{80} \times ProbSurviving_{81} \times ProbSurviving_{82} \times ProbSurviving_{83} \times ProbSurviving_{84} \times ProbSurviving_{85} \times ProbSurviving_{86} \times ProbSurviving_{87} \times ProbSurviving_{88} \times ProbSurviving_{89}) \quad (6.4)$$

The following formula will yield a table containing the expected longevity for sixteen different types of individuals aged 62.

5.2 Claiming Behaviour

In order to analyse what effect expected longevity has on an individual's propensity to claim their pensions within the first year of eligibility, we need to make a new regression model. In our linear regression model, we use the dummy variable $EarlyClaiming_i$ (pension claimant or not) as the dependent variable. The independent variables are: high paying line of work, high wage (annual earnings above 800 thousand NOK), civil status (married or single), children (children or no children), male (male or female), employment status (employed or non-employed) and expected longevity (Appendix 7).

1. First of all, we regress our endogenous regressor $ExpectedLongevity_i$ on the instruments (z_i), z_i being the dummy variables: education, wealth and resident in an urban area.

$$ExpectedLongevity_i = \prod_0 + \prod_1 \times z_i + \prod_2 \times Male_i + \varepsilon_i \tag{6.5}$$

   These are the instrument variables that cause the variation in $ExpectedLongevity_i$.

2. The second stage consists of regressing our new dependent variable, $EarlyClaiming_i$ with the new independent variable, $ExpectedLongevity_i$.

$$\begin{aligned} EarlyClaiming_i \\ &= \Phi_0 + \Phi_1 \times ExpectedLongevity_i + \Phi_2 \times Male_i \\ &+ \Phi_3 \times h_i + \epsilon_i \end{aligned} \tag{6.6}$$

   h_i being the independent dummy variables: high wage, married, children, and being in work. $Male_i$ now acts as a control variable, removing its variation on $ExpectedLongevity_i$ as well as reducing the problem of OVB.

Our linear regression model for estimating the claiming behaviour among pensioners becomes:

$$EarlyClaiming_i = \beta_0 + \beta_1 \times HighLineOfWork_i + \beta_2 \times HighWage_i + \beta_3 \times Married_i + \beta_4 \times Children_i + \beta_5 \times EmploymentStatus_i + \beta_6 \times ExpectedLongevity_i + \beta_7 \times Male \tag{6.7}$$

Since our dependent variable $EarlyClaiming_i$ is a dummy variable, the output will be a percentage, indicating the likelihood of claiming pensions early.

5.3 Labour Market Continuation

In order to see how the different variables affect labour market participation after reaching the age of 62, we make a new linear regression model where being part of the labour market is the dependent variable. The independent variables are: high line work, high wage, civil status, children, gender and expected longevity (Appendix 7).

$$InWork_i = \beta_0 + \beta_1 \times HighWork_i + \beta_2 \times HighWage_i + \beta_3 \times Married_i + \beta_4 \times Children_i + \beta_5 \times Male_i + \beta_6 \times ExpectedLongevity_i \tag{6.8}$$

By running the regression using data from one year after the new pension system we can measure how the population have reacted to the new pension system.

6.0 Result and Analysis

The result and analysis section is divided into three main parts. The first section consists of analysing the results regarding the model for expected longevity and discuss how our model compares to previous findings. The second section will be an analysis of the results we compiled from the claiming behaviour regression. The third section will consist of analysing how labour market participation has changed after the introduction of the new pension system.

6.1 Expected Longevity Results

Table 6.1.1 shows the expected longevity for sixteen different individuals at the age of 62. The expected longevity interval for a 62-year-old individual ranges from 18,343 to 24,495 years, meaning the lowest life expectancy is 80,343 years of age and, the highest is 86,49 years of age.

Table 6.1.1 - Expected Longevity

The table shows the expected longevity of 16 different types of individuals aged 62. The different characteristics are being a male or female, having a high or low education, living in an urban area or non-urban area and having a high or low fortune. The frequency of how many individuals that have the different characteristics have also been added to the table. The highest estimated expected longevity is 24,495 years and the lowest is 18,434 years.

Type of individual	Expected Longevity	Frequency
Male LowEduc, Urban, HighFortune	**20,836**	194495
Male, HighEduc, Urban, HighFortune	**22,400**	151743
Female, HighEduc, Urban, LowFortune	**22,862**	297914
Female, LowEduc, non-Urban, HighFortune	**23,414**	31832
Male, LowEduc, Urban, LowFortune	**18,343**	548884
Male, LowEduc, non-Urban, LowFortune	**18,823**	246059
Male, HighEduc, Urban, LowFortune	**20,363**	194704
Male, HighEduc, non-Urban, LowFortune	**20,763**	50253
Male, LowEduc, non-Urban, HighFortune	**21,181**	98345
Female, LowEduc, Urban, LowFortune	**21,329**	626630
Female, LowEduc, non-Urban, LowFortune	**21,679**	262847
Male, HighEduc, non-Urban, HighFortune	**22,681**	27030
Female, HighEduc, non-Urban, LowFortune	**23,142**	98658
Female, LowEduc, Urban, HighFortune	**23,173**	120887
Female, HighEduc, Urban, HighFortune	**24,303**	97247
Female, HighEduc, non-Urban, HighFortune	**24,495**	17290
Total		3064801

Table 6.1.2 - Expected Longevity Distribution

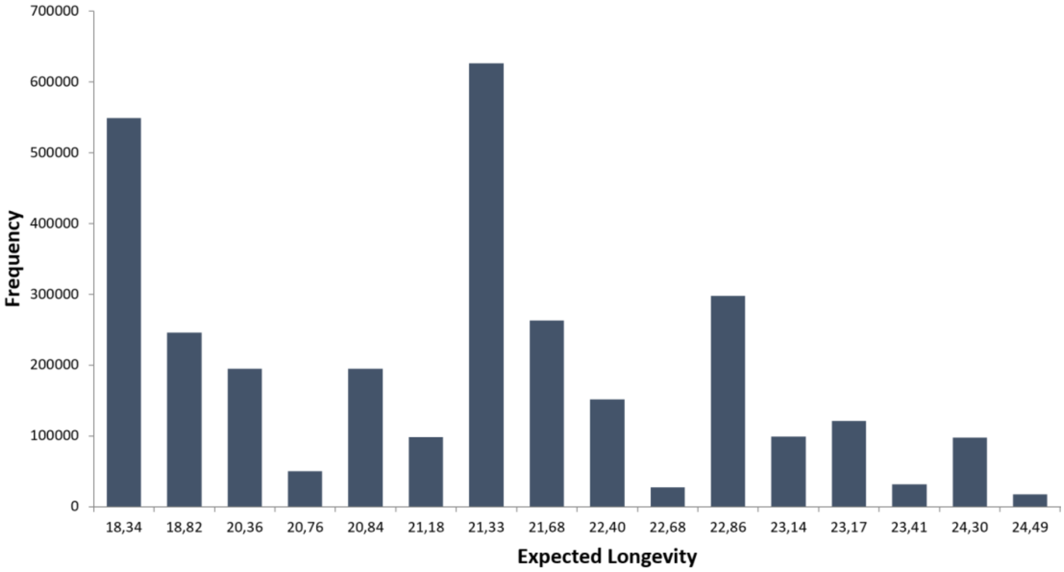


Table 6.1.2 shows the distribution of individuals' expected longevity aged 62. The individuals that have a life expectancy of 21,33 years have the highest frequency. These individuals are classified as females with low education, low fortune and resident in an urban area. The individuals with the lowest frequency have a life expectancy of 24,49 years; these individuals are females with high education, high fortune and residents in a non-urban area. The range between the highest and lowest life expectancy is 6,15 years.

6.1.1 Gender

We can see from table 6.1.1 that "male" individuals have lower expected longevity compared to "female" individuals. This result is also supported by previous literature on the subject. Beltrán-Sánchez, Finch & Crimmins (2015) argues that the reason for lower expected longevity among male individuals is mainly a result of biological factors. For male individuals, we get an average life expectancy of 82,67 years, whereas the female average life expectancy amounts to 85,05 years of age (Appendix 2). According to SSB (2018), life expectancy for male individuals was 80,9 years of age, where it for female individuals was 84,3 years of age in 2017. Our results differed slightly from the results published by SSB. The main reasons for the different results occur since we are calculating life expectancy for 62-year-old individuals in 2012. Because life expectancy is increasing for every birth cohort (SSB, 2018), and the fact that we are only using socio-economic variables (lacking health variables), our regression yields slightly different results.

6.1.2 Education

Another interesting result we can see from table (6.1.1) is that individuals with high education have higher expected longevity compared to individuals with low education. For individuals with high education, we got an average life expectancy of 84,26 years of age, whereas individuals with low education had an average life expectancy of 83,09 years of age (Appendix 2). The difference in average life expectancy was at 1,16 years. Individuals with higher education are often more likely to have a higher income, and they also invest more time and money in keeping a healthy diet and exercise more compared to individuals with lower education (Hammond, 2003). Mirowsky & Ross (2000) argue that individuals with higher education have the expectation of a healthy, secure and long future, and thus are expected to live for a longer duration of time.

6.1.3 Urban Area

The urban area variable yielded small differences between being a resident in an urban area versus a non-urban area. An individual residing in a non-urban area is expected to live for approximately 0,32 years longer than an individual residing in an urban area (Appendix 2). According to Borgan (2007), people residing in non-urban areas have had a higher life expectancy since the 1870s. The risk of getting infected with life threatening diseases was considerably higher in highly populated areas.

Over a hundred years later, people living in non-urban areas are still expected live for a more extended period, although the differences have flattened out. A higher standard of living has increased the life expectancy among the Norwegian population. This new way of living has also been the residing factor to the decrease in infectious diseases and an increase in cardiovascular diseases (Borgan, 2007).

The article states that 40-year-old individuals between 2001-2005 living in non-urban areas have a higher life expectancy. The men have a life expectancy of 79,3 years while those residing in urban areas have a life expectancy of 78,4 years. The difference between the men is 0,9 in years, and 1,6 years for women. This is consistent with our analysis and result where the life expectancy is higher in non-urban areas.

6.1.4 Wealth

The wealth variable yields somewhat expected results. Individuals with a high amount of wealth, above 1 million NOK, have an average life expectancy of 84,81 years, whereas individuals with a low amount of wealth, below 1 million NOK, have an average life expectancy of 82,91 years. A difference of almost two years. In a recent study comparing the effects of income on life expectancy in the US and Norway, they find that individuals belonging to a high-income quartile live for a longer period of time. The study contained Norwegian individuals aged at least 40, between 2005-2015. They found that: "the difference in life expectancy between the richest and poorest 1 %, was 8.4 years for women and 13.8 years for men. The differences widened between 2005 and 2015…" (Kinge, Modalsli, Øverland, Gjessing, Tollånes, Knudsen, Skirbekk, Strand, Håberg & Vollset, 2019, p. 1917).

One of the most significant contributors to the difference in life expectancy in the article mentioned above comes from health-related issues. Individuals in the low-income quartile were more prone to dying from cardiovascular diseases and cancer, compared to individuals in the high-income quartile (Kinge et al, 2019). Hammond (2003) argues that individuals with higher education and higher income, with a higher socio-economic status, invest more time and money in keeping a healthy diet. They are also happier and less prone to feelings of insecurity and chronic stress, which can have adverse effects on mental and physical health.

6.2 Claiming Behaviour Results

6.2.1 Expected Longevity and claiming behaviour

Table 6.2.1 contains the expected longevity for different individuals and the amount of them choosing to claim pensions within the first year of eligibility. The population now consists of individuals aged 62 in the year 2012. There are therefore only 38823 observations in this sample. The average expected longevity amounts to 21.69 years, and individuals marked in grey have expected longevity above average, whereas those marked in light grey are below average. Among those individuals with below average expected longevity, 28,57% claim their pensions early, whereas individuals above average, only 15,56% claim early.

We also see a significant difference in claiming behaviour among males and females, as well as individuals with high education and low education. Among males, 37,44% claim their pensions early, whereas only 10,33% of females claim early (Appendix 3). Among individuals with low education, 27,66% claim pensions early, whereas only 17,22% of individuals with high education claim their pensions early (Appendix 3).

Table 6.2.1 - Expected Longevity and Pension Claiming

The table shows the expected longeveties for 15 different types of individuals aged 62 in the year 2012, and the percentage who claimed their pensions within the first year of eligibility. The characteristics are being a male or female, having a high or low education, living in an urban area or non-urban area and having a high or low fortune. The average expected longevity amounts to 21,69 years, the darker shaded areas indicate an above average expected longevity, whereas the lighter shaded areas indicate a below avergae expected longevity.

Type of individual	Expected Longevity	Percentage claiming early
Male LowEduc, Urban, HighFortune	**20,836**	46,39 %
Male, HighEduc, Urban, HighFortune	**22,400**	25,48 %
Female, HighEduc, Urban, LowFortune	**22,862**	8,62 %
Female, LowEduc, non-Urban, HighFortune	**23,414**	10,54 %
Male, LowEduc, Urban, LowFortune	**18,343**	43,69 %
Male, LowEduc, non-Urban, LowFortune	**18,823**	38,79 %
Male, HighEduc, Urban, LowFortune	**20,363**	24,38 %
Male, HighEduc, non-Urban, LowFortune	**20,763**	19,77 %
Male, LowEduc, non-Urban, HighFortune	**21,181**	41,03 %
Female, LowEduc, Urban, LowFortune	**21,329**	11,12 %
Female, LowEduc, non-Urban, LowFortune	**21,679**	7,37 %
Male, HighEduc, non-Urban, HighFortune	**22,681**	24,96 %
Female, HighEduc, non-Urban, LowFortune	**23,142**	9,18 %
Female, LowEduc, Urban, HighFortune	**23,173**	16,60 %
Female, HighEduc, Urban, HighFortune	**24,303**	7,85 %

6.2.2 Results From the Linear Regression Model

Table 6.2.2 shows the output from our linear regression model. Our dependent variable is early pension claiming and our independent variables are a high line of work, high wage, married, children, employment status, male and expected longevity. All independent variables are categorised as dummy variables except for expected longevity.

Table 6.2.2 - Regression analysis on claiming behaviour (2012)

*The table shows the output from running the regression where early pension claiming is the dependent variable with seven other explanatory variables. The variables HighLineOfWork, HighWage, Married, Children, Inwork and Male are all dummy variables, taking on the value one or zero. The expected longevity variable contains a table with life expectancy of different types of individuals. For a more detailed description of the variables, see appendix 3. *Represents significant at the 10% level, ** represents significant at the 5% level, and *** Represents significant at the 1% level.*

Number of obs	38823
R^2	0.10627550616819881
Adjusted R^2	0.10611432952368449

EarlyClaiming	**Coef.**	**t-value**	
HighLineOfWork	-0,00517 *0,00555*	0,931666	
HighWage	-0,03558 *0,00943*	-3,772265	***
Married	0,01622 *0,00459*	3,534072	***
Children	-0,03061 *0,00515*	-5,943019	***
InWork	0,01460 *0,00579*	2,520282	**
Male	0,23510 *0,00570*	41,246430	***
ExpectedLongevity	-0,02052 *0,00169*	-12,115770	***
Constant	0,54398 *0,03773*	14,416395	***

6.2.2.1 Expected Longevity

Our primary focus is to see how individuals' expected longevity affect claiming behaviour. The variable expected longevity affects the probability of claiming early negatively, by -2,05 percentage points. Meaning that for every year an individual is expected to live beyond the age of 62, the probability of claiming pension within the first year of eligibility declines by 2,05 percentage points. This, in terms, means that an individual with a higher life expectancy will have a lower percentage chance of claiming his pensions early, compared to an individual with a lower given life expectancy. The expected longevity variable has a t-statistic of negative 12,12, meaning it is statistically significant on a 1% level.

Table 6.2.3 - Regression Analysis; Expected Longevity on Claiming behaviour

*The table shows the output from running EarlyClaiming as a dependent variable and only having ExpectedLongevity as a independent variable. The expected longevity variable contains a table with the expected longevity of different types of individuals. For a more detailed description at the variables, see appendix 3. *Represents significant at the 10% level, ** represents significant at the 5% level, and *** Represents significant at the 1% level.*

Number of obs	38823		
R^2	0.0622552386		
Adjusted R^2	0.0622310830		
EarlyClaiming	**Coef.**	**t-value**	
ExpectedLongevity	-0,064091538 *0,001262472*	-50,7667062	***
Constant	1,650540174 *0,026872685*	59,74102574	***

Brinch et al. (2018) found that expected longevity reduces the probability of claiming within the first year of roughly negative four percentage points when only using expected longevity as an independent variable. Our model yields a slightly higher effect of negative 6,4 percentage points, a difference of roughly 2,4 percentage points (table 6.2.3). Table 6.2.3 shows how expected longevity affects claiming behaviour in 2012. Looking at the analysis four years (in 2015) after the implementation (Appendix 5), the model yields a negative effect of 6,8 percentage points. Thus, the effect of expected longevity on claiming behaviour has not changed significantly.

Table 6.2.4 shows the results from running the regression in the year 2015, four years after the implementation of the new pension system. We wanted to see if there had been any changes in claiming behaviour among pensioners. The effect of expected longevity has decreased from -2,052% to -2,661%, a reduction of 0.609 percentage points. This means that the expected longevity variable has a more significant impact in terms of delaying pension claiming. The adjusted R^2 in this regression is also higher (0.12381 vs 0.1062) than the previous, meaning that the model explains more of the variation in claiming behaviour, indicating that we have a better model.

Table 6.2.4 - Regression analysis on claiming behaviour (2015)

*The table shows the output from running the regression where early claiming is the dependent variable with seven explanatory variables. The regression analysis analyses the claiming behaviour four years after the reform change. The variables HighLineOfWork, HighWage, Married, Children, Inwork and Male are dummy variables, taking the value of one or zero. The expected longevity variable contains a table with the expected longevity of different types of individuals. For a more detailed description of the variables, see appendix 3. *Represents significant at the 10% level, ** represents significant at the 5% level, and *** Represents significant at the 1% level.*

Number of obs	42806		
R^2	0.12396095209096425		
Adjusted R^2	0.12381766798106741		
EarlyClaiming	**Coef.**	**t-value**	
HighLineOfWork	0,0023 *0,00563*	0,40891	
HighWage	0,05066 *0,00883*	5,73502	***
Married	0,01217 *0,00466*	2,61357	***
Children	-0,03293 *0,00463*	-7,1127	***
InWork	0,23379 *0,00875*	26,72085	***
Male	0,24138 *0,00604*	39,94481	***
ExpectedLongevity	-0,02661 *0,00177*	-15,05291	***
Constant	0,55035 *0,03962*	13,89022	***

By creating a regression model 4 years after the implementation of the new pension system, we are able to see how the different variables affect claiming behaviour after some time has passed. What we see from the new regression is that the results are somewhat similar, with very few significant changes.

Our analysis does not observe individuals who choose to wait as longs as possible before choosing to claim their pension. The full effect of the new pension system may not be observable until a “decade or so has passed” (Brinch et al., 2018). First then, we might see a significant reduction in individuals choosing to delay pension claiming.

Even though the variables expected longevity and children favours a pension claiming delay in the year 2015, most of the variables point in a different direction.

From appendix 6 we can see that the percentage of 62-year olds claiming pension in 2012 amounted to 24,54% of the population, while it in 2015 had increased to 33,03%. An increase of 8,49 percentage points. This is a clear indication that there has been a significant increase in pension claiming since the new pension system was introduced.

Our first hypothesis was whether individuals who claim pensions early have lower expected longevity. Judging by the results from the regression in table 6.2.2, it becomes clear that individuals with lower expected longevity will be more prone to be the ones who claim pensions early.

Our second hypothesis was whether individuals act on their knowledge about their life expectancy when deciding when to claim pensions. Coile et al. (2001) conclude in their paper that it is optimal for individuals with lower life expectancy to claim their pensions earlier; that way, they can maximize their utility. It is hard to say whether the individuals in our regression model are fully aware of their expected longevity or if this fact has had any say in their claiming behaviour. It is more likely that the differences in claiming behaviour come as a result of education, profession and wages, which again increases ones expected longevity. Highly educated individuals are usually the ones with higher paying professions and more knowledge about their personal economy.

6.2.2.2 High Wage

Table 6.2.2 shows how the different variables affect the individuals claiming behaviour. In our third hypothesis, we wanted to determine if variables such as wage, profession, being married and the acquisition of children cause individuals to delay their pension claiming.

Having a wage higher than 800 000 NOK implies that there is approximately a 3,6-percentage point probability of delaying claiming. Having a t-value of -3.77 shows that the variable is statistically significant for any significance level. This finding is also supported by Hurd et al. (2004), where they argue that favourable working conditions can delay pension claiming.

6.2.2.3 High Line of Work

As for the variable high line of work, the results differ from the wage variable. The variable has an effect on claiming behaviour, indicating delays in claiming. However, the variable is not statically significant with a t-value of only 0.93.

6.2.2.4 Civil Status and Children

Being married has a significant effect on claiming behaviour where the t-value is 3.53. In our model, it shows that being married lowers the likelihood of claiming pensions early with 1,62 percentage points. From previous literature, there are different findings of what effect marriage has on claiming behaviour. Our findings were that being married increased the likelihood of claiming pensions early. This is supported by Chan & Stevens (2002). However, discoveries from Brinch et al. (2018) and Coile et al. (2001) show that being married causes delays in claiming. In the case of having children, this variable reduces the likelihood of claiming pensions early by roughly three percentage points. The variable is also statistically significant with a t-value of -5.94.

6.2.2.5 Gender

Being a male has a significant impact on claiming behaviour and increases the likelihood of claiming pensions early with 23,5 percentage points (table 6.2.2). This result is also supported by Brinch et al. (2018).

If we do not control for the gender variable, we get somewhat different results regarding the effect of expected longevity (Appendix 4). For every year an individual is expected to live beyond the age of 62, the probability of claiming pensions within the first year now amounts to negative 6.709 percentage points. A reduction of almost four percentage points when not controlling for gender (Appendix 4).

The main reason for the reduction in percentage points by leaving out the gender variable, was because it would have led to an omitted variable bias problem. Even though we included the variable in our expected longevity analysis, we would still get an OVB problem in the regression model for claiming behaviour. Adding gender as a control variable in the claiming behaviour regression prevented OVB related to gender. The intuition behind this is that most men have a lower life expectancy compared to woman and men are also claiming pensions earlier

(Appendix 3). Thus, we have a double effect on claiming behaviour we need to control for. We can also see that the correlation between the variable male and expected longevity is -61% (Appendix 1), which explains why the effect of expected longevity increases when not controlling for gender.

Furthermore, by including the gender variable in the claiming behaviour regression we can see that R^2 increases from 6 to 10 percent. Hence, the variation in claiming behaviour is more explained by the independent variables when we include gender. For these reasons, we chose to include the variable in the claiming behaviour regression analysis.

6.2.2.6 Employment Status

The employment status variable (InWork), increases the likelihood of claiming pensions early with a modest 1,4 percentage points (table 6.2.2). This result differed from that of Brinch et al. (2018) concluded in their article.

Our third hypothesis was whether wage, profession, marriage and children led to a reduction in the likelihood of claiming pensions early. From our results, it is clear that having a higher wage as well as children are factors that reduce the probability of claiming early. Being married increases the likelihood of claiming early, i.e. not agreeing with our original hypothesis. Having a high line of work did not yield significant results on claiming behaviour. The reason for this fact may be that the profession in itself is irrelevant for an individuals' claiming behaviour, whereas the working conditions related to the profession may be the decisive factor. As mentioned earlier, Hurd et al. (2004) argues that favourable working conditions increases the probability of delayed claiming.

6.3 Labour Market Continuation Results

Table 6.2.5 - Labour Market Continuation Results

*The table shows the output from running the regression where labour market participation is the dependent variable with six explanatory variables. The variables HighLineOfWork, HighWage, Married, Children and Male are dummy variables, taking on the value of one or zero. The expected longevity variable contains a table with the expected longevity of different types of individuals. For a more detailed description at the variables, see appendix 3. *Represents significant at the 10% level, ** represents significant at the 5% level, and *** Represents significant at the 1% level.*

Number of obs	38823		
R^2	0.019845654929047107		
Adjusted R^2	0.01969414714693607		
InWork	**Coef.**	**t-value**	
HighLineOfWork	0,063872 *0,004853*	13,16038	***
HighWage	0,078284 *0,008256*	9,48195	***
Married	0,007069 *0,004023*	1,75736	*
Children	0,03388 *0,004509*	7,51319	***
Male	0,035216 *0,004991*	7,05635	***
ExpectedLongevity	0,015434 *0,001482*	10,41246	***
Constant	0,471131 *0,032973*	14,28854	***

Table 6.2.5 shows the output from running a regression with the variable “InWork” as the dependent variable. Our goal was to see how the different variables affect labour market continuation after reaching retirement age. All the variables go in the direction of prolonging an individual’s labour market participation. The variables high line of work and high wage are the variables that affect labour market participation the most. These variables are also the ones that have more in common with favourable working conditions, an important factor for wanting to remain a part of the labour force (Hurd et al., 2004).

For every year an individual is expected to live beyond the age of 62, the likelihood of continuing to be a part of the labour market increases by 1,54 percentage points. Meaning that an individual with a high expected longevity has a higher probability of remaining part of the labour force for a longer period of time. A 62-year-old individual with an expected longevity of 24 years, will have a 37-percentage point likelihood of remaining part of the labour force for that current year.

In the previous regressions, “males” were among the individuals who claimed their pensions the earliest. In this regression, we see that being male increases the likelihood of labour market participation by 3.52 percentage points, which means that male individuals are more prone to claim their pensions while continuing to work.

	2010	2012	2015
Unemployed	8037	5939	2760
Employed	32142	32887	40045
Total	40182	38828	42806
Percentage employed	79,99 %	84,70 %	93,55 %

Table 6.2.6

A question of interest that we wanted to answer, regarding hypothesis 4, was whether labour market continuation has changed after the introduction of the new pension system.

Table 6.2.6 shows the number of 62-year-old individuals who are employed and unemployed in the years 2010, 2012 and 2015. It is important to note that individuals reported as unemployed may not be individuals who have chosen to retire; these can also be individuals who have lost their job and are unemployed because of this. From the table above, we see a significant increase in the percentage of individuals continuing their labour force participation at age 62. An increase of 8.85 percentage points from 2012-2015, indicating that the new pension system has influenced labour market participation, since its implementation in 2011. We see an even more significant increase from 2010, prior to the new pension system, to the year 2015 of 13.55 percentage points. This finding is also supported by Hernæs, Markussen, Piggott & Røed (2016), they found that the incentives from the new pension system has resulted in a more mature labour force.

The fact that elderly individuals choose to work longer may be as a result of the new AFP system, which incentivises individuals to prolonging their labour market participation (AFP, 2018). It is important also to note that some of the reason for the low employment percentage in 2010 may be a result of the financial crisis in 2008. Norway experienced a rise in the unemployment rate in 2008-2009, before it in 2010 started to smooth out (Ekeland, 2011).

7.0 Conclusion

In this thesis, we find that expected longevity has an effect on claiming behaviour as we initially were planning to reveal. Our findings uncover that individuals with higher expected longevity have a higher probability of delaying pension claims, consistent with our first hypothesis. However, we are not able to derive a conclusion for our second hypothesis, to what extent an individual will act on their knowledge about their life expectancy in choosing when to claim pensions. It is more likely that individuals claiming behaviour is as a result of their education, profession and wage, rather than knowledge about their own life expectancy. Our thesis provides significant numbers on the result that expected longevity induces delays in pension claiming.

When comparing our thesis to the article by Brinch et al. (2018), we discover rather similar findings. The variable expected longevity yielded a slightly higher effect on claiming behaviour compared to the findings in the article by Brinch et al. (2018). Running the regression analysis on claiming behaviour four years after the implementation of the new pension system, resulted in expected longevity effecting claiming behaviour slightly more in favour of delayed claiming.

When considering labour market participation, the results concluded that the new pension system has impacted the labour market participation among the Norwegian population aged 62. Indicating that the implementation of the new pension system has had a positive effect on the age wave problem. We also find that having higher expected longevity increases the likelihood of continuing to be a part of the labour force.

Although our thesis shares similarities with previous literature regarding the topic of claiming behaviour, the thesis still has some weaknesses. If we were able to use the missing values in Microdata.no and had the opportunity to use health related variables to estimate our expected longevity for a 62-year old, our model would be more precise and yield more accurate results. However, our model provides findings relatively consistent with findings by Brinch et al. (2018) on how expected longevity affects claiming behaviour. In our view, it is hard to yet conclude what the long-term effects of the new pension system are. It will be hard to say much about this effect until some time has passed, but judging from our findings, the results seem to move in the right direction.

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9.0 APPENDIX

Appendix 1: Correlation between the variables in claiming behaviour.

Appendix 1 - Correlation between the variables in claiming behaviour

	Male	ExpectedLongevity	HighWage	Married	Children	InWork
HighLineOfWork	0,097827101	0,209886773	0,263725758	0,048475023	0,06052794	0,108116673
Male		-0,616150456	0,194296022	0,07340336	0,117040491	0,026680354
ExpecteLongevity	-0,616150456		0,060614492	-0,02675565	-0,016995158	0,05903715
HighWage	0,194296022	0,060614492		0,04737497	0,055877917	0,086282996
Married	0,07340336	-0,02675565	0,04737497		0,089652501	0,019892272
Children	0,117040491	-0,016995158	0,055877917	0,089652501		0,050750208

Appendix 2: Average expected longevity for variables

average Male:	20,674
average Female:	23,050
average HighEduc:	22,626
average LowEduc:	21,097
average Urban:	21,701
average non-Urban:	22,022
average HighFortune:	22,810
average Lowfortune:	20,913

Appendix 3: Average percentage claiming early

Type of variable	Average percentage claiming early
Males	37,44 %
Females	10,33 %
Low expected longevity	28,57 %
High expected longevity	15,56 %
High fortune	28,81 %
Low fortune	22,13 %
Urban claiming	24,82 %
non-urban	23,32 %
High education	17,22 %
Low education	27,66 %

Appendix 4:

Appendix 4 - Regression Analysis on Claiming Behaviour Without Gender

*The table shows the output from running the regression where early claiming is the dependent variable with six explanatory variables. The regression analysis is not controlled for the variable Male. The variables HighLineOfWork, HighWage, Married, Children, Inwork and Male are dummy variables, taking the value of one or zero. The expected longevity variable contains a table with the expected longevity of different types of individuals. For a more detailed description at the variables, see appendix 3. *Represents significant at the 10% level, ** represents significant at the 5% level, and *** Represents significant at the 1% level.*

Number of obs	38823		
R^2	0,06710341		
Adjusted R^2	0,066959207		
EarlyClaiming	**Coef.**	**t-value**	
HighLineOfWork	0,04712	8,532157085	***
	0,005522345		
HighWage	0,0541	5,767817693	***
	0,009379275		
Married	0,02417	5,157199333	***
	0,00468678		
Children	-0,00728	-1,39169855	
	0,005230498		
InWork	0,02315	3,914360184	***
	0,005915059		
ExpectedLongevity	-0,06709	-51,99782	***
	0,001290389		
Constant	1,62091	58,23977616	***
	0,027831702)		

Appendix 5: Expected longevity on claiming in 2015

Regression Analysis; Expected Longevity on Claiming 2015

Number of obs	42806	
R^2	0.061910391359575545	
Adjusted R^2	0.061888475426283396	

EarlyClaiming	**Coef.**	**t-value**
ExpectedLongevity	-0,068634959	-53,14981898
	0,001291349	
Constant	1,786754834	64,99918885
	0,027488879	

Appendix 6: Employment Status and Pension Claiming

Appendix 6 - Employment Status and Pension Claiming

	2012	2015
Unemployed & non pension claimant	4554	2442
Employed & non pension claimant	24749	26215
Unemployed & pension claimant	1390	314
Employed & pension claimant	8140	13829
Total employed	32887	40045
Total unemployed	5939	2760
Total pension claim	9528	14139
Total non pension claim	29300	28664
Total observations	38828	42806
Percentage employed & non pension claimant	63,74 %	61,24 %
Percentage employed & pension claimant	20,96 %	32,31 %
Percentage unemployed & non pension claimant	11,73 %	5,70 %
Percentage unemployed & pension claimant	3,58 %	0,73 %
Percentage claiming pensions at age 62	24,54 %	33,03 %

Appendix 7: The Variables

When making a model for expected longevity, one possibility is making a logit model for every age cohort. Accumulating the results from every age cohort will yield a model for expected longevity. When operating with a logit regression model, all dependent variables need to be dummy variables. In our case, all variables imported to the dataset are programmed to be dummy variables. All the data used in our regression models are from the year 2011. We use data from 2011 in order to yield a more accurate result when estimating what effects, the new pension system (introduced in 2011) has had on pensioners claiming behaviour.

9.3.1 Mortality

In our analysis of life expectancy, mortality is the dependent variable in the logit model. Taken into account that our data is from year 2011, we estimated the mortality rate in 2012, in order to retrieve more accurate data. The dummy variable takes on the value 1, if an individual died during 2012 and 0, otherwise.

9.3.2 Gender

The gender variable contained data, dating back to 1992. We categorized the gender variable as a dummy variable, taking on the value 1, if male and 0, if female.

9.3.3 Education

The education variable contains data on 4431 different categories of education. The data set contains data up until 2016, but we will be using data from the year 2011. We categorized the education variable as dummy variable, taking on the value 1, if having high fortune and 0, if having low education. Having "high" education is categorised as having a bachelor's degree level or higher. During the 1980's, high education, was categorized as having some for of education after finishing high school (Tor Jørgensen, 1997).

9.3.4 Resident in an urban area

The urban area value is defined as an area where there is a minimum of 200 people and the distance between the residents do not exceed 50 meters (Microdata, 2018).

The variable is categorised as a dummy variable, taking on the value 1 if resident in an urban area and 0, if resident in a non-urban area.

9.3.5 Fortune/ Savings

The wealth variable contains the amount of wealth for the Norwegian population (Microdata, 2018). Since the Norwegian population has an average of 1 million NOK in fortune (Epland, J & Kirkeberg, M, 2012), we categorized the variable as a dummy variable, taking on the value 1, if wealth exceeds 1 million NOK, and 0, if below.

These variables were chosen in order to estimate the logit model for expected longevity. The following variables were chosen to estimate claiming behaviour of the Norwegian population.

9.3.6 Early claiming

The pension claiming variable contains the date of when individuals choose to claim their old aged pensions (Microdata, 2018). The variable contains all forms of claiming, either an individual chooses to claim 20 % or 100 % of their pensions. The variable is categorized as a dummy variable, taking on the value 1, if an individual is to claim his/her pensions during the first year of eligibility and 0, otherwise.

9.3.7 Profession

The line of work variable contains 201 categories of different professions. We categorised this variable into a dummy variable, selecting professions related to high income and a high education degree to take on the value 1 and 0, otherwise. Professions containing the value 1 are for example: politicians, lawyers, doctors, physicists, accountants etc.

9.3.8 Married

The civil status variable contains data on individual's civil status (Microdata, 2018). We categorised the variable as a dummy variable, taking on the value 1, if married or cohabitant at age 62 and 0, otherwise.

9.3.9 Children

The children variable contains data on individual's accusation of children (Microdata, 2018). We categorised the variable as a dummy variable, taking on the value 1, if an individual has one or more children when aged 62 and 0, otherwise.

9.3.10 Wage

The wage variable contains data in individuals' level of annual wage in NOK. We categorised the variable as a dummy variable, taking on the value 1, if wage is above 800 thousand NOK annually and 0, if below. We chose the value of 800 thousand NOK, because the average wage for 60+ year olds was 610 thousand NOK (SSB, 2019), making 800 thousand NOK a sum above average. Income above 885 thousand NOK, also implies a surtax, creating an incentive cut off at this value (Skatteetaten, 2019).

9.3.11 In work

The variable "in work", contains data on the employment status of Norwegian population (Microdata, 2018). We categorized the variable as a dummy variable, taking on the variable 1, if employed at age 62 and 0, otherwise. The variable is our dependent variable in the last regression when estimating likelihood of exiting the workforce.