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The effects of unemployment rates on employment of senior workers

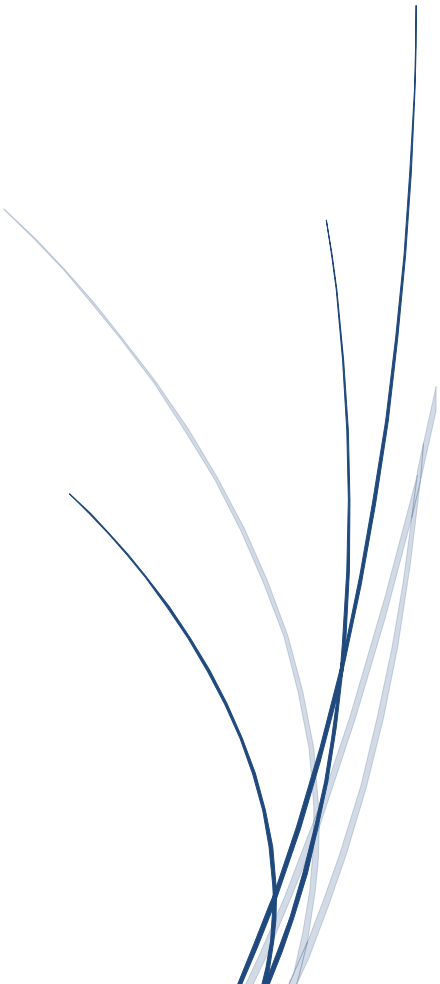
Master's Thesis in Business Administration

Economic Analysis

Maren Lunde – 216553

Marthe Amdal – 212387

Thesis Advisor: Venke Furre Haaland



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AUTHOR(S)		SUPERVISOR:
Student number: 216553 …… 212387 ……	Name: Maren Lunde …… Marthe Amdal ……	Venke Furre Haaland

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"It's a recession when your neighbor loses his job; it's a depression when you lose your own"

- *Harry S. Truman, April 13th 1958*

Abstract

The unemployment rate that faces individuals in different industries can affect workers differently. In this paper we analyze how vulnerable the senior employees are to changes in the unemployment rate. By analyzing registry data for Norwegians between 1972-2015, we demonstrate that the unemployment rate affects senior workers negatively.

Our study suggests that the unemployment rate, both the overall and the industry-specific rate, affects senior employees negatively. The likelihood of being employed when reaching senior years, which we define as being between 60-76 years old, decreases when the unemployment rate increases. The effect is more negative for seniors than for the middle aged groups. However, the effect is smaller than for the youngest survey participants, who are between ages 16-35. We also found indications that the effect is greater for senior employees who are not in a relationship, for individuals with low levels of education and for men.

We believe that as long as senior employees are valuable assets to the firm, it creates added value to the Norwegian economy to keep them in the labor force as long as possible. If seniors leave the labor force earlier due to insecurity around their position, Norway will experience higher expenses and less economical contribution to the society. We hope that this study will have value for the policy makers action development, and that we can contribute to individual's personal reflections on selecting working sectors and labor market decisions. We also hope to contribute to future research on senior worker's position in the labor market.

Preface

This paper represents the completion of a two-year master's degree in Business Administration at the University of Stavanger. This paper is written within the field of human resource management, under the study program Economic Analysis.

First and foremost, we would like to thank our thesis advisor Venke Furre Haaland for great guidance and support, and for insightful discussion and quality advising.

Second, we would like to thank the Norwegian Centre for Research Data (NSD) and Statistics Norway for providing us with data needed in order to complete our paper. The data used in this paper is retrieved from the "Labor Force Survey 1972-2015". The data is collected by *Statistics Norway*, and organized and made anonymous by *Norwegian Centre for Research Data AS*. Neither Statistics Norway or NSD are responsible for the data analysis or interpretation that is performed in this paper.

Finally, we would like to thank our family and friends for great support.

Maren Lunde and Marthe Amdal

Stavanger, June 2016

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1. Introduction

The Governor of the Central Bank of Norway, Øystein Olsen, said in his annual address[1] "*The Norwegian economy has enjoyed an exceptionally long summer. Winter is coming".* Norway has for a long time experienced an economic upturn, with high revenues from the oil- and gas sector. In the summer of 2014 the price of oil dropped to an all-time low, which will create negative effects and challenges to the Norwegian economy in the years to come (Olsen Ø., 2016). Fluctuation in the economic activity is not exceptional to Norway. Business cycles have large implications on the national economy. Economic factors like unemployment, inflation and monetary and fiscal policy are especially affected. Recessions tend to have particular large effects, creating repercussions of different aspects. When recession occurs, the economic growth will slow down, which usually means that the unemployment rate rises (Davis & Haltiwanger, 1999).

The unemployment rate in Norway has increased during the last years, reaching 4.9 percent for the overall population in 2016 (Statistics Norway, 2016). Recent research shows an increase in the unemployment rate for workers aged 60 and above of around 30 percent since 2014, which is high compared to other age groups (NyAnalyse AS and Vivens AS, 2016). At the same time, Norway faces both an increasing aging population and an increased life expectancy. The Norwegian population is predicted to be approximately 6.9 million people in 2060, where every 5th citizen is at least 70 years old (Statistics Norway, 2014). This means that a large fraction of the population is now late middle aged and entering senior years. In other words, reaching retirement or doing so in the next 10-15 years. The retirement system in Norway has changed throughout history, and the pension age has become more flexible. This gives senior employees greater retirement options, for example making it easier to leave the labor market at a younger age[2]. This has implication for the society through considerable economic costs, particularly through social security benefit payments and a lower tax base. The same study by NyAnalyse and Vivens (2016) estimates the value loss for the society to be 27 billion NOK, if workers aged 58-62 reduce their labor force participation to the same extent as they did during the banking crisis in the 1980's and 1990's.

[1] The annual address is given by the Governor of the Central Bank of Norway every year. This is a tradition that dates back to 1922. The Governor addresses the economic situation of Norway, and reflects on the nation's future prospects.

[2] Norway has also experienced a strong increase in GDP per capita in the past decades. This might also have possible effects on the retirement date, most likely pushing the retirement age down.

Recessions have impact on everyone, and unemployment hits all ages. Previous research emphasizes groups like men, minorities and low-educated workers to be especially vulnerable during recession and when unemployment rates are high (Hoynes, Miller & Schaller 2012). Low-ability males that face high unemployment rates when graduating, are more likely to suffer from long-term negative labor outcomes (Haaland, 2015). However, there are few studies that focus on the consequences for the elderly. Some studies show that senior workers experience more difficulties getting a new job (Farber, 2004; Coile & Levine, 2011), and therefore many choose to be inactive and eventually retire. Because it is often more ideal to be registered as retired instead of as unemployed, the statistics may differ from reality. In other words, the statistics may not indicate the real unemployment rate for this age group.

Previous empirical studies provide evidence that the labor market status is a highly important factor for the retirement decision at the individual level (Coile & Levine, 2011; Hairault, Langot, & Zylberberg, 2015). Research, all the way back to the 1980's, finds that those who are unemployed leaves the labor force permanently more often than those who are employed (Bould, 1980). The purpose of this thesis is to examine how vulnerable the senior employees are to changes in the unemployment rate, and how the likelihood of being employed changes with age. We will also investigate how the unemployment rate has different effects across subsamples broken down to age, marital status, gender and level of education.

The background and theory part of this thesis will focus on retirement, which is what the majority of the seniors select when leaving the labor force. The research question is conducted in the following way:

"How does the unemployment rate affect senior employees?"

To answer our research question we have analyzed the Labor Force Survey by the Norwegian Centre for Research Data[3] (NSD). The dataset provides information from 1972-2015, a time period with both recessions and expansions. The information is regarding the labor force status and personal background such as working hours, temporary work absences, job seeking and education. This allows us to run several regressions to look for potential patterns. We have processed the data and conducted several Ordinary Least Squares (OLS) regression

[3] NSD provides data to researchers in Norway and abroad, and is one of the largest archives for research data of its kind in Norway. NSD´s research data provides information about the human societies, and is organized in individual level data, regional data and data that concerns institutions and political systems.

analysis. To help answer the research question we have divided it into the four following sub-questions:

1. *How does the overall unemployment rate and the industry-specific unemployment rate affect senior employees, and does the rates affect them differently?*
2. *Does the unemployment rate 5 and 10 years ago affect the senior's employment status today?*
3. *Is the effect different across different sub-samples?*
4. *Are these effects substantially different between different age-groups?*

The first sub-question is conducted to answer most of the research question. By including the industry-specific unemployment rate we hope to get a better estimate of the effect on employment status. By lagging the unemployment rate 5 and 10 years back we want to see if there is a lagging effect of the unemployment rate on employment status. In other words, that there might take some time before the effects of the unemployment rate strikes in. The third sub-question will answer the different effects on groups with different personal characteristics. Lastly, to see if the effect is unique for senior employees, we compare the results to other age-groups. This will hopefully enable us with information that can help draw a conclusion.

In our analysis we explore how the unemployment rate effects employment of individuals aged 16-35, 36-45, 46-59 and 60-76 differently. For identification we utilize information on worker's industry specific unemployment. In our estimation model, we include industry-specific unemployment rate interacted with age, year- and industry fixed effects and gender. This allows us to control for time-invariant year- and industry characteristics, and differences between the genders. The different effects of unemployment rate across age groups are thereby identified by how the industry unemployment rate changes over time and across industries.

There are many reasons for why the unemployment rate could affect senior employees labor force participation. First, senior employees might choose to exit the labor market when unemployment is high. The leisure-/work model by Lazear (1987) suggests that Social Security benefits can encourage senior workers to work less when the gap between the wage in the labor market and the possible income outside the labor market decreases. In addition, re-entering the labor market at senior years is more difficult compared to when being young,

and many senior workers might therefore choose leisure over consumption. The reservation wage also has to be considered, as this can change during recessions. The added worker effect reviles the effect of how rising unemployment rates might actually increase individuals labor force participation incentives, in terms of increased motivation to work if the spouse is at risk of losing his or her job. We will also investigate a senior worker's probability of becoming a part of the disability pension program when health decreases, which is often the case for seniors.

Second, effects on senior employees labor force participation can also be seen from a labor demand point of view. Senior employees might be target for buyout packages in economic recessions. Becker's theory of human capital (1962) and Lazears seniority wage model (1979) suggests that senior employees often are the most unproductive workers relative to their earnings, when a high degree of specific human capital is present. This is because senior employees invest less in human capital and because they are collecting returns from earlier investments, generating small profits to the firm. In addition, an unemployed senior worker might be a less attractive hire because of limited time remaining in the labor market. Therefore, both the option value and the benefits from specific human capital investments are relatively low, compared to prime age workers.

There is a growing literature exploring the relationship between retirement age and unemployment. Some of the studies have several similarities to our paper. One of them is Mormora and Ritters study (2015) that investigates the retirement decision as a result of an unemployment spell. They find that unemployed workers leave the labor market permanently at a significantly higher rate than employed workers. This effect is enhanced in relation to social benefits received. Tatsiramos (2010) also shows that the degree of various forms of public social support has an effect on retirement age. Countries with relative higher unemployment insurance for senior employees experience a higher retirement rate and a lower re-employment rate. This is relevant to our study as Norway has generous unemployment benefits. The findings of Tatsiramos therefore indicates that individuals in Norway might leave the labor force earlier. Coile and Levine (2011) also supports the idea that senior employees are more likely to withdraw from the labor market when unemployment is high. However, their study finds that the effect is bigger for the workers with less education and lower income level. Previous literature also shows that involuntary job loss can result in large and lasting impact on future employment probabilities. Much of this is reflected by standard job search difficulties (Chan and Stevens, 2001, 2004).

The analysis indicates that the unemployment rate, both overall and the industry-specific rate, affects senior employees negatively. The effect is small, but still present. When looking at the overall unemployment rate the effect is stronger than when looking at the industry-specific rate. All findings in our main analysis are statistically significant at 1%. In our main model we find that a one percent increase in the unemployment rate leads to a decrease in expected employment of 0.04 percentages for the seniors. We also conducted sub-sample analysis for marital status, level of education and gender. We found that the effect is greater for senior employees who are not in a relationship, for men and for the workers with low levels of education.

As expected, and consistent with previous research, the youngest group, 16-35 are the ones who are most negatively affected by changes in the unemployment rate. However, one interesting thing to notice about the results is that the senior employees gets *more* negatively affected by changes in the unemployment rate, both the overall and the industry-specific rate, compared to individuals aged 36-45 and 46-59. Reasons for this are explained in the theory-section of this paper.

Our analysis contributes to existing literature as it focuses at senior workers instead of younger workers, which most previous studies focus on. The focus of previous studies on the younger workers is natural, as they have a long working career ahead. However, we find it important to look at the senior workers as many create high value to the society, but still chooses to retire. This can lead to a loss in value creation in Norway, like NyAnalyse and Vivens (2016) has predicted. We hope that these findings might have significance for policy makers, in terms of development of pensions reforms and restrictions on labor rights, as well as for an individual's personal reflections when selecting working sectors and work lifecycle pattern. Previous research (Rege, Telle & Votruba, 2009) also shows that downsizing affects health and mortality negatively, making it important to create good arrangements that will reduce the senior's vulnerability when downsizing.

This paper is organized in the following way. A brief overview of the labor market with focus on senior employees and the retirement system is given in Section 2. Section 3 presents the theory used and some of the existing literature concerning unemployment effects on retirement decision. In Section 4 we present our data used to carry out our analysis, before we in Section 5 present and discuss our empirical strategy. Our results are presented and

discussed in Section 6, before we sum up and draw a conclusion based on our findings in Section 7.

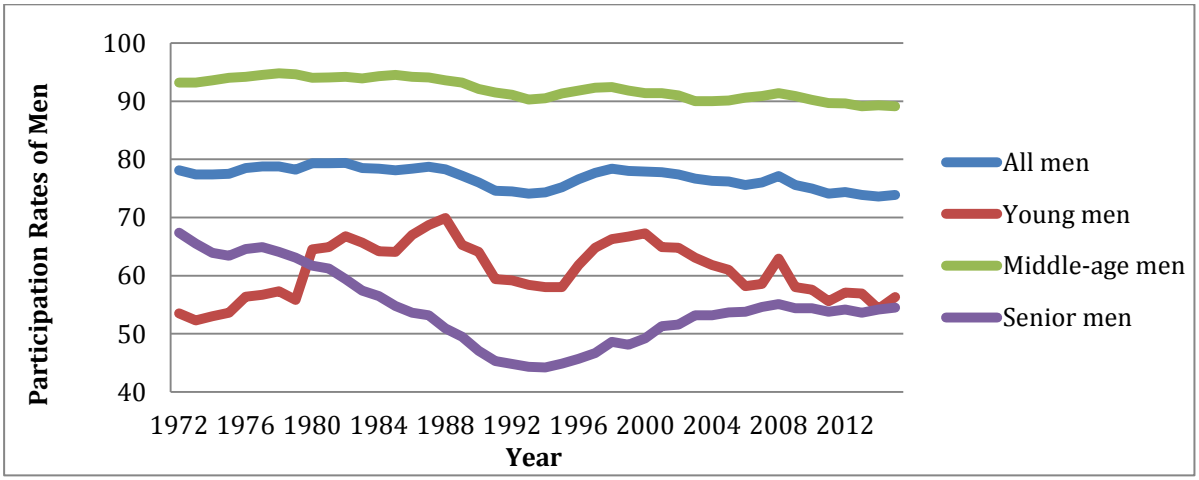
2. Background

As mentioned in Section 1, Statistics Norway predicts that every 5th citizen in Norway will be at least 70 years old in 2060. This increase in the average age of the population will increase the number of senior employees in the labor force. If many of these workers choose to leave the labor force, the labor force could be drastically reduced. In this section we will discuss the labor supply in Norway and what alternatives senior employees faces when leaving the labor force.

2.1 The Labor Supply in Norway

The labor market in Norway is in constant change, as well as the trend in the labor supply. Figure 1 demonstrates the trends in the labor force participation rate for men between 1972 and 2015, divided into young men (age 15-24), middle-age men (age 25-54) and senior men (age 55-74). The table shows that the labor force participation rate has been stable for middle-aged men. There was a fall in the rates for the young men from 70 percent in 1988 to 58 percent in 1994. The rate has also been falling from year 2000. The labor force participation rate is lowest for the seniors, but the rate has been increasing the last 20 years. Overall, the labor force participation rate for all men has been somewhat stable, between 74 and 80 percent.

Figure 1: Labor Force Participation Rates of Men, 1972 - 2015

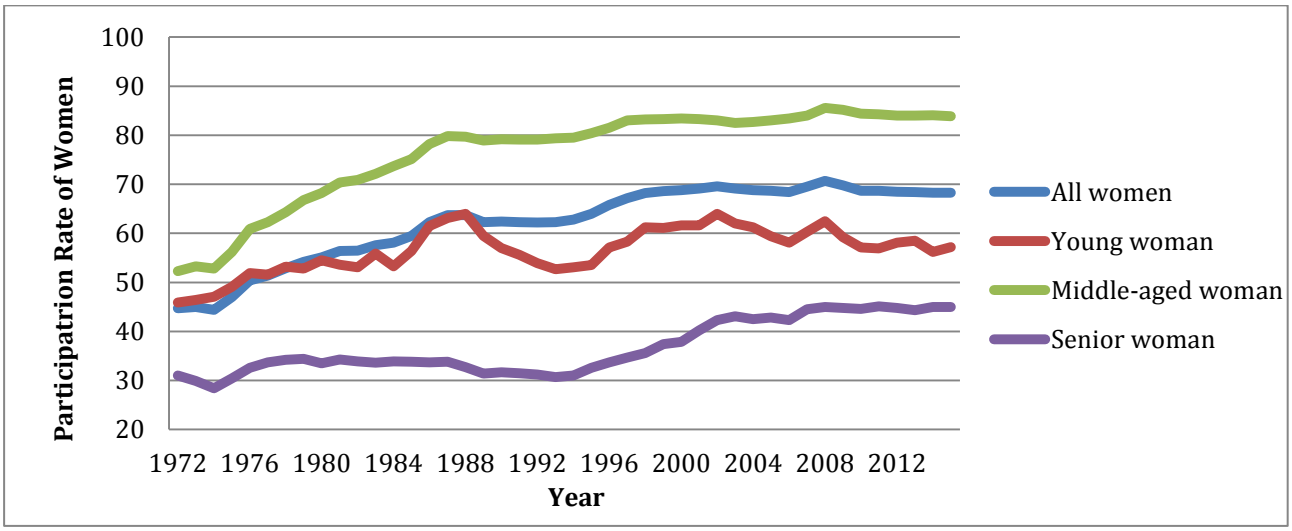


Notes: The graph is self-composed, with numbers retrieved from the Labor Force Survey. Y-axis in percentages.

Figure 2 shows the labor force participation rate for women between 1972 and 2015, for young women (age 15-24), middle-age women (age 25-54) and senior women (age 55-74). Ass seen in Figure 2, there has been a significant increase in the participation among women

in the work force the last 45 years, increasing from 43 percent to close to 70 percent. The greatest increase is seen for the middle-aged women and the senior women. This is in example due to a reduction in average hours of work per week, higher educational attainment, a higher focus on equality between the genders and the increased use of gender quotas.

Figure 2: Labor Force Participation Rates of Women, 1972 - 2015



Notes: The graph is self-composed, with numbers retrieved from the Labor Force Survey. Y-axis in percentages.

Both Figure 1 and Figure 2 shows that the participation rate among the seniors has been remarkably lower than for the other age groups, both for women and for men. The participation rate for senior women has been around 40 percent over the last 20 years, which is in average 10 percent less than for senior men. There are several possible explanations for why the participation rate is lower for seniors. Many seniors in this age group could have already left the labor force or for example be on disability pension. These factors will be discussed later in the theory part of this paper. An interesting note is that the participation rate fell remarkably for senior men in the period before 1992, whilst the rate among women was more stable. Norway was experiencing a recession from the 1980's into the 1990's, which can be one explanation of the falling participation rate among men. At the same time the labor force participation equalized between the genders, which can explain why the recession did not affect women as significant as men.

2.2 The Pension System in Norway

The Norwegian pension scheme is a complex system, and comprises of complex calculations. In the following section we will make an understandable overview of the most important aspects.

During employment, both the employer and the social security deposits money into a pension fund. This fund becomes available at retirement age to substitute for the lost income. Everyone who lives or works in Norway obtains the right to retirement after a certain age. There are also other pension arrangements that one might be entitled to, but we will not discuss these further in this paper. The pension is normally divided into two parts:

1) Granted pension – This is the pension that you are entitled to regardless of your occupational history.

2) Income pension – This is the pension that you build up during your employment, and is added to your granted pension.

If you earn above a certain level, you can withdraw the saved pension from age 62.

The retirement system in Norway has changed during the analytic period of our analysis. In 1973 the retirement age was reduced from 70 years to 67 years[4], with the option of early retirement (Statistics Norway, 1995). Declining retirement ages has also been the case in other parts of the world. The fact that more individuals qualify to retirement could result in a higher proportion of the population being retired now than before 1972.

In 2001 the government appointed a pension commission, which consisted of both politicians and independent experts. This commission was appointed to create a new pension reform, that was adopted by the Norwegian Parliament in 2009. This reform makes the retirement age more flexible, and gives people greater choice of when to retire. The thought behind the reform was to encourage people to stay longer in the work force, as people was getting older and the reproduction rate was declining. On the other hand, it gave flexibility to those who were not considering themselves as valuable assets to the work force anymore. Before this

[4] Some groups have other retirement ages. Pilots and drivers = 55 years. Sailors, fishermen, lumberjacks and cabin crew = 60 years. Nurses, offshore workers, travelling salesmen, miners, reindeer shepherds, driving instructors crane operators, excavator drivers, bulldozer drivers and insurance salesmen=65 years (Dahl, Nilsen, & Vaage, 2000).

reform was in place it was not abnormal for people to exploit other unemployment benefits, such as the disability pension, as a pathway to early retirement. By making people choose their own pension savings instead of the government funding, the commission tried to motivate people to work longer. This resulted in a larger proportion of the population being employed and a smaller proportion of the population being retired.

A combination of the post-World War II Baby-Boom[5] and the fact that fewer children are being born today than before, has resulted in a continuous older population. People are also living longer. When the pension age first was lowered to 67 years in 1973, the average life expectancy was 81 years. The life expectancy in 2050 is estimated to be 99 years (Statistics Norway, 2014). This would result in over twice as high expenses for the Norwegian Government, from 6% of mainland-GDP in 2003 to 15% of mainland GDP in 2050 (The Royal Department of Finance, 2004). To obtain a sustainable economic future for generations to come, changes had to be made.

The individual pension payments depend on retirement age. In the appendix there is a specific example of a woman who is born in 1963 and has been working since 1987. She will be 62 years old in 2025, and she wants to investigate her different pension options. She wants to investigate how her pension payments change if she retires at age 62, 67 or 70. The income has been stable, of 6 times the Norwegian Base Amount (G) (which is equivalent to NOK 540 408, calculated using the G from 1st of May 2015) all her working years. The pension increases by 18,1% every year until reaching 7,1G. When calculating the pension, we divide the income with a number that is different for each year, which is supposed to take the life expectancy into account. The number for people born in 1963 are 19,72 if retiring at age 62, 15,68 if retiring at age 67 and 13,29 if retiring at age 70 (the average for the year) (Nav, 2015). Note that we assume no private savings, or savings made by the employer. This example only contains the public pension. If she retires 100% at age 62 she receives a yearly payment that is approximately 80 000 NOK lower than the payment she faces when retiring at 67. The same difference from 67 to 70 years is 70 500 NOK. See appendix 1 for calculations. She can also choose to only partly retire, and thereby still earn some of her normal salary. Calculations of this will not be provided.

[5] In 1946 there was born over 70 000 children in Norway. This was a result of many women being in the right age, and that the future looked brighter as the war had ended (Hagemann, 2015).

2.2.1 Social Security in Norway

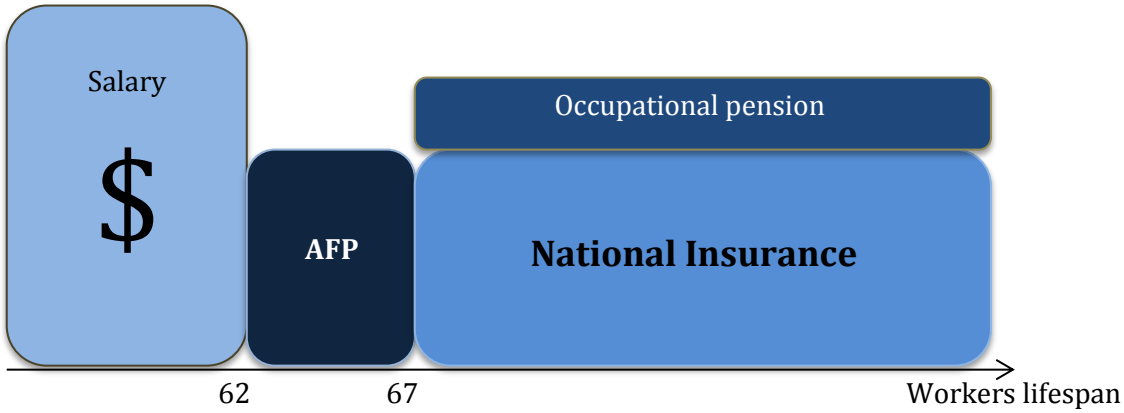
The retirement pathway may also be affected by the degree of various forms of public social support. By using data from Germany, Italy, Spain and the UK, Tatsiramos (2010) finds that unemployed workers in Germany and Spain have significantly lower re-employment rates than senior employees in UK and Italy. This is because countries with relatively higher unemployment benefits for older workers experience a higher retirement rate and a lower re-employment rate. The unemployment benefits in Norway are generous, indicating that the incentives to get re-employed might be lower here compared to other countries. In Norway we have unemployment insurance, disability pensions, sick-leave compensation, rehabilitation pensions and means-tested social assistance, to mention some of the benefits provided by the National Insurance Program. According to Bondal and Pearson (1995) the replacement rate for a fully disabled person living alone in the United States and the United Kingdom is 30 percent. In Norway the earnings replacement rate for unemployment insurance is 60 percent, which is high compared to the same rate in the U.S. that is less than 40 percent. The generous unemployment subsidiaries in Norway may cause the long-term effects on labor market outcomes of being re-employed in a recession to be worse here than in countries with less generous welfare systems.

2.2.2 Contractual pension (AFP)

In Norway we have Contractual pension (Avtalefestet pensjon - AFP). This is a collectively agreed pension scheme for those working in the private sector, and is founded 1/3 by the Government, 1/3 by the employers organization[6] and 1/3 by the employees organization[7]. This is an arrangement for those working until they reach 62 years. If you leave the working force earlier, you lose your right to AFP. AFP was revised together with the new pension reform in 2011. The old pension system in Norway was according to Figure 3.

[6] In example NHO
[7] In example LO

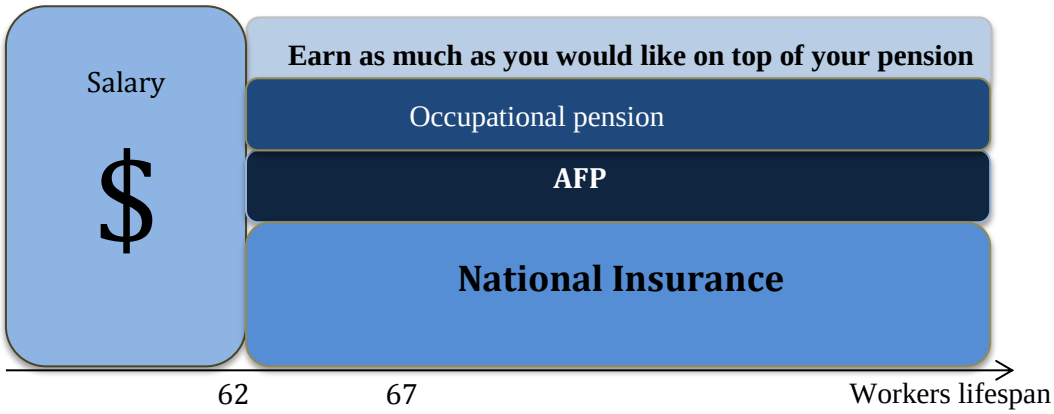
Figure 3: Pension system before 2011



Source: Figure can be found at Fellesordningen for AFP, retrieved from *http://www.afp.no/hva-er-afp* 04.03.16

The revised pension scheme is as according to Figure 4.

Figure 4: Pension system after 2011



Source: Figure can be found at Fellesordningen for AFP, retrieved from *http://www.afp.no/hva-er-afp* 04.03.16.

The revised model eliminated the disclosed time frame between ages 62 and 67. Now one can get the AFP from age 62 until the end of life, as a supplement to the national insurance. In addition, one can now work as much as desired, while still receiving pension payments (Fellesordningen for avtalefestet pensjon, 2011).

3. Theory and existing literature

The unemployment rate can affect both employers and employees. During a recession, the unemployment rate often rises and the employers can be forced to lay-offs. The employees can be affected by insecurity around their employment situation, and the senior employees may therefore consider retirement.

In this section, we will describe several mechanisms through which the unemployment rate can affect senior workers labor force decisions. We will first discuss retirement decision through a labor supply model. This model explains the possible combinations of work and leisure, and how social security affects it. Second, we will look at labor demand. We will both consider how firms have incentives to dismiss seniority workers, and how they have incentives to not hire them at all. Third, we will look at existing literature that has researched subjects like the labor market and business cycles, especially towards senior employment patterns.

3.1 Labor Supply

The decision to retire is a complex issue, and is often a result of different factors. Different factors like wealth, health, family situation and how one values leisure, are all contributing to the decision on when to retire. In this section, we focus on how labor market conditions and personal preferences based on the workers constraints could affect how long individuals wants to stay in the labor force. In our study we focus on the senior workers.

The unemployment rate may affect retirement age, and could thereby affect the labor supply. We will explain this through a labor supply model developed by Edward P. Lazear (1986). This model shows the budget constraint that a worker is facing, with and without Social Security benefits. After the worker is offered a wage profile, the worker is allowed to select his or her optimal work/leisure path. A number of theoretical models are explaining this decision, on the basis of pensions, social security and life cycle savings behavior. The simplest and most primitive model of retirement is called the Leisure/Work-model. This model treats each year independently, where the retirement decision affects one year at a time.

The workers' lifetime utility function can be written as:

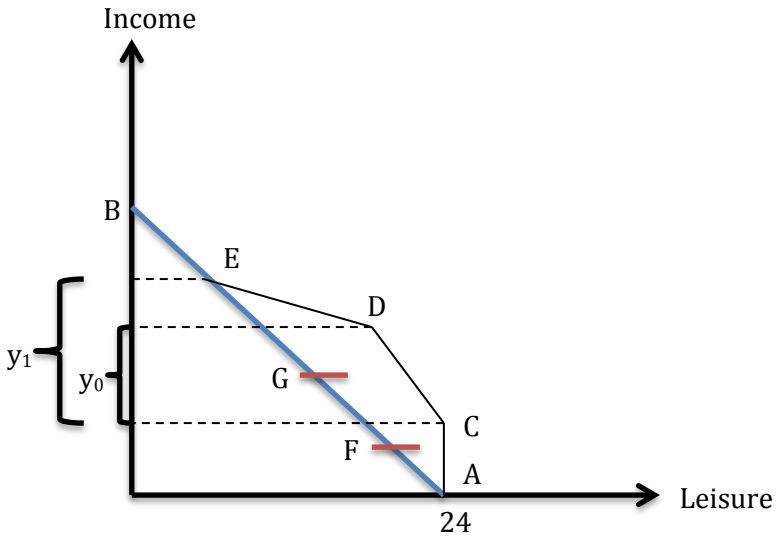
$$U = U(L_1, X_1, \dots, L_t, X_t),$$

where L_t is consumed leisure in period *t* and X_t is consumed goods in period *t*. To ensure that no borrowing or lending occurs, the workers' lifetime utility function, can be written as

$$U = U_1(L_1, X_1) + U_2(L_2, X_2) + \dots + U_t(L_t, X_t)$$

Full retirement occurs when leisure equals the full amount of time available, 24 hours per day.

Figure 5: Leisure/work-model



Source: Lazear E., Retirement from the Labor Force in Handbook of Labor Ecomonics, 1986: p. 313

Figure 5 illustrates how Social Security benefits affects a person's budget constraint. The blue line, AB, shows a person's options when choosing between income (working more) and leisure (working less). The black line, ACDE, represents the Social Security benefits that is available. This model is interesting to look at in term of our research question because at some point the senior employees will have the option to choose between working or retire. If they choose retirement they receive Social Security benefits, which can actually result in them obtaining a higher income and more leisure. When reaching full retirement at point A, Social Security benefits allows the individual to be at point C instead of A, and by that have some income while still obtaining full leisure. This is if earned income does not exceed the maximum amount of allowed income (Y_0). If the income does in fact exceed Y_0, some amount will be extracted from the Social Security benefit, until income reaches Y_1. Then the

person will be back at the budget constraint without benefits. If the person is at point F in the figure, and retires fully, he or she will be moved to point C (through point A). This gives increased income and increased leisure. If being at point G one might move to point D, work fewer hours without retiring fully and still earn more (Lazear, 1986). This model shows how senior workers has incentives to choose more leisure and higher earnings, assuming that they are not working full hours.

3.1.1 Labor supply decisions

When it comes to labor supply decisions one has to find the bundle of consumption (C) and leisure (L) that maximize one's wellbeing. In order to consume more goods, you have to give up on leisure, and in order to gain more leisure you have to give up on some consumption. This is of course the case when talking about people who are not independently wealthy, which most of us are not.

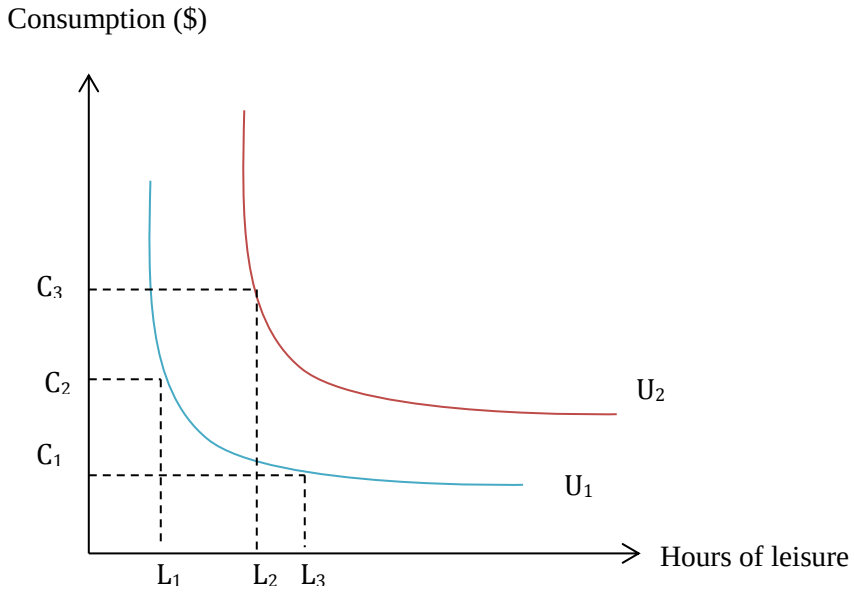
The fact that individuals maximize their utility by choosing the optimal bundle of consumption and leisure is denoted by the *utility-function:*

$$U = f(C, L)$$

The U stands for *utility* and denotes a person's happiness or wellbeing. We here assume that both consumption and leisure are economic "goods", which means that higher consumption of either leads to a higher level of satisfaction.

The next step is to look at an individual's indifference curve. This is a curve that denotes all possible combinations of consumption and leisure, that gives the same level of utility. This is illustrated by an example in Figure 6.

Figure 6: Indifference curves



Source: Borjas, 6th edition, 2013: p. 28

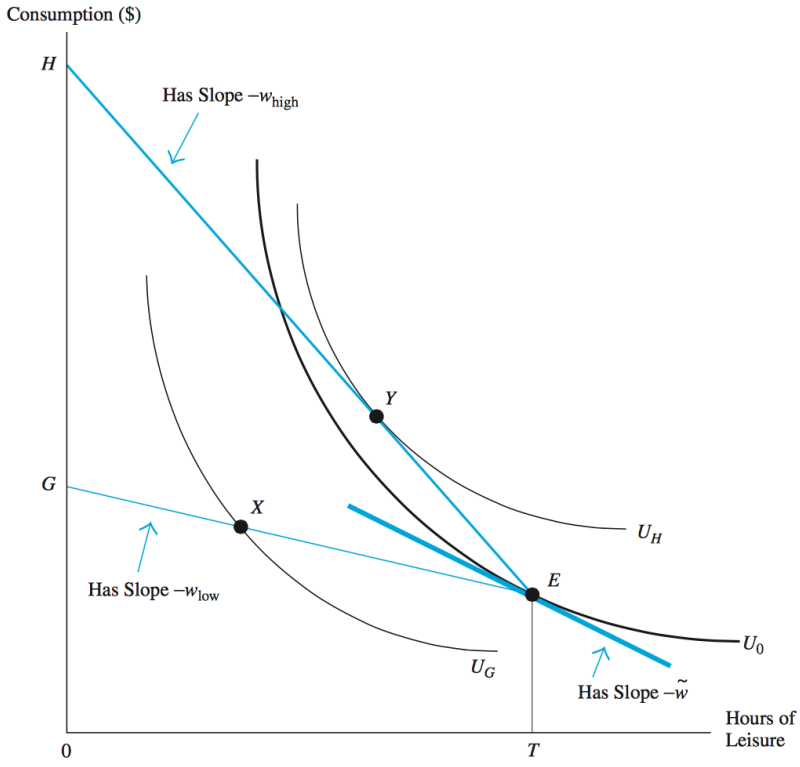
In Figure 6, the bundle (C_1, L_3) and (C_2, L_1) are on the same indifference curve, and gives the same amount of utility, U_1. The bundle (C_3, L_2) is on a higher indifference curve, and yields a higher level of utility. Figure 6 tells us that the person should strive to consume C_3 worth of goods and L_2 hours of leisure, in order to obtain the highest possible level of utility (Borjas, 2013).

We consider this model with a full-life perspective. A person can choose to work for many years, and in that way consume a lot of goods and services, but in that way obtain less leisure. Alternatively, he or she can choose to work for less years, and consume less goods and services, but obtain more leisure. If the pension payments are high seniors might choose to leave the work force earlier, in order to obtain more leisure. When the unemployment rate is high, there will be increased pressure on wages. This will shift the worker to a lower indifference curve, hence earning less, whilst working the same. This may lead to more senior employees leaving the labor market if the difference in income, inside and outside of the labor market, is not as big compared to before. This is illustrated in Figure 7.

3.1.2 The reservation wage

Figure 7 illustrates the model of the reservation wage, which can help us understand why individuals at one point find it better to retire than to work. Consider a woman, who is earning w_{high}. The line HE initially illustrates her budget constraint. The best combination of consumption and leisure would be at point Y, obtaining U_H units of utility. She then loses her job, and ends up with an expected income of w_{low} in another job, due to the loss of firm-specific human capital. The line GE gives her new budget constraint, and there is no point on the curve that yields higher utility that in the endowment point E, which yields U_0 units of utility. If she decides to re-enter the labor market she would move to a lower indifference curve, making her less happy. At point X she will get U_G units of utility, which is lower than U_0. She will therefore choose not to work at $w_{low.}$ Rotating the budget line from w_{high} to w_{low} encounters a wage rate, $\tilde{w}$. This wage makes her indifferent between working and not working. This is referred to as her reservation wage (Borjas, 2013). In light of our problem, we can look at T as the pension age, let us say 67 years. At 67 she will receive pension payments worth TE. She can choose to work in addition, receiving $w_{low,}$ but since this is on a lower indifference curve, she will rather prefer not to work at all.

Figure 7: The Reservation Wage

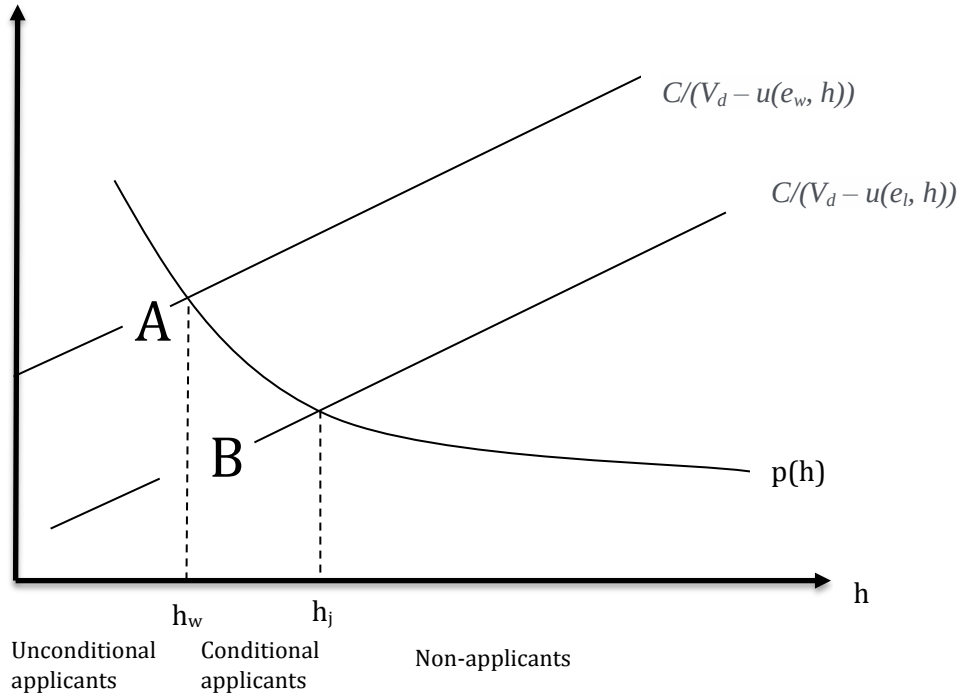


Source: Borjas, 6th edition, 2013: p. 41

3.1.3 Probability of becoming a part of the disability pension program

Lower expected income also affects labor market exits of senior workers through the probability of becoming a part of the disability pension program. Previous research shows that, when downsizing, older workers with poorer health are more likely to apply for disability benefits if the net benefit of receiving disability pension payments exceeds the costs of applying for it (Rege, Telle, & Votruba, 2009). Rege et. al. illustrates how health affects the decision to apply for disability pension.

Figur 8: People's labor supply choices



Source: Rege, M., Telle, K., & Votruba, M., The effect of plant downsizing on disability pension utilization, 2009: p. 762.

In Figure 8, health is denoted by *h. u(e,h)* denotes the utility of being in the workforce, *d* denotes disability pension, *w* denotes workforce, *e* denotes expected earnings and V_d denotes the fixed value of receiving disability benefits. e_w denotes future expected earnings if you retire and e_l denotes future expected earnings if you are laid-off. The model assumes that $e_w > e_l$, meaning that the cost associated with re-entering the labor force gives lower future expected earnings. *C* denotes the cost of filling an application, and *p(h)* is the probability that your application succeeds. Those with $h<h_w$ will apply for disability pension, no matter what. Those with $h_w<h<h_j$ are conditional applicants, meaning that they will apply for disability

benefits if the expected net benefit of receiving the disability pension is higher than the cost of applying. Those with health $h>h_j$ are non-applicants, meaning that they will not apply in either case.

Area A denotes the likelihood that a random worker who is retained, applies for disability pension. Area A+B denotes the likelihood that a random worker who is laid-off, applies for a disability pension.

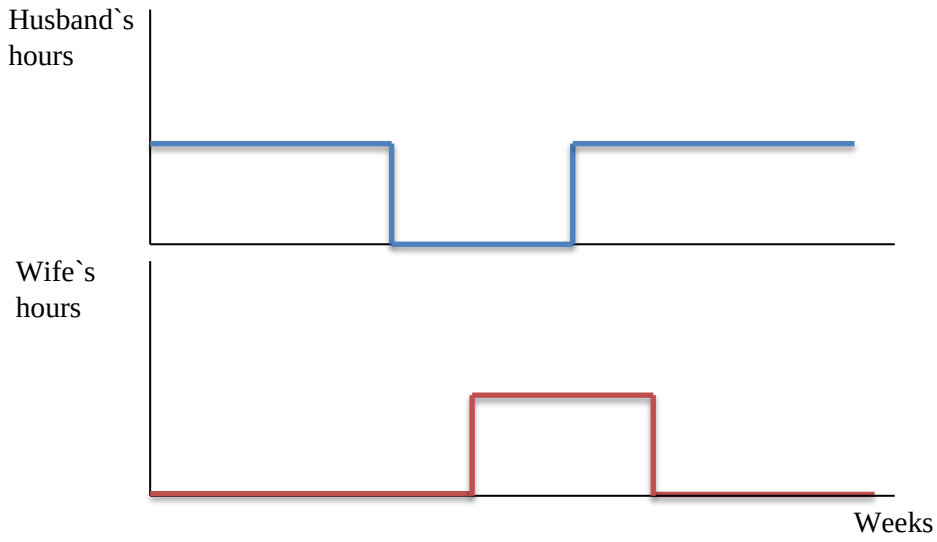
In summary, downsizing can affect both expected future earnings and health, which in turn affects the likelihood of applying for disability pensions (Rege, Telle, & Votruba, 2009). We can also look at this in terms of our study. When the unemployment rate increases, many firms have to downsize, and many are therefore in the risk of losing their job. Senior workers often have poorer health than younger workers, and it is therefore more likely that they are in area A or B than their younger peers. In other words, it is likely to say that senior workers might choose to apply for disability pension when the chances of getting retained or laid-off increases.

3.1.4 The added worker effect

Recessions do not only discourage workers and by that decrease the labor force participation rate. Economic downturns can also motivate workers to both maintain their place in the labor force and also enter or re-enter the labor market. If some family members are in the position of losing their job, or potentially losing it in the near future, one might be motivated to participate in increasing or maintaining the family income. This is called the "added worker affect".

The effect implies a countercyclical movement of the labor force participation rate. In many situations the wives' reservation wage is a result of the husband's wage. Therefore, in situations where the husband's wage will decrease or is in a high risk of decreasing, the wife enters the labor market. This is illustrated in Figure 9. When the husband in the family becomes unemployed, the wife, who is originally outside the labor force, is motivated to enter the labor force to make up for the family income loss. The wife's entrance has some lag, as a result of time spent on searching for jobs and similar. The wife's time in the labor force is only temporary, and the length is associated with the time of her husband's unemployment spell (Lundberg, 1985).

Figure 9: The added worker effect



Source: Lundberg, S., The Added Worker Effect, 1985: p. 13.

In light of our research, it is interesting to see if the effect of the unemployment rate on the labor force participation of females is different for married and single workers. We will therefore both use marital status as a control variable in our analysis, and conduct a sub-sample analysis for those being in a relationship, those being single and for gender.

3.2 Labor Demand

The decision of retirement is not only a personal choice. Factors in the labor market, for example firm's actions and seniority politics, have strong influence on senior employees. We will focus on how the firm's actions affects labor demand, both in terms of their incentives to lay-off existing senior workers and their incentives not to hire new senior employees. The theory of human capital developed by Becker (1962) and the seniority wage model developed by Lazear (1979), can help explain this relationship.

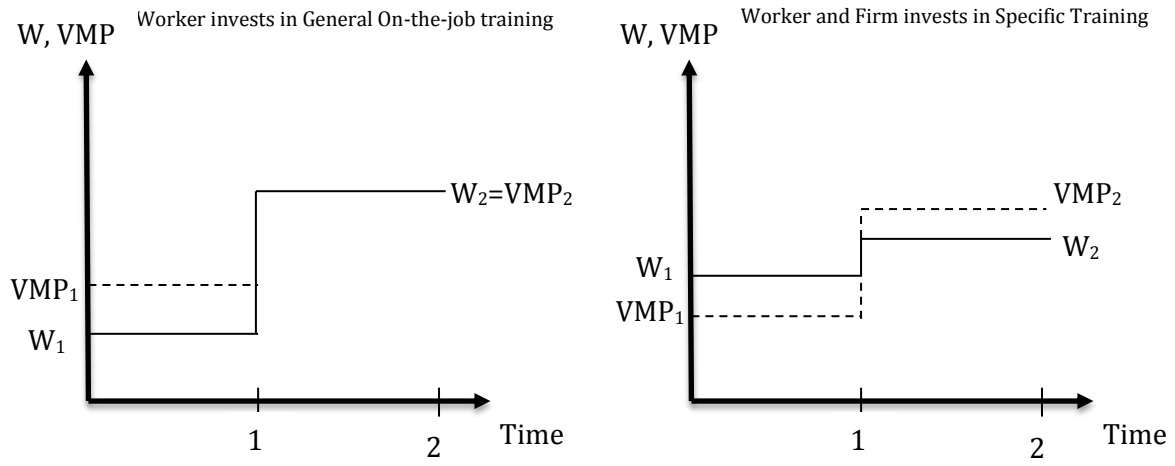
3.2.2 Incentives to lay-off existing senior workers

In times subject to economic decline, dismissals may be necessary for a company to survive. This often results in offering workers buyout packages. Each company must determine which worker that is most optimal to target for buyout packages, and which that are worth keeping. According to Lazear (1979), workers who are less beneficial to the firm relative to other workers are the ones to lay off. These are often unproductive workers that produce less compared to their salary. Before we explain which workers this might be, we need to

understand the matter of human capital. The theory of human capital, developed by Gary Becker (1962), argues that the income of a worker increases with time because productivity increases with training efforts. This training (on-the-job training) can be divided into general and specific training. General training increases the workers productivity both in the current firm and in other firms. Specific training only increases the worker's productivity in the current firm[8] (Becker, 1962).

The underlying assumption is that, at all points in time, competitive forces guarantee that wage equals the value of marginal product. A worker who invests in general training, both pays and gets the full return from the training. Consider a two-period case; the worker compensates the firm for its costs on training by accepting a first period wage, which is less than the marginal product. The worker then obtains the full return by receiving a second period wage, which is equal to the marginal product (Becker, 1962). On the other hand, the two-period case for specific training would have other outcomes. Here, both the worker and the firm would share the cost and the benefits of training investments. In the first period the worker receives a higher wage than the value of marginal product to compensate for the investment in the firm-specific training. In the second period, when the training is completed, the worker gets a higher wage. The wage in the second period is, however, less than the value of marginal product, which has now increased. This makes the firm also benefit from the training (Becker, 1962). This is illustrated in Figure 10, where VMP denotes Value of Marginal Product, W denotes wage, 1 denotes period 1 and 2 denotes period 2.

Figure 10: Investment in training

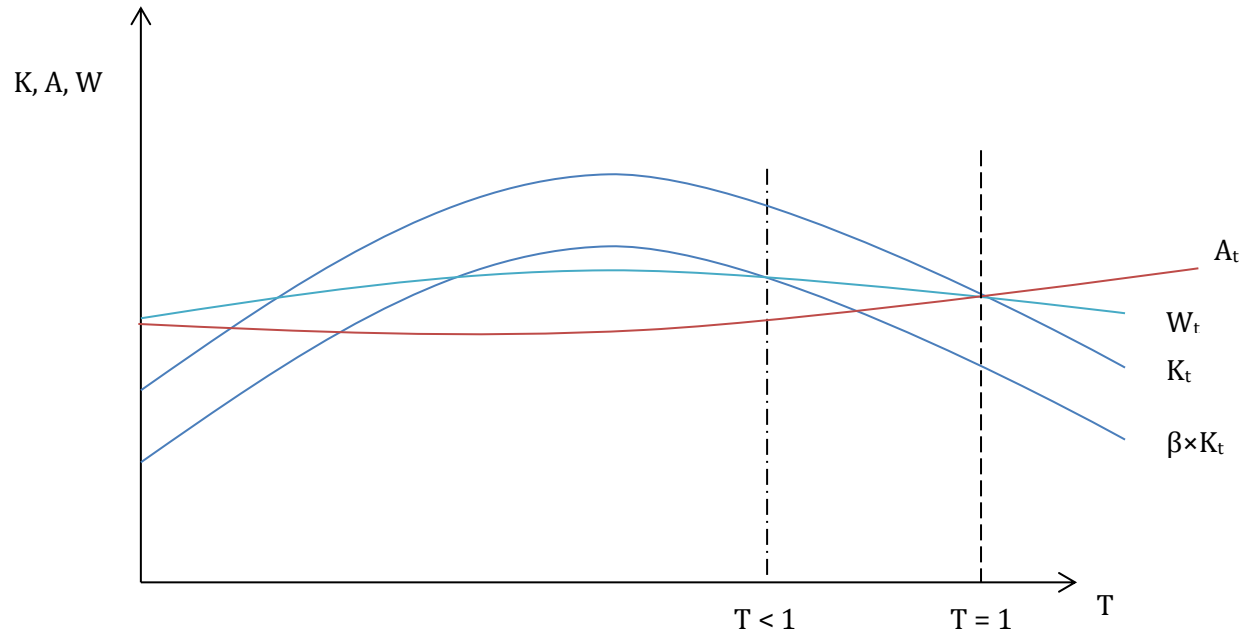


Source: Becker, G., Investment in Human Capital, 1962.

[8] In reality, most training falls somewhere in between general and specific training.

The theory of human capital helps us understand the wage-seniority relationship. Wages tends to rise with seniority in the firm, and in most organizations senior workers receive higher wages than junior workers (Abrahan & Farber, 1987; Hutchens, 1989). The seniority wage model by Lazear (1979), suggest that the age-earnings profile is upward sloping and concave. This is explained by senior employees earning more because they invest less in human capital, and because they are collecting returns from earlier investments (Lazear, 1979). This is consistent with the widely used Mincer Earnings Functions theory[9]. Further, the firm maximizes its profits by laying off workers who has recently started and the ones that are near retirement. This, however, is only true when specific human capital is important to the firm. The intuition behind this is presented in Figure 11.

Figure 11: Productivity and pay over the career with investment in specific human capital



Source: Lazear, E. and Gibbs M., Personnel economics in practice, 2011: p.84.

Figure 11 shows the profile of a workers pay and productivity over the career, when specific human capital is invested. The wage is labeled W and the productivity is labeled K. A denotes the workers best alternative outside the firm. For senior employees this depends on how the worker values leisure, as explained earlier in the paper. Therefore, at some point, the best outside alternative is retirement. T denotes time, and T=1 equals retirement age. The rising profile of A_t tells us that all workers would be better off retiring eventually (Lazear & Gibbs, 2015). As we can see from the Figure 11, the age-productivity profile does not match the age-

[9] For extended review of the Mincer Earnings Functions see "Schooling, Experience, and Earnings", *New York: Columbia University Press*, 1974.

wage profile. There are different explanations for why the productivity of senior employees is stagnating. Lazear points out one explanation that the worker chooses to shrink his productivity because the value of leisure and the earnings are almost equal. Even at the worst scenario, where the worker gets laid-off, the worker loses nothing because of the high value of leisure. Therefore, the senior employees have little incentive to work hard (Lazear, 2011).

When the workers' training is specific, the worker and the firm share both costs and benefits of the training. Right after the training is completed, the present value of the productivity profile is higher than the wage, where the difference represents part of the return earned by the firm. When the worker approaches retirement there is little remaining profit for the firm to earn. Therefore, the profit for the firm is highest for workers that has completed the specific training, and has many years left in the business. This is generally workers of medium age (Lazear, 1979).

In a recession the productivity falls, shown as a drop in K_t to $\beta \times K_t$, where $\beta < 1$. The firms profit of a worker drops, and it would therefore be profitable to lay off senior employees, as we can se from $W_t > \beta \cdot K_t$, after a certan age ($T < 1$) (Lazear & Gibbs, Personnel Economics in Practice, 2015). The steepness of a firm's seniority wage profile relative to the productivity profile is the key to distinguish between firms and worker's decision for early retirement. A steeper seniority wage profile will increase the incentives for a firm to lay-off senior employees (Frimmel, Horvath, Schnalzenberger, & Winter-Ebmer, 2015). At the same time, this decreases the worker's incentive to leave the work force. This must also be seen in relation to the degree of specific human capital investments (Lazear & Gibbs, 2015).

Although laying off older workers seems most reasonable for the firm to do, several factors suggest that one should not target senior workers to lay-off. Laying off senior employees is controversial and highly complicated. Senior employees are protected by some of the laws in the Norwegian Act on the Working Environment, which protects and serves in the best interest of the senior employees. Like §15-13a:

> *"AML §15-13 a. Termination of employment due to age*
> *(1) The employment relationship may be terminated when the employee is 72 years."*
>
> (Norges Lover, 2005)

Termination due to age was in 2005 increased from 70 to 72 years. This means that in many situations it is illegal to lay off senior employees. Employees may sue the company if they feel that they are fired on wrong terms. Such litigations are costly, and if the firm loses the lawsuit it will have to pay expensive damages. Because of the cost and the potential of being sued, offering buyouts is often a good idea. Buyout packages should be carefully designed to motivate and target the desired group to leave. The optimal rule for buyouts can be written as;

$$PW(W) - PV(K) > PV(W) - PV(A),$$

where PV present the present value. In other words, the workers best alternative, A, (in this case, retirement) has to exceed the present value of the worker's productivity, K, at the firm. If the buyout offer is accepted by the worker depends on the pension scheme the worker has acquired. Also, the length of the time until retirement plays a role. Those close to retirement have little to lose by accepting the package, because they have earned most of the return on their investment in human capital, and also puts a large value on leisure. Workers further from retirement require larger buyouts packages (Lazear & Gibbs, 2015).

Despite the above-mentioned reasons for laying off senior employees, the senior employees can be a very important resource to the firm. For example, the senior employees are often in position of valuable experience, information and knowledge, especially if they have invested in specific human capital. They are perfectly aware of many idiosyncratic processes and methods used in the firm, and they have strong knowledge and understanding of the firm's culture and informal network. They may also have developed good relations outside the firm that will benefit the firm, i.e. with clients, suppliers and partners. This experience, information and knowledge is very expensively obtained and hard to redistribute, and can therefore be lost when the worker leaves the firm (Lazear & Gibbs, 2015).

3.2.3 Incentives not to hire senior employees

When hiring new employees, the firm uses the same reasoning as when firing. In the hiring process, the key is to find applicants with large option value. Option value is referred to as the applicant's potential to create great profit for the firm. Here, the length of employment plays a large role. After a worker is hired, the firm invests in the worker, especially when high degree of specific human capital is desired. The profit from hiring the worker will therefore be larger the longer the worker tends to stay with the firm (Lazear & Gibbs, 2015). Therefore, the potential employer's willingness to invest in additional human capital might be very low, as

the senior employee faces limited remaining time in the labor force (Coile & Levine, 2011). The cost of hiring senior employees is enhanced when firms have health care plans and relatively costly pension plans (Scott, Berger, & Garen, 1995).

The reasons for both avoiding hiring senior employees and for targeting them for buyout packages are being reinforced in the light of the importance of technology and its development. New technologies require more modern skills. Not only does senior employees have less education and experience with new technology, the upcoming retirement also reduces a worker's incentive to invest in technological development skills relative to younger workers. Study also shows that workers with technological skills tend to retire later than non-users (Friedberg, 2003). Therefore, in light of human capital theory, there should be a positive correlation between technological changes and the investment in training, in order to keep employees in the firm longer. This is however hard to implement when unexpected changes in the rate of technological change occurs (Bartel & Sicherman, 1993).

3.3 Previous research

There are several papers that study the relationship between the labor market and business cycles. Many of these studies are addressing the effects on workers resulted by recessions, both in terms of employment, earnings and income. Most previous studies find groups like men, young people and ethnical minorities, to be especially affected by recessions. Most of these studies are from the United States, and may therefore not be directly applicable to Norway. The study of Hoynes, Miller and Schaller (2012) finds that recessions creates reductions in employment and income, where groups like men and black workers experience significantly larger unemployment increase compared to female and white workers. This is also the case for workers with low education, compared to workers with high education. The same study by Hoynes et. al. finds that men are more likely to act as discouraged workers (ref. the added worker effect) and women are more likely to act as added workers. Bell and Blanchflower (2011) shows that unemployment increased more rapidly among young people. The effect is greater among young people with low levels of education and skills, especially if they come from ethnic minorities.

Goodman and Mance (2011) finds evidence that the people working in construction, manufacturing and service-providing industries, suffer significantly more in recessions than other industries. Verick (2009) also provides evidence that economic downturns have larger

effects on the younger part of the population, especially young men. This is somewhat explained by the high proportion of young men in heavily affected industries, such as construction. A Norwegian study by Haaland (2014) finds that low-skilled men who enters the labor market when the unemployment rate is high, experience worse labor market conditions at age 35 compared to their peers who enter the labor marked when the unemployment rate is lower.

There are also personal characteristics that can affect senior's employment status. Several papers have studied the relationship between marital status and health. One of them is by Verbrugge (1979). She states that mortality rates in the US are higher for non-married, and that married people appear happier, healthier and that they have the lowest rates of chronic disabilities. Goldman, Koreman and Weinstein (1995) studies if the health effect on married people still exists among the seniors. They find that marital status both affect health and survival outcomes among the oldest ages.

Previous research on recessions effect on retirement decision among senior employees has been scarce, and the literature is also less conclusive. A study of by Marmora and Ritter (2015) looks at unemployment and the retirement decision of senior employees. By using individual-level panel data from the Survey of Income and Program Participation (SIPP), the study includes information on timing labor market transitions and all income sources, like social security and unemployment insurance benefits. This allows Marmora and Ritter to determine whether the retirement decision was predicted by an unemployment spell. They use a Difference-in-Difference model approach to control for unobserved heterogeneity that could drive their results. This is especially important due to the fact that workers who are more likely to be unemployed, also are more likely to leave the labor force. The study estimates that job loss and unemployment spell have a large influence on the timing of social security. Unemployment late in a worker's career and the low hiring rate for senior employees often triggers early retirement. The effect of unemployment is significantly large after turning 62[10], with an increase in the worker's monthly retirement rate by 7 percentage points, when not receiving unemployment insurance.

Chan and Stevens (2001, 2004) study the employment patterns of senior employees who have experienced an involuntary job loss, and use a method similar to Marmora and Ritter. They discovered that a job loss results in a significant reduction on the probability of future

[10] The age of 62 is the Social Security eligibility age in the United States.

employment. They also conclude that displaced senior employees retire at substantially higher rates than non-displaced senior employees. Much of this is reflected by standard job search difficulties. Another previous study that is similar to our study is the one by Coile and Levines from 2011, where they look at the correlation between unemployment and retirement. In addition, Coile and Levine look at differential effects of unemployment on retirement age across worker's income and professional skill level. They document that workers that experience recessions close to retirement are more likely to leave the labor force premature. The impact is significantly higher for less educated who rely more on Social Security support. Coile and Levines study uses state-level unemployment rate, unlike our study that uses industry-specific unemployment rate.

Senior employees' retirement decisions due to recessions have also been subject for studies in Europe and Norway. Dorn and Sousa-Poza (2010) separate involuntary from voluntary retirement, which moves the focus from individual preference for leisure versus work to labor market conditions. The result from the study discovered significant international differences, but highlights that involuntary retirement is an important phenomenon in Europe. In some countries, like Germany and Portugal, more than half of the retirement has been involuntary. The results are linked to company's encouragement for early retirement to reduce employment during economic slowdowns. A Norwegian study done by Dahl, Nilsen and Vaage (2002) analyze early retirement pathways for Norwegian workers. The findings suggest several gender differences on how workers react to factors that are important for the early retirement process. These factors are family characteristics, expected income, industry attachment and local unemployment. However, the study states that disability and unemployment are exchangeable pathways into early retirement.

Another Norwegian study by Rege, Telle and Votruba (2009) consider the impact of plant downsizing on disability pension utilization in Norway. The disability entry rate increased substantially for workers exposed to plant downsizing. Downsizing has also documented negative effect on workers in form of economic opportunities and health. Rege, Telle and Votruba also study the social aspects on disability pension participation among senior employees in a later research[11].

[11] For extended review of the social aspects on disability pension participation among senior employees, see "Social Interaction Effects in Disability Pension Participation: Evidence from Plant Downsizing" *The Scandinavian Journal of Economics*, 2012, p: 1208-1239.

4 Data

In this section we will first present a general overview of the data. Second, we will describe the sample selection, and how we processed the data. Third, we will present some summary statistics.

4.1 Data and sample

The data in this study is collected by and obtained from NSD. To carry out the research in our paper, we used individual level survey data. The brunt of this paper is based on the "Labor Force Survey" (LFS), which is individual level data from the labor force that has been collected since 1972, both quarterly and yearly up until today. The purpose of the survey is to give information about the development in the labor market, looking at both employment and unemployment. Another purpose of the survey is to look at different groups of the population's affiliation to the labor market.

We have decided to use data from quarter one each year because the yearly data is only given up until 2011. We are interested in obtaining a dataset that is consistent over as many years as possible, especially over the last few years, since the information about the individuals has become more extensive in later years. Notably, data from quarter one might deviate from the yearly data due to seasonal impact. However, we will always employ data from the same quarter each year, so we consider the data selection to be applicable for the purpose of the study.

We want to use a quantitative study to explore our topic of research. This is because a quantitative study is a structured and systematic method that uses a broad and representative part of the population as respondents. The method is descriptive and suitable to establish an overview of the extent of a problem. It provides insight into the variables that exists within a research field (Harboe, 2006). In addition to being descriptive it provides enough data to do more complicated analysis, and not just descriptive ones. Another benefit of using quantitative surveys is the large number of questions asked, and the large amount of respondents. It is generalizable and testable, and has the benefit that it can be analyzed mathematical and statistical.

The disadvantage of these types of studies is that once the survey is completed, it is hard to retrieve new and supplementary information. It is also hard to customize the focus. It is

therefore important to be aware of what one wants to resolve before sending out the survey. The survey used in this thesis is not developed by us, and is therefore not specified to our field of research. We may therefore meet some challenges when it comes to *what kind* of information is retrieved.

The unmodified dataset includes quarterly information retrieved from 9.000-21.000 individuals between years 1972 and 2015. The number of participants varies over the years, and the selection of individuals is random. Some of the individuals have participated more than once, but it is unfortunately not possible to follow the individuals over time. To get a representative selection of individuals, all individuals living in Norway is a part of the basis of selection. On basis of those registered with an address in Norway a number of family units are being selected such that about 9.000-21.000 individuals are surveyed each quarter. In 1972 there were 10.379 participants, whilst there in 2015 was 19.198 participants. The LFS covers individuals registered as living in Norway from 15 to 81 years old. In addition to surveying many individuals, the individuals' chosen are also representing all counties of Norway. The survey does not include expats or people working in the country on short term engagements (<6 months).

The unmodified dataset contains around 50-70 variables, where both the questions and amount of variables change from year to year. The comprehensive information obtained covers both employed, under-employed and non-employed individuals. The data includes variable groups such as personal background, working sector and income, working hours, temporary work absences and the process of job seeking and education[12]. NSD's data is being used on national level, both by politicians and Statistics Norway. By using NSD´s data, the sample comes from the same base system and satisfies a high degree of reliability and quality. The size of the sample also reduces the strength of the potential sampling bias. Sampling bias is the phenomenon of having a sample where some members of the population are less likely to be a part of the sample than others (Hug, 2003). Several variables in the dataset are not consistent across years or included in the full time period. Thus, we have selected a few variables, to get a consistent dataset that is applicable for all years.

[12] There have been made some changes in the LFS throughout the years, to improve the survey quality and comparability with similar studies in other countries. To ensure that the sample is consistent over the years, it has therefore required some recoding on our part.

As mentioned earlier, the dataset does unfortunately not provide us with the opportunity of following the same individuals over time. The consequence of this is that we are not able to see if some of the individuals outside of the labor force eventually re-enters. We neither have the ability to examine for how long the individuals are unemployed, if the unemployment duration is different for young and old, or if elderly chooses disability pension as a pathway to retirement. If we had such information we would be able to see more precisely how the fluctuations in the unemployment rates affects labor force participation.

4.2 Variables

In this sub-section we will present the variables that we used in our analysis, and describe how we processed them.

4.2.1 Dependent variable

The main dependent variable in this study is employment. Employment is a dummy-variable telling if the individual is employed or not. This includes all being active in the work force, both full-time and part-time. It also includes those working at home, since this is by own choice. Those being retired and receivers of disability pension are not included in the labor force, which includes those who are working and those who are applying for jobs.

As our dependent variable we look at employment instead of unemployment because many of the elderly are not registered as unemployed. This is due to several years of missing information on who is retired. As discussed in Section 3.2, firms have incentives to lay of senior employees. Senior employees are often not as motivated to apply for new jobs if they get laid-off, because they only have a few years left before retirement. Instead they might choose early retirement or disability pension as a pathway to retirement. This can lead to misinterpretation of how sensitive the senior employees are to unemployment, and it is therefore better to look at this age group in terms of whether or not they are employed.

4.2.2 Independent variables and control variables

Our key explanatory variables are the yearly unemployment rate and the industry-specific unemployment rate. These variables measure what share of the labor force that are seeking jobs. This is calculated as the total share being unemployed divided by the total labor force. Because many of the survey participants were registered without an industry, the industry-

specific unemployment rate got registered as 100% for all these. This inflated the variable, and we therefore dropped these individuals, 156.437 in total, out of the analysis.

We have included several control variables to solve our research question. We have included a dummy-variable for age, where the survey participants are divided into age groups. To capture differential vulnerability to the unemployment rate, we have divided the individuals into the following four age categories; 16-35, 36-45, 46-59 and 60-76, and interact them with the unemployment rate. We have divided the individuals into these age groups because after running some regressions with different age classifications, we discovered that the group 60-76 was most sensitive to changes in the unemployment rate[13].

The first age group represents the younger part of the population and includes both the newly graduates and those with only a few years of work experience. The two middle-aged groups have more working experience than the younger one. The group of interest is the senior age group, age 60-76, because the vulnerability among the younger workers has been subject to multiple previous studies (see Hoynes, Miller, & Schaller, 2012; Bell & Blanchflower, 2011b). From the study by Hoynes et. al. we know that youth are most sensitive to changes in the employment rate, when considering the likelihood of being employed as the outcome variable.

The variable gender is divided into male and female. The ratio is close to 50/50 throughout the survey, which also strengthens the representativeness of the sample selection. This variable is conducted as a dummy-variable, where male is given the value 1 and female is given the value 0.

In our dataset we also include the variable year that represents which year the survey participants completed the survey.

The variable industry was originally categorized into 40-80 different industries in which the survey participants were working in, and the industry definition changed through the years. We reduced the number of categories to 17 according to the Standard Industrial Classification (SIC2007) (Statistic Norway, 2014). See Appendix 2 for classification description.

[13] By running regressions with the oldest group being 55-76, 57-76 and 60-76, we discovered that the latter was most sensitive. The individuals in this group are close to retirement age, and if they lose their job it is likely that they will retire or take out disability pension instead of getting a new job, due to only having a few years left in the workforce.

The variable marital status has changed through the years, as we have more categories in the latter years. We have re-categorized this variable into a dummy-variable, where in a relationship or married takes the value 1 and single takes the value 0. We included divorced with singles. We used this variable as a control variable in our analysis, because marital status might have an impact on employment. In example, older individuals that are not in a relationship can be more motivated to get a new job compared the ones who are married. There might also be a selection problem in that elderly that are married work in industries that are more sensitive to business cycles compared to the ones who are single. Whether or not the elderlies living alone are more vulnerable compared to the ones living in a relationship will be tested in a sub-sample analysis. This is interesting in terms of the motivation and the willingness to work then reaching close to retirement age.

The last control variable is the level of education. This variable is also applied as a dummy-variable, where *high education* is given the value 1 and *low education* is given the value 0. We define high education as university level and low education as anything below university level. Goodman and Mance (2011) have studied which industries that suffers more in recessions. They discovered that construction, manufacturing and service-providing industries was most fragile. These are typically low-educated industries. Because of these findings we use level of education as a control variable, to see if this also is the case in our study.

4.2.3 Sample definition

The remaining variables left us with about 550.000-750.000 observations for each variable. We have excluded some observations that may disturb the results. In some years the variable age was ranged from 14 to 80 years old. Since our focus is on employment, we restrict the sample to individuals aged 16-76. We have therefore dropped observations above and under these thresholds. Even though normal retirement age is 67, some choose to work longer. Because of this we kept observations up to 76 years old. In total we dropped 3268 observations of individuals above 76 years old and 14 observations of individuals under 16 years old. By removing these observations, we obtain a dataset that is more balanced and robust, and we also reduce the potential effects like inflated errors and distortions of parameter and statistic estimates (Zimmerman, 1998). The mean age of the participants after the exclusion is 42.7 years.

In some years, information about gender was missing. We removed these observations, 3 in total, leaving us with 738.419 observations of gender.

As mentioned, we re-categorized the variable industry to 17 categories according to the Standard Industrial Classification (SIC2007) (Statistic Norway, 2014). We did this to make the variable comparable throughout the years and to get a proper amount of observations in each industry. There were originally 568.476 observations of this variable, but after dropping the missing observations we are left with 497.279 observations.

The variable marital status originally contained 738.360 observations. We removed all observations that were missing, 2580 in total, leaving us with 735.780 observations. We also dropped all the unknown observations for level of education, which was 7945. The variable originally contained 736.811 observations, but after dropping the unknown we are left with 728.866 observations.

4.3 Summary statistics

In this sub-section we will present a table of summary statistics. Table 1 gives the key variables of interest. The means and the standard deviations are presented separately for each of the four age groups. We can see from the table that the likelihood of being employed is highest for those in the prime-working age groups, 36-45 and 46-59. It is much lower for the seniors. This can be a result of many factors, in example many seniors could have retired or taken disability pension. The unemployment rate is higher for the youngest and the oldest parts of the population. The likelihood of being married increases with age, and the opposite is true for being single. We also see that there are more individuals with low education in the oldest age group, and age group 36-45 contains more individuals with higher education. This is because many of those in age group 16-35 have not fully completed their education.

The elderly are the ones with lowest education, because the need for education has increased over the last decades. It is more normal to take higher education today than it was 40-50 years ago. Further, we can see that the most common industry among the oldest age group is education, human health and social work, closely followed by manufacturing and domestic trade and car repair shop. Mining and quarrying is the industry with the lowest proportion of elderly. Among the youngest age group, the most common industry is agriculture, forestry and fishing, followed by real estate activity and education, human health and social work. Among this group, electricity and gas supply is the smallest.

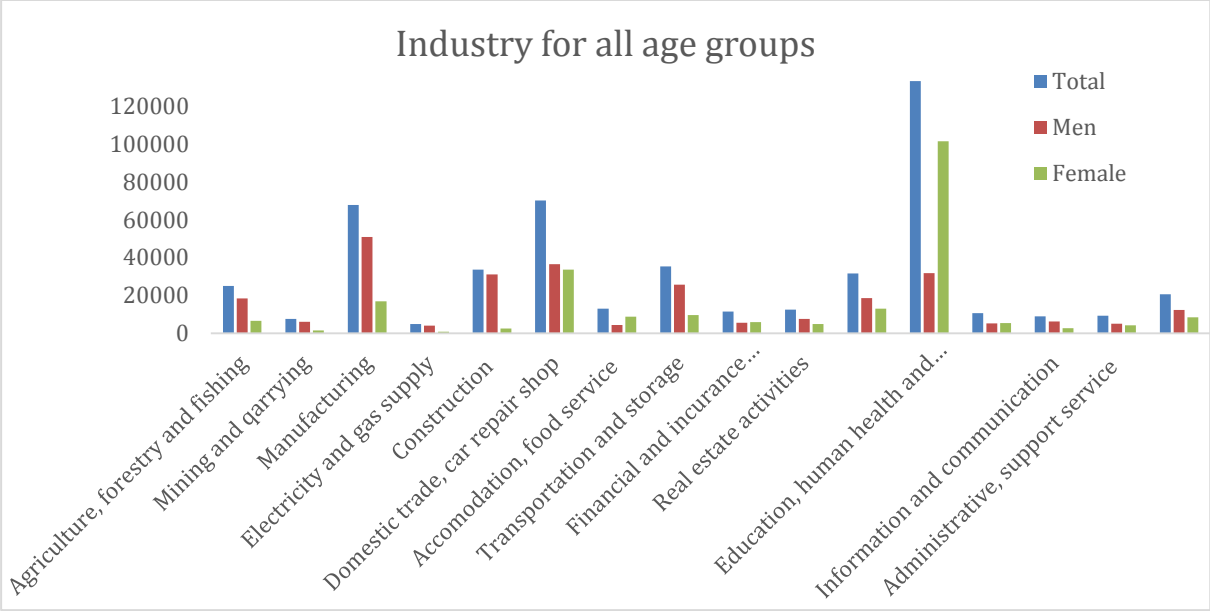
Table 1: Summary statistics

	Age 16-35	Age 36-45	Age 46-59	Age 60-76
Employment	0.969	0.990	0.989	0.935
	(0.174)	(0.099)	(0.103)	(0.246)
Unemployment Rate Industry	0,024	0,011	0,012	0,066
	(0,128)	(0,070)	(0,078)	(0,235)
Age	25,970	40,467	52,224	66,210
	(5,663)	(2,867)	(4,015)	(4,254)
In a relationship or married	0,329	0,687	0,751	0,747
	(0,001)	(0,001)	(0,001)	(0,002)
Single	0,671	0,313	0,249	0,253
	(0,001)	(0,001)	(0,001)	(0,002)
Low education	0,782	0,717	0,756	0,803
	(0,001)	(0,001)	(0,001)	(0,002)
High education	0,218	0,283	0,244	0,197
	(0,001)	(0,001)	(0,001)	(0,002)
Agriculture, forestry and fishing	0,366	0,041	0,056	0,111
	(0,0004)	(0,001)	(0,001)	(0,001)
Mining and quarrying	0,013	0,019	0,017	0,009
	(0,0002)	(0,0004)	(0,0003)	(0,0004)
Manufacturing	0,136	0,135	0,139	0,138
	(0,001)	(0,001)	(0,001)	(0,002)
Electricity and gas supply	0,007	0,011	0,012	0,013
	(0,0002)	(0,0003)	(0,0003)	(0,001)
Construction	0,075	0,068	0,062	0,057
	(0,001)	(0,001)	(0,0006)	(0,001)
Domestic trade, car repair shop	0,172	0,126	0,121	0,124
	(0,001)	(0,001)	(0,001)	(0,002)
Accommodation, food service	0,043	0,0190	0,015	0,014
	(0,0005)	(0,0004)	(0,0003)	(0,001)
Transportation and storage	0,072	0,073	0,071	0,063
	(0,0001)	(0,001)	(0,0007)	(0,001)
Financial and insurance activities	0,021	0,026	0,025	0,019
	(0,0003)	(0,0005)	(0,0004)	(0,001)
Real estate activities	0,253	0,029	0,022	0,024
	(0,0004)	(0,0005)	(0,0004)	(0,001)
Public administration, defense, social security	0,061	0,599	0,070	0,065
	(0,001)	(0,001)	(0,001)	(0,001)
Education, human health and social work	0,239	0,287	0,291	0,268
	(0,001)	(0,001)	(0,001)	(0,002)
Arts, entertainment and recreation	0,022	0,020	0,020	0,026
	(0,0003)	(0,0004)	(0,0004)	(0,001)
Information and communication	0,018	0,021	0,018	0,013
	(0,0003)	(0,0004)	(0,0004)	(0,001)
Administrative, support service	0,020	0,019	0,018	0,016
	(0,0003)	(0,0004)	(0,0003)	(0,001)
Professional, scientific and technological activities	0,039	0,046	0,043	0,041
	(0,0004)	(0,001)	(0,001)	(0,001)
Observations	244330	134534	165344	116445

Notes: Standard deviations in parenthesis for mean statistics. Age is measured in mean age in each group. All others are measured in percentage share when multiplied with 100.

To get a better understanding of the industries, we present a histogram that divides the industry participation between the genders. As demonstrated in Figure 12, there are clearly highest participation in the education, human health and social science industry. This is also one of three industries that contains the highest female participation, along with accommodation and food service, and arts, entertainment and recreation. More modern industries, like financial and insurance activities and real estate activities are the ones with most equality between the genders.

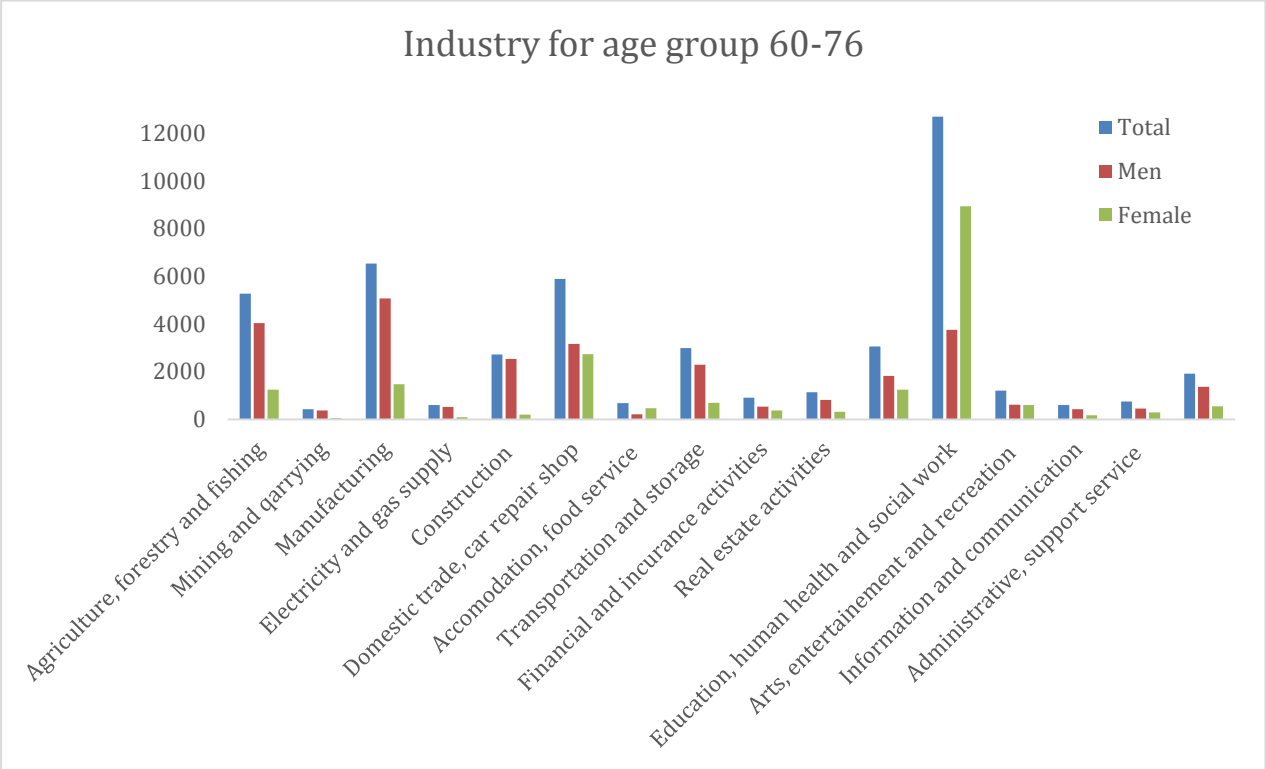
Figure 12: Participation rate in different industry for all age groups



Notes: The graph is self-composed, with numbers retrieved from the Labor Force Survey. For full names of all industries, see Appendix 2.

We also present the industry participation between genders, among the oldest age group, aged 60-76. This is presented in figure 13. The pattern is similar to Figure 12, but the proportions are a bit different. Education, human health and social work is still the dominating industry, with the highest proportion of women. The most significant difference from the figure above is seen in the industry agriculture, forestry and fishing. This is a traditional industry, which requires less education and therefore has a high participation rate among the elderly. At the same time, as seen in Table 1, this industry also contains a large share of younger participants. This may be a result of many Norwegian youths are born and raised in the districts, where agriculture is very common. Many may still be working at home, also during their education.

Figure 13: Participation rate in different industry for age group 60-76



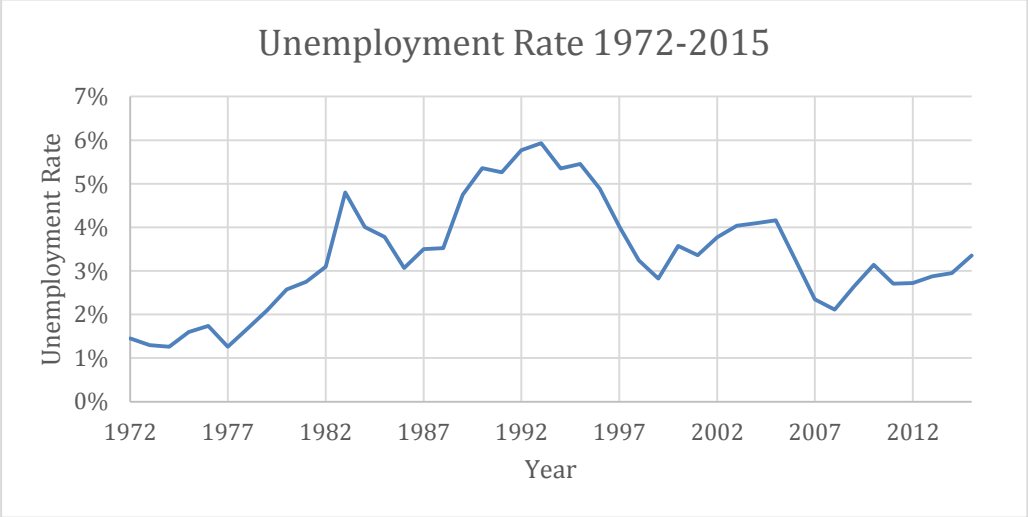
Notes: The graph is self-composed, with numbers retrieved from the Labor Force Survey. For full names of all industries, see Appendix 2.

To get an improved overview of the main independent variable unemployment rate, we present the variable over the entire period, from 1972 to 2015[14], in Figure 14. The fluctuations in the unemployment rate reflect the business cycles in the economy. During recessions, the unemployment rate is increasing, and during expansion the unemployment rate is decreasing. From Figure 14 we see that over the analytical period there has been great variation in the unemployment rate, both in terms of recessions and expansions.

From Figure 14 we see that there was a big recession in Norway in the late 1980's. In the start of the 1980's, Norwegian economy was experiencing high growth, which resulted in higher depths in the households. Also, the real interest rate was increasing, which together with increasing unemployment and falling housing prices decreased the demand for goods and services. The banking sector was struggling in the early 1990's, and an international downturn from 1990 extended the Norwegian downturn until 1992. From 1993 we experienced a long upturn, pushed by a low interest rate and higher public expenditures.

[14] When comparing this graph to the one made by Statistics Norway it is basically the same.

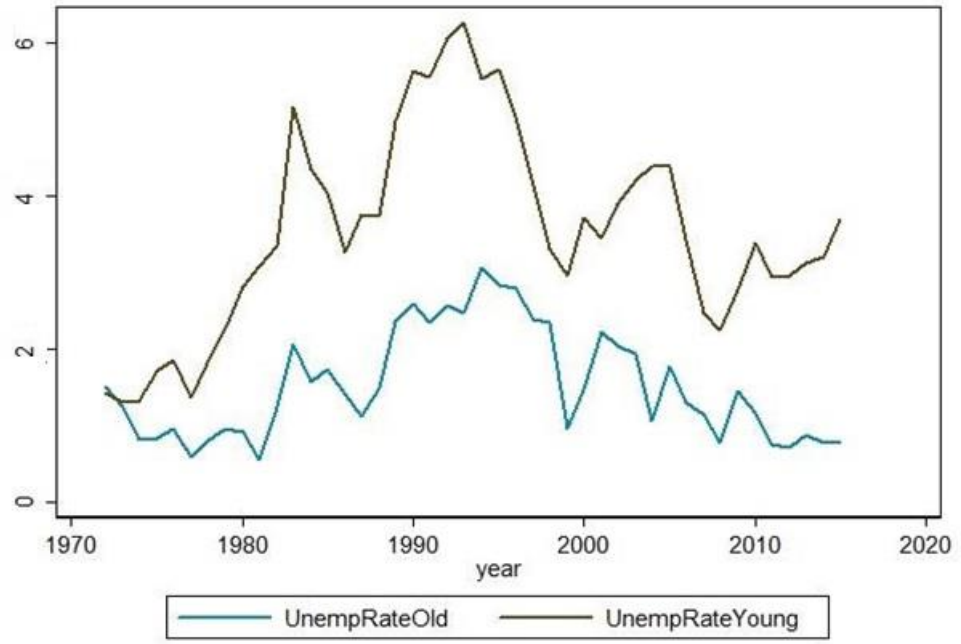
Figure 14: Unemployment Rate



Notes: This graph shows the unemployment rate in Norway from 1972 until 2015.

After the economic downturn, the need for durable goods was high, and demand increased. Norway was also in a good competitive position, after some years of low inflation. From 1993 to 1998 the employment grew with around 230.000 people. After 1998 the growth declined. This was, among other factors, due to the Asia-crisis, a drop in the price of oil and an increase in the interest rate (Benedictow, 2006).

Figure 15: Gap between those above 60 (old) and those under 60 (young)



Notes: This graph shows the unemployment rate from 1972 until 2015, separated for those under 60 years old and those above 60 years old. Y-axis in percentages.

From Figure 15 we can see the development in the unemployment rate during the period for seniors (> 60 years) and younger (< 60 years) workers separately. It seems that the fluctuations in the two rates are correlated and both groups experience the same drops and growths in the rate, following the business cycles of the economy. However, the younger workers face a higher unemployment rate than the senior employees, and the fluctuations also seems more dramatic. This gap between younger and senior employees is consistent with Hoynes et. al. (2012) findings. The study gives evidence that younger workers are more vulnerable than senior employees, due to little work experience, and therefore being the first subject to lay-offs. Therefore, the unemployment rate among the younger worker will be consistent at a higher level compared to the seniors.

5 Empirical Strategy

In the last part will describe our empirical strategy and our main fields of research based on the overall interest in figuring out the impact of unemployment rates on elderly's participation in the labor force.

5.1 Model 1

Using ordinary least squares (OLS) we estimate the effect of the unemployment rate, both overall and the industry-specific, on employment. There are several studies that investigates how venerable younger people are to unemployment, but not many that looks at the effect on elderly. Therefore, we intend to identify potential relative unemployment effects among the rapidly aging Norwegian population. In order to resolve this, we will start our analysis by exploring the effect of national changes in the unemployment rate over time on employment. The main focus in our analysis is to consider differentiated effects by age.

(1) $$y_i = \beta_1 age16-35_i * UR_t + \beta_2 age36-45_i * UR_t + \beta_3 age46-59_i * UR_t + \beta_4 age60-76_i * UR_t + \gamma_1 age36-45_i + \gamma_2 age46-59_i + \gamma_3 age60-76_i + \sigma_1 year + \sigma_2 year^2 + \rho gender$$

where

y_i	Whether or not an individual is employed
i	The notation *i* refers to individual *i*
t	The notation *t* refers to time *t*
UR	The yearly unemployment rate defined as; the sum of unemployed/the sum of individual in the labor force
Age 16-35, … ,60-76	Indicators of the age-groups
Year	The year the survey was answered
Gender	Dummy-variable taking value 1 if male and 0 if female

The left-side of the equation with the dependent variable y_i, is the employment rate for a particular individual in a particular industry. The right-side of the equation includes UR, which represent the yearly unemployment rate. $Gender_g$ and Age_g are group-specific

intercepts, and $\beta_{age-group}$ gives the vulnerability of a specific age-group. The gender-term is included to control for gender differences. This variable is not endogenous because it is not affected by the unemployment rate, which in turn affects the outcome variable, employment. We can therefore include the variable in our main analysis. In our regression model, we interact the yearly unemployment rate with each of the defined age groups. Age 16-35, age 36-45, age 46-59 and age 60-76 are indicators of the age groups defined in Section 4.2.2. The coefficients on the interaction terms $\beta_1, \beta_2, \beta_3$ and β_4 captures the effect of the yearly unemployment rate on employment for each of the defined age groups.

We are primarily interested in investigating if the coefficient β_4 is larger than coefficients $\beta_1 - \beta_3$. Especially age 36-45 and 46-59, since we already know that the young, aged 16-35, are especially vulnerable to changes in unemployment rate (Hoynes, Miller & Schaller, 2012). The coefficients on the terms $\gamma_1, \gamma_2, \gamma_3, \gamma_4$ captures difference in employment between the base group 16-35 and the other age groups. We include year and year^2 to control for linear and quadratic national time trends that potentially could bias the coefficients $\beta_1, \beta_2, \beta_3$ and β_4. National time trends can be a problem if, in example, change in the pension reforms or changes in health has contributed to an increased employment among the elderly more than among the younger, and that this change is correlated with a reduction in unemployment rate over time. Then it might look as if a decline in the unemployment rate affects the elderly more than the young, even though there is no causality. The effects of these are denoted by σ_1 and σ_2. Lastly, we include gender to control for gender differences in employment. The effect on this is denoted by ρ.

If year-to-year changes in health or pension reform is correlated with year-to-year changes in the unemployment rate, the coefficients $\beta_1, \beta_2, \beta_3$ and β_4 can potentially be biased. In equation 2 we control for a linear and quadratic trend in employment through the inclusion of year and year^2. However, if there is a change in the pension reform one year, this might affect employment more for some of the age groups compared to others. In addition, at the same time the unemployment rate might increase or decrease. The effect of the pension reform on employment might thus be attributed to the change in the employment unemployment rate this year, and the interaction between UR and age 60-76 would be biased. If this is the case, it is not sufficient to control for a yearly linear and quadratic trend. It is also conceivable that the age groups in some years are facing complex changes that are different to other years. There could, in example, be more elderly with lower education in some years, and on the

same time they could face higher unemployment. To address this issue we follow Hoynes et. al (2012), and employ model 2.

5.2 Model 2

(2) $$y_i = \beta_1 age16-35_i * UR_{t,ind} + \beta_2 age36-45_i * UR_{t,ind} + \beta_3 age46-59_i * UR_{t,ind} + \beta_4 age60-76_i * UR_{t,ind} + \gamma_1 age36-45_i + \gamma_2 age46-59_i + \gamma_3 age60-76_i + \alpha_{ind} + d_t + \rho gender$$

In equation 3 we have substituted the variable UR with $\mathrm{UR_{t,ind}}$. $\mathrm{UR_{t,ind}}$ is the unemployment rate in a particular industry in time t. This allows us to see if the effect on employment differs in different industries. We also included $\alpha_i \; and \; d_t$, which are year and industry fixed effects. Hoynes et. al. applies region of residence as source of variation in the unemployment rate and include region fixed effects, but since we do not have this information available in our dataset, we utilize variation in unemployment rates across regions and include industry fixed effects.

The industry fixed effects are included to control for time-invariant industry characteristics. Like Friedberg (2003) states, elderly working in industries that are object to technological changes can be subject to replacement. This can make them more vulnerable to changes in the unemployment rate than their younger colleagues. Younger employees are more capable of adapting to technological changes and development than elderly, which makes the elderly easier to replace.

Another example can be that the average retirement age might be different for various industries, which can affect the choice of early retirement. This can be seen in relation to the human capital theory by Becker (1962), as described in Section 3.2. It is likely that senior employees are more vulnerable than younger workers in the same industry. This could be because the seniors are easier to replace, due to lower levels of firm specific human capital. The firms might therefore be motivated to lay-off these senior employees, or offer them buyout packages.

By including year and industry fixed effects we no longer use the variation in the unemployment rate from one year to another. Instead we use the variation that occurs as a result of the fact that different industries experience different changes in the unemployment rate from year to year. Goodman and Mance (2011) highlight the possibility that recession

affects different industries differently. With this assumption in mind, we expect to see differences between the models. The benefit of including year fixed effects is that it captures the variation in the outcome that occurs in the period of time, and that is not ascribed to the other explanatory variables.

5.3 Model 3 and 4

(3) $$y_i = \beta_1 age16-35_i * UR_{t,ind} + \beta_2 age36-45_i * UR_{t,ind} + \beta_3 age46-59_i * UR_{t,ind} + \beta_4 age60-76_i * UR_{t,ind} + \gamma_1 age36-45_i + \gamma_2 age46-59_i + \gamma_3 age60-76_i + \alpha_{ind} + d_t + \rho gender + MaritalStatus_g + LvlOfEduc_g$$

In addition to including industry- and year fixed effects, we control for marital status and level of education, which are two other group-specific intercepts. These dummy variables tell us what degree of education the individuals have and what their relationship status is. We include these to see if there is any compositional difference in the population over time that affects our results. The experienced employment among married may differ from the one experienced for those being single. This could also be the case for high and low educated. These variables may also be endogenous, and are therefore not included in our main analysis. A variable is endogenous if it is affected by one or more of the other variables in the model (Dahlum, 2014). In this case, marital status and level of education might be affected by the unemployment rate.

Model 4 includes the interaction between the age groups and the industries, as there could be a fundamental difference in employment across the age groups. For example, assuming that older workers are more likely to work in traditional industries, like agriculture, forestry and fishing, could make the adaption-process to a new job longer. Like Coile and Levine (2011) states, there is less willingness to invest in employees when they have limited remaining time in the labor force. This indicates that a high unemployment rate could be more harmful for these age groups. This highlights the importance of interacting the age groups with the industries.

6 Empirical Results and discussion

In this section we will present the results from our analysis, and we will use the theory presented in Section 3 to discuss our findings. First, we will present our main results. Second, we will present our results of analyzing the unemployment rate as a lagging indicator. Third, we will present the results from the sub-sample analysis.

6.1 Main results

The estimated effects of the unemployment rate on the employment status for different age groups are presented in Table 2. The four different columns denote the four different regression models, as explained in Section 5. By interpreting column 1 we learn that the likelihood of being employed is negatively affected by the yearly unemployment rate for all age groups. The effect is, however, most significant for those being young (age 16-35) and for the seniors (age 60-76). This is as predicted for the youngest group, since they are often more negatively affected by the unemployment rate, due to lack of job experience. The more interesting aspect is that the coefficient for the seniors is more negative than for the youngest workers. By dividing the coefficient for the senior employees with their mean employment rate we find that a 1 percentage increase in the yearly unemployment rate leads to a decrease in expected employment of 15.8 percentages. This is statistically significant at 1%.

Observing a larger effect for the youngest group and for the seniors aligns well with the theory outlined in Section 3.1. This suggests that seniors might have incentives to retire, when the gap between wage and the income outside the labor market is not as significant. If the unemployment rate increases, and wages decreases, the indifference curve of the seniors will shift inwards, giving them incentives to strive for a higher level of utility, either in case of higher consumption or higher levels of leisure (see Figure 6). Younger workers and those in their prime working age might also be more career-focused, and will try harder to obtain their position in the labor force. Senior workers have less time remaining in the labor market, and the leisure/work-model suggests that seniors eventually will have incentives not to work at all. When the unemployment rate increases there will be downward pressure on wages, increasing senior's reservation wage in the labor market. Alternatively, the leisure/work-model from Section 3 suggests that seniors will increase their preference of leisure, thus increase their incentives to leave the labor force. This might be one explanation to why the

coefficient for the seniors is more negative than for the younger and the workers in their prime working age.

The reason for higher vulnerability among the senior workers can also be explained by the labor demand side of the theory. As earlier described, when firms are in the position where they need to lay-off workers, the seniors are often the ones who are most profitable to target. This will make the seniors more vulnerable during recessions, which is consistent with our findings. In addition, as described in Section 3.2, senior employees are less likely to adapt to technological changes, due to the upcoming retirement. This is another explanation to why the seniors are more vulnerable to change in the unemployment rate.

Table 2: Main results

	(1)	(2)	(3)	(4)
16-35xUR	-0.0186**			
	(0.0004)			
36-45xUR	-0.0082**			
	(0.0003)			
46-59xUR	-0.0118**			
	(0.0003)			
60-76xUR	-0.0641**			
	(0.001)			
16-35xUR_In		-0.01946**	-0.01945**	-0.01967**
		(0.0006)	(0.0006)	(0.0006)
36-45xUR_In		-0.00159**	-0.00161**	-0.00139**
		(0.0002)	(0.0002)	(0.0002)
46-59xUR_In		-0.00120**	-0. 00116**	-0.00086**
		(0.00016)	(0.0002)	(0.0002)
60-76xUR_In		-0.00163**	-0.00153**	-0.00133**
		(0.0003)	(0.0003)	(0.0003)
Observations	504691	497147	496460	496460
R^2	0.0638	0.0678	0.0692	0.0705

Notes: Dependent variable is employment. Robust standard errors are presented in parentheses. The number intervals represent the different age groups. UR denotes the unemployment rate, and UR_In denotes the unemployment rate divided by industry. Model 1-4 represents the four regression models presented in Section 6. Significance levels are indicated as follows: + significant at 10%, * significant at 5%, ** significant at 1%.

As discussed in Section 5, our estimation results in model 1 could be biased if year-to-year changes in health or pension reform are correlated with year-to-year changes in the unemployment rate. In addition, the effect of the pension reform on employment might be attributed to the change in the unemployment rate this year, and the interaction between UR and age 60-76 would be biased. Model 2 investigates such potential bias arising from using the overall unemployment rate. We have substituted the overall unemployment rate with the industry-specific unemployment rate. In model 2 we have also included year- and industry fixed effects. In model 3 we have included marital status and level of education. In model 4 we have included the interaction between age and industry. The results are all statistically significant at 1%. What is interesting to look at is *how much* the coefficients change when adding control variables. Even though we are adding several control variables from model 2 to model 4 there is only a marginal change in the coefficients. However, we will still highlight some reasons to *why* there is a change.

Model 2 is our main model. Here the pattern is the same as in model 1. The youngest and the seniors are the ones being most negatively affected by the unemployment rate, and the youngest somewhat more affected compared to the seniors. For the seniors, a 1 percentage increase in the industry unemployment rate results in a decrease in expected employment of 0.4 percentages. This is statistically significant at 1%. The results have changed significantly from model 1. This is a result of having substituted the unemployment rate with the industry-specific unemployment rate and added year- and industry-fixed effects. This changed the coefficient for the seniors from -0.0641 to -0.00163.

This change can be explained by several factors. First, the estimation results in model 1 can be biased. As explained in Section 5, some of the yearly changes in pension reforms that particularly affect the seniors could happen on the same time as the unemployment rate changes to a large extent. Second, since the data set do not provide us with information about which industries the seniors worked in prior to becoming unemployed, it could be a possibility that these individuals get more affected by the changes in the unemployment rate. We might therefore loose some important information. However, we see the same pattern in model 1 and model 2, which is reassuring. We will therefore include both models in further analysis. Finally, by using the industry specific unemployment rate we remove much of the variation in the overall unemployment rate. The industry specific unemployment rate only use variation in the unemployment rate that is greater in one industry compared to overall changes. This is reason to expect lower estimates in model 2, compared to model 1.

In model 3, we discovered that the middle-age group, 36-45, is a bit more affected than the seniors. This indicates that this groups gets more affected when marital status and level of education is controlled for. The coefficient for the seniors has slightly decreased compared to model 2, which indicates that they are less affected when controlling for marital status and level of education. In this model, a 1 percentage increase in the industry unemployment rate leads to a decrease in expected employment for the seniors of 0.38 percentages. This finding is statistically significant at 1%. The coefficient has decreased from -0.00163 to -0.00153. By including control variables, we see if there are compositional changes between the models. The changes in the coefficients are only marginal. This indicates that there are only small compositional changes based on observable and unobservable characteristics of the groups. Later, in the sub-sample analysis, we will look at those who are married/in a relationship, to see if they are more affected by the unemployment rate than those who are not.

In model 4, the coefficients for all age groups except of the youngest have decreased when including interaction between age and industry. The reason for adding control for the interaction between age and industry is to explore if there are linear non-parallel trends in the employment rates across industries for the different age groups. Such non-parallel trends could potentially bias our coefficient in model 2. In example, one industry might experience a decrease in the retirement age, due to a change in the pension reform. On the other hand, other industries might experience increasing unemployment rate. This could lead to biased coefficients in our model. In this model, a 1 percentage increase in the industry employment rate leads to a decrease in expected employment of 0.33 percentages for the seniors. This is statistically significant at 1%. The coefficient for the seniors has decreased from -0.00153 to -0.00133.

The coefficient for the seniors is not that different to the coefficient for the age groups 36-45 and 46-59, especially in models 2-4. This can be due to the restrictions against laying-off senior employees. As discussed in Section 3, there are regulations that protect the rights of the seniors, which makes it harder for the firms to let them go. This forces the firms to treat the seniors more on the same basis as their younger peers. In addition, the valuable experience, information and relations that senior workers have obtained after a long working career, reduces the incentives to lay them off.

As we can see, the number of observations varies in the four models. This is because we had to drop some observations that were used to conduct the industry-specific unemployment rate,

due to missing observations on what industry some of the individuals were working in. This lead to an overestimation on the industry-specific unemployment rate.

6.2 Lagging the unemployment rate

Several previous studies investigate how graduating during a recession leads to long term effects on employment or earnings (see e.g. Haaland, 2014; Devereux, 2002; Bell and Blanchflower, 2011). We therefore expect that seniors who experience unemployment during recessions might use more time to get re-employed. The theory from Section 3 suggests that firms both have incentives to lay-off senior employees, and not to hire senior applicants. During a recession, the probability of getting laid-off is therefore higher for senior employees than for their young and prime working aged colleagues, especially when specific human capital is important to the firm. Further in Section 3.2 we discussed how senior applicants might struggle to get re-hired. This indicates that we could expect to see a long run negative effect of the unemployment rate on senior workers, more that for the younger and prime aged workers. This would be easier to see if we could follow the individuals in our sample over time, but unfortunately the data set does not allow us to do that. As an option we will lag the unemployment rate 5 and 10 years back to see how this affects the outcome – employment.

Table 3: Lagging variables

	(1) Lag N-0	(2) Lag N-5	(3) Lag N-10
16-35xUR_Lag	-0.01946** (0.0006)	-0.01940** (0.0006)	-0.01935** (0.0006)
36-45xUR_Lag	-0.00159** (0.0002)	-0.00157** (0.0002)	-0.00152** (0.0002)
46-59xUR_Lag	-0.00120** (0.0002)	-0.00118** (0.0002)	-0.00115** (0.0002)
60-76xUR_Lag	-0.00163** (0.0003)	-0.00162** (0.0003)	-0.00160** (0.0003)
N	497147	497067	496987
R^2	0.0678	0.0674	0.0671

Notes: Dependent variable is employment. Robust standard errors are presented in parentheses. The number intervals represent the different age groups. UR_Lag denotes the lagged industry unemployment rate. N-0 denotes today, N-5 denotes 5 years ago and N-10 denotes 10 years ago. Significance levels are indicated as follows: + significant at 10%, * significant at 5%, ** significant at 1%.

By considering the change in the coefficients in Table 3, we see that the effect of lagging the industry unemployment rate is present and significant, but only marginal. This indicates that the industry unemployment rate that the individuals was facing 5 and 10 years ago has none or only a small effect on the probability of being employed today. The same is true for all age groups. For the seniors, we see that the coefficient is more or less equal for all three models. This can be due to the fact that the seniors have more experience and that they are more attached to the firms. However, our theory states that the firms have incentives to lay-off senior employees. The study by Chan and Stevens (2001, 2004) looks at the employment patterns of senior employees who have experienced an involuntary job loss, and finds that a job loss has large and lasting impacts on future employment probabilities. This can indicate that an increase in the unemployment rate could have possible impacts on the employment status today. However, this is not sufficient with our findings.

6.3 Results for different groups

As the research by Lazaer and Gibbs (2015) states, seniors have great value to their respective firms and industries, as they have obtained valuable knowledge over time. When seniors reach a certain age, their productivity decreases relative to their earning-profile. This is making them less valuable to the firm, and can lead to them being subject to buyout packages and thus leaving the labor force. This is especially true when a high degree of specific human capital is present, since the seniors with a high degree of human capital often have higher wages than the ones who does not. This results in a greater loss for the firm when the productivity decreases, incentivizing the firm to let them go.

This is equivalent to the theory of Becker (1962). Based on this theory we expect to see differences between seniors with different levels of education. Verbrugge (1979) states that marriage is positively correlated with health, meaning that married people are healthier and happier than non-married. Goldman et. al. (1995) finds that this is also true for seniors. We therefore want to see if those being married/in a relationship are more affected by the unemployment rate than those being single. Hoynes et. al. (2012) finds that men experience significantly larger unemployment increase compared to other groups. We will therefore also see if there are differences between the genders.

In Table 4, we have conducted sub-sample analysis for those being single, those being in a relationship, those with high education, those with low education and for gender. This is conducted from our main model, model 2, where the dependent variable still is employment.

Tabell 4: Sub-sample analysis

	If Single	If In a relationship	If High education	If Low education	If Male	If Female
16-35xUR_In	-0.0303**	-0.0037**	-0.0078**	-0.0217**	-0.0265*	-0.0018**
	(0.0008)	(0.0005)	(0.0010)	(0.0006)	(0.0007)	(0.0004)
36-45xUR_In	-0.0045**	-0.0006**	-0.0003	-0.0022**	-0.0020**	0.0001
	(0.0006)	(0.0002)	(0.0003)	(0.0003)	(0.0002)	(0.0003)
46-59xUR_In	-0.0038**	-0.0002	-0.0003	-0.0015**	-0.0020**	0.0005
	(0.0006)	(0.0001)	(0.0003)	(0.0002)	(0.0002)	(0.0002)
60-76xUR_In	-0.0021**	-0.0010**	-0.00012	-0.0020**	-0.0027**	0.0007**
	(0.0004)	(0.0003)	(0.0002)	(0.0003)	(0.0004)	(0.0002)
N	209959	287168	118950	377530	269998	227149
R^2	0.1547	0.0083	0.0211	0.0644	0.1341	0.0091

Notes: Dependent variable is employment. Robust standard errors are presented in parentheses. The number intervals represent the different age groups. UR_In denotes the unemployment rate divided by industry. The four regressions are sub-samples for those who are single, those being in a relationship, those with high education and those with low education. Significance levels are indicated as follows: + significant at 10%, * significant at 5%, ** significant at 1%.

From Table 4 we see that when being single, there is a significantly lower probability of being employed, compared to model 2 in Table 2. The probability is especially low for the youngest group. From there, the probability of being employed increases with age, but all age groups are more vulnerable when being single. The opposite is true for those being in a relationship or married. All coefficients have increased compared to model 2 in table 2, and all, except of the one for age group 46-59 are statistically significant. All groups are less vulnerable to changes in the unemployment rate then being in a relationship, compared to when being single.

For de elderly, the probability of being employed has increased from -0.5 percentages per 1 percentage increase in the industry unemployment rate when being single to -0.2 percentages per 1 percentage increase in the industry unemployment rate when being in a relationship or married. There might be different explanations for why the pattern is like this. First, there

might be different individual characteristics for those being in a relationship and for those being single. This might also differ between different age groups. The single seniors might be in the position of having lost their partner. As mentioned, Verbrugge (1979) and Goldman et.al. (1995) finds that health and marriage is positively correlated. It is therefore reason to believe that the single seniors have poorer health, compared to those being in a relationship or married. This might be one reason for the findings that single seniors are more negatively affected by the unemployment rate than the seniors who are in a relationship or married. Figure 8 from Section 3 (Rege et.al., 2009) implies that the senior workers with poorer health have greater incentives to withdraw from the labor market, both if they are laid-off and if they are retained.

The workers with high education are less vulnerable to the industry unemployment rate, when compared to model 2 in Table 2. When human capital increases, workers get more sought after compared to when the level of human capital is low. However, only the finding for the youngest group is statistically significant. The low-educated are all more vulnerable to the industry unemployment rate compared to the results from model 2 in Table 2, except for the age group 46-59, who are actually a bit less vulnerable. As described in Section 3.3, Goodman and Mance (2011) have studied which industries that suffers more during recessions. They found that construction, manufacturing and service-providing industries are the ones who suffers the most. These are industries that are typically low-educated, and are therefore consistent with our findings here.

However, these results must be analyzed with caution, especially for the younger, as education can be assumed to be an endogenous variable, since the unemployment rate affects education. In example, we see a fluctuation from oil-related studies at the Norwegian University of Science and Technology and at the University of Stavanger due to the present oil-crisis in the region (Olsen & Andersen, 2014)

Further we see that the coefficients for men have increased in a negative manner for all age groups, compared to model 2 in Table 2. Hoynes et. al. (2012) finds that men are more affected by recessions than women, which is consistent with our findings. Male often choose more cyclical industries, like manufacturing. The theory of the added worker effect, and the study by Hoynes et. al. (2012) finds that men are more likely to act as discouraged workers. This means that they decrease their labor force participation during recessions. For females, Table 4 shows that they are the only group with positive coefficients. This can also be explained by the added worker effect, and the study by Hoynes et. al. (2012). They find that

when unemployment increases, women increase their labor force participation, as a result of the withdrawal of the men. Also, women tend to choose less-cyclical industries, like public administration, defense and social security, and are therefore less vulnerable to recessions. However, only the coefficients for the youngest and the oldest age groups are significant at 1%. The coefficients for the age group 46-59 and the age group 36-45 are not statistically significant.

7 Conclusion

There is a lot of previous research on the relationship between business cycles and labor market outcomes, and findings suggest that groups like men and young workers are especially affected by recessions. For senior employees, previous research suggests that unemployment late in a worker's career and the low job finding rate often triggers early retirement (Marmora & Ritter, 2015). Other previous studies document that job loss results in large and lasting impacts on future employment possibilities (Chan & Stevens, 2004) and that workers that experience recessions around the time of retirement are more likely to leave the labor market earlier. If this is true, we would expect to see higher vulnerability among the senior employees in terms of changes in the unemployment rate. Further, if senior employees choses to retire earlier it could have great impact to the Norwegian economy, in terms of higher pension payments and lower value creation.

Although one might expect that the unemployment rate affects the employment status of senior employees, it is less clear how significant this effect is and little previous research showing how vulnerable senior employees are. This might be depending on different factors like how the unemployment rate is in the senior employees respective industries and personal characteristics like education and marital status. This paper investigates the relationship between the unemployment rate, both overall and industry-specific, and senior employees employment status. We define senior employees as aged 60-76.

As expected, the results suggest that the likelihood of being employed is negatively correlated with the unemployment rate. The effect is stronger when looking at the overall unemployment rate, and it gets reduced when looking at the industry-specific unemployment rate. In our main model, model 2, where the independent variable is industry-specific unemployment rate, we find that a 1 percentage increase in the industry-specific unemployment rate leads to a decrease in expected employment of 0.04 percentages. This answers the first sub-question from Section 1.

Even though the results are small, and therefore hard to draw a conclusion from, the results suggest that there is a negative effect of the industry-specific unemployment rate on the probability of being employed. The effect gets even smaller when we control for factors such as education and marital status.

We wanted to see if there was any effect of the unemployment rate that faced senior employees 5 and 10 years ago, but we could not find evidence that supports this. Since unemployment rate is a lagging indicator, one should expect to see an effect here, but our results suggest that there is not. This answers the sub-question 2.

When taking a closer look at our variables, by separating them into sub-analysis, we find that the effect is greater for the senior employees that are not living in a relationship. In addition, the effect is greater for the low-educated. The effect of a 1 percentage increase in the industry-specific unemployment rate is a 0.5 percentages decrease in expected employment, when being single. The same effect for those being in a relationship 0.2 percentages. For the low-educated the effect is 0.5 percentages, and for the high-educated the effect is 0.03 percentages. The effects are very small, but present. This answers sub-question 3.

All analysis, except for model 1 in our main analysis, suggests that the youngest age group are more vulnerable to changes in both unemployment rates, when compared to the other age groups. In model 1 in our main analysis, the seniors seem to be more vulnerable than all other groups. The senior employees are more vulnerable than the two middle aged groups in our main model, and in the analysis where we investigate the effect of the unemployment rate 5 and 10 years ago. In the sub-sample analysis, the youngest age group is still the most vulnerable in all samples. The seniors are more vulnerable than the two middle aged groups when investigating the sub-sample for those being in a relationship, those with high education and males. The senior females are the least vulnerable, when compared to the other groups. This answers sub-question 4.

Our main research question asks how the unemployment rate affects senior employees. We found evidence that the unemployment rate, both the overall and the industry-specific rate, affects senior employees in a negative manner. This is true for all our analysis, except for the senior females. The females seem to be positively affected by the unemployment rate, which can be explained by the added worker effect. However, this finding is not statistically significant.

Since our results seems to be very small and thereby hard to conclude from it would be interesting to investigate if there is difference in the effect in different municipalities and for individuals with different background characteristics such as different income- and wealth levels. There are also other factors that can affect the results, such as the age of the

participants respective partners. The dataset that we had available was not specified to this research, leading to lack of many variables that could be interesting to look at. By conducting the survey on our own we could have a more specified dataset. However, making a dataset as comprehensive as the one we used here would not be possible for us to obtain by ourselves and could therefore lead to errors when considering representativeness. We leave this up to further research.

Clearly, a more flexible pension system and a growing and aging population have large implication for the labor market, especially when facing recessions. This will have large influence on individuals, employers and the society as a whole, in terms of a changing workforce structure and an increasing pressure on the sustainability of the social welfare and security systems. The need for solid knowledge about the labor market responses to changes in business cycles is therefore important. Especially how unemployment in the labor force might affect the work/retirement decision of senior employees creates a demand for a well-developed retirement system that captures the most efficient outcome. This is highly topical and more important now than ever before.

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Appendix

Appendix 1: Specific example of pension payment

If she retired 100% at age 62 it would be the following:

Pension Found: NOK 540 408 x 38 years x 18,1%	NOK 3 716 926,22
Income Pension: NOK 3 716 926,22x100%/19,72	NOK 188 485,10
Total pension/Total payout:	NOK 188 485,10

If she retired 100% at age 67 it would be the following:

Pension Found: NOK 540 408 x 43 years x 18,1%	NOK 4 205 995,46
Income Pension: NOK 4 205 995,46x100%/15,68	NOK 268 239,51
Total pension/Total payout:	NOK 268 239,51

If she retired 100% at age 70 it would be the following:

Pension Found: NOK 540 408 x 46 years x 18,1%	NOK 4 499 437,00
Income Pension: NOK 4 499 437,00x100%/13,29	NOK 338 558,10
Total pension/Total payout:	NOK 338 558,10

Appendix table 2: Industry specification

Value	Industry	Value	Industry
1	Agriculture, forestry and fishing	10	Real estate activities
2	Mining and quarrying	11	Public administration, defense, social security
3	Manufacturing	12	Education, human health and social work
4	Electricity and gas supply	13	Arts, entertainment and recreation
5	Construction	14	Information and communication
6	Domestic trade, car repair shop	15	Administrative, support service
7	Accommodation, food service	16	Professional, scientific and technological activities
8	Transportation and storage	17	Unknown
9	Financial and insurance activities		