Network for Studies on Pensions, Aging and Retirement

Netspar THESES

Ruud Mullers

How Sensitive are Retirement Decisions to Financial Incentives

A Stated Preference Analysis

MSc Thesis 2014-015

How Sensitive are Retirement Decisions to Financial Incentives: A Stated Preference Analysis

R. Mullers

August 29, 2014

Abstract

Due to the high financial pressure on pension systems at the moment, many industrialized countries have to adapt their pension systems. The reforms applied by these countries, however, differ greatly. It is, therefore, of great importance to know the effects of different types of pension reforms. This paper investigates the effects of two pension reforms by using stated preference data (The ABP representative survey 2013 and administrative data). Participants of this questionnaire are asked to state their expected retirement age for several hypohetical pension systems. The pension systems are designed such that a price effect, caused by an increase of the implicit tax on early retirement by 2 and 4 percentage points, and an income effect, caused by a drop of pension wealth by 7 and 14 percentage points, can be estimated. The results of this paper show that a decrease of someones pension wealth by 7 and 14 percentage points results in an average retirement postponement of 7 and 14 months, respectively. An increase of the implicit tax on early retirement by 2 and 4 percentage points leads to an increase in the average expected retirement age by 5 and 9.5 months, respectively. The results also show that several socio-economic variables have significant effects on the overall retirement age and on the size of the effects of the pension reforms. This paper also investigates whether the pension reforms have different effects on early retirement and late retirement. The results show that the price effect depends on the current retirement age, since the price effect is significant on early retirement, but insignificant on late retirement. We also find that the effects of the socio-economic variables on early retirement differ from the effects of the socio-economic variables on late retirement.

Contents

1 Introduction

Because the composition of the labor force changed drastically over the past few decades, many pension schemes of industrialized countries are becoming financially unsustainable. Two trends are mainly responsible that pension expenditures have increased dramatically. Due to ageing of the population in almost all industrialized countries, the ratio of people older than 65 years and people between 20 and 64 years old has increased rigorously (Commission, 2012). Because the first group receives pension benefits from the pension systems and the second group finances the pension system, an increase in this ratio results in a higher financial pressure on these systems. Next to the ageing of the population of many industrialized countries, labor force participation of older workers has decreased significantly in the previous decades, mainly because of attractive early retirement plans, which were established in most industrialized countries at the end of the previous century. This trend even further increases the already high pressure on the social security systems (Gruber & Wise, 2002).

Fortunately many industrialized countries have already tried to tackle the first trend by reversing the previously instated early retirement plans and therefore penalizing earlier retirement. However, to deal with the ageing population and its effects, new and more harsh pension reforms have to be implemented. Several countries have already started to increase the statutory pension age over the coming years and others are most likely to follow. Other countries are implementing pension reforms which increase the price of earlier retirement even further. Some even implement a combination of the two plans (OECD, 2013). Since many different pension reforms are in place it is incredibly important to know what the actual effects of these reforms will be on the labor force behavior of older workers. It is also important to know whether these reforms will result in a large enough reduction of the financial pressure on these pension systems in order to once again make them financially sustainable.

This paper analyzes the effectiveness of the different potential retirement plans in raising the overall expected retirement age. More specifically, this thesis compares the income effect of a pension reform (by analyzing the effects of a decrease in the overall pension benefits) with the price effect of a pension reform (by analyzing the effects of an increase in the penalty for retiring a year earlier). Next to an analysis of the size of the effect, this paper investigates whether socio-economic variables are interacted with the price effect and income effect. Lastly the price effect and income effect are again compared, but now in relation to early and late retirement.

The first section of this paper will give an overview of the reforms in place in several industrialized countries. The next section will give a more detailed overview of the Dutch Pension system and its recent changes. The third part gives an overview of the existing literature on the effects of financial incentives on retirement decisions. We will discuss articles which use revealed preference data as well as stated preference data. As this paper will use stated preference data in its analysis, stated preference is discussed in more detail. After which, the differences between lifetime income curves and net replacement rates are explained. The sixth section of the paper describes the data set which is used in the rest of the analysis. Following the description of the data, the models used in this paper are described more closely. In the eight section, the results of the analysis is presented and compared to previous research. Lastly, in section nine, the most important conclusions will be stated.

2 Pension Systems in General

Due to the ageing of populations in countries all over the world, pension systems are becoming more and more unsustainable. Two trends, which are present for decades now, are causing the ageing of the population of the EU-27, namely an increase in the life expectancy and a decrease in the birth rates. The two trends cause the old-age dependency ratio to increase, in the EU-27 the old-age dependency ratio has increased from 23.0% in 1990 to 28.4% in 2010 and is expected to increase even further to 58.5% in 2060 (Commission, 2011). These figures are catastrophic for many pension systems, since the group who finance the pension system (the current labor force) increases in size compared to the the group who receives benefits from the pensions system (retirees). This leads to enormous financial pressure on the existing pension systems and makes them financially unsustainable. Next to the problem of ageing Gruber and Wise (1998) have found in a study covering multiple countries that labor force participation of older workers (55-64) decreased severely between 1960 and 2000. The Netherlands, for instance, had a labor force participation of more than 70% in the 1960s, but in the mid-1990s it dropped to less than 20% for older workers. In all countries investigated by Gruber and Wise similar patterns were observed. The main reason for these drops were the early retirement schemes in place in most countries. These schemes made it beneficial to retire at an earlier age than the official retirement age. Since early retirement has to be paid by the pension systems and the revenues from the labor force decrease, the already bad financial situation of the social security systems worsens.

According to the OECD (2013), countries try to improve the financial situation of their social security system by adopting three types of reforms. The first type of reform increases the statutory retirement age. The previously instated statutory retirement age of 65 has been increased to 67 and even higher in many OECD countries. Several countries tie the statutory retirement age to life expectancy of its population. For instance Denmark and Italy will increase their statutory retirement age beyond 67 from 2020 onwards by an amount depending on the life expectancy at that point. Other countries which have similar plans are Hungary, Korea and Turkey. Next to the increase of the overall statutory age of pension systems, several countries have adopted reforms which make the statutory retirement age equal for men and women. Slovenia, Australia, Italy and Greece for instance are changing their statutory retirement age such that the statutory retirement age does not depend on gender anymore. Only Israel and Switzerland do not yet have plans for equal retirement ages for men and women. A second type of reform tries to give people financial incentives for retiring later. For instance Australia, Ireland, France and Spain offer financial benefits to older workers (past the statutory retirement age). The third reform penalizes early retirement instead of rewarding late retirement as was the case in the second type of reform. For instance, Poland and Portugal got rid of the attractive early retirement schemes to prevent retirement before the statutory retirement age. Other countries, such as, Italy have only weakened their early retirement schemes. It is important to know with such diverse social security reforms in place what the effects of the different reforms are. Before an analysis is presented to measure the effects of the different types of reforms, a closer look at the Dutch pension system is provided, since the data set used are composed of Dutch workers.

3 The Dutch Pension System and its reforms

The Dutch pension system consists of three pillars. The first pillar consists of the Dutch General Old Age Pensions Act (AOW), which entitles inhabitants to a basic state pension based on the statutory minimum wage. The current statutory retirement age depends on the birth date of individuals. Table 1 shows the current retirement age for all different birth rates. Note that for inhabitants born after the first of January 1957 the statutory retirement age is not known. After 2024, namely, the AOW eligible age will be determined five years in advance and will depend on the life expectancy in the Netherlands. Single pensioners receive 70% of the minimum wage, couples receive 50% each. Each year someone lives or works in the Netherlands in the 50 years before his or her statutory retirement age, he or she accrues 2% of this pension. Hence, when someone lives or works in the Netherlands 50 years before his or her statutory retirement age he or she receives 100% of the state pension benefits. The state pension is a pay-as-you-go system, which means that it is paid by the current workforce. Hence, the old age dependency ratio, which has increased from 20,8% in 1990 to 25,6% in 2010 in the Netherlands (OECD, 2013), has a dramatic effect on the financial situation of the pension system. The second pillar consists of a pension which depends on wages earned throughout someones career. Almost 90% of the population take part in such a pension scheme. These pension schemes are either of defined-benefit or defined-contribution type and are organized at the sector or firm level. The third pillar includes all voluntarily built-up savings that are in addition to the first two pillars. Typically, these savings are annuities through an insurance company. Due to the well-established first two pillars of the Dutch pension system, however, the third pillar is less well developed in the Netherlands than in other countries.

Over the last few decades several pension reforms have changed the Dutch pension system. To deal with the low labor force participation rate of older workers, which decreased from 70% in the 1960's to less than 20% in the 1990's, early retirement schemes in the second pillar were targeted. These early retirement schemes made it attractive to retire several years before the statutory retirement age and are the main reason for the large decrease in labor force participation of older workers (Gruber & Wise, 2002). The first major reform of the second pillar occurred in the 1990's and changed the Vervroegde Uittreding (VUT) into pre-pension (PP) arrangements. Three main differences existed between these two early retirement schemes. First of all, pre-pension arrangements are funded early retirement plans in comparison to a pay-as-you go system, which the VUT-schemes were. Secondly the change from VUT plans into PP arrangements led to a decrease of the gross replacement rate by at least 10 percentage points. Finally actuarial adjustments were made in the PP schemes which increased the price of leisure, which made most PP arrangements actuarially fair, which was not the case for the VUT schemes (Euwals, van Vuuren, & Wolthoff, 2010). In 2006, a second reform was implemented to further discourage the use of early retirement plans by lowering the fiscal benefits of the PP schemes. At the moment it is still possible to take part in a pre-pension scheme, but it is fiscally unattractive. Since these reforms labor-force participation of older workers (age 55-64) has increased significantly, from below 20% in 1990 to around 60% in 2014 (Gruber & Wise, 2002). Since the financial unsustainability of the Dutch pension system was not just caused by the low labor-force participation rate of older workers, but also by the ageing of the Dutch population, the Dutch government had to implement even more reforms than the cancellation of early retirement schemes.

To address the issue of the ageing of the Dutch population, the Dutch government had to make adaptions to the first pillar of the Dutch pension system. Since 1957, when the AOW scheme was instated, the statutory retirement age has been equal to 65. In 2010, however, the government has gradually increased the statutory retirement age from 65 to 67 by increasing the pension age to 66 years in 2020 for inhabitants born after 1954 and to 67 years in 2025 for inhabitants born after 1959. Secondly it was agreed upon that every five years the pension system was to be evaluated and adapted, if due to an increase in life expectancy the need arose. The expected effects of this reform are investigated by De Grip, Fouarge, and Montizaan (2013), they found that inhabitants born after 1954 tend to retire 3.9 months later than inhabitants born before 1954. Moreover, inhabitants born after 1959 expect to retire 10.9 months later than inhabitants born before 1954. In the spring of 2012, however, the Dutch Government decided, in the so-called Lente-Akkoord, to increase the statutory retirement age more rapidly. Again the actual retirement age of an individual was determined by his birth date. In table 1 the different AOW retirement ages are displayed for the different categories of birth dates. These are the current AOW retirement ages for inhabitants of the Netherlands. However, in

October 2012, the Dutch government decided to increase the statutory retirement age even more rapidly. Table 2 reports these retirement ages for each category of birth dates. This reform has, however, not yet been implemented. As one can see, the new pension system increases the retirement age to 66 by 2018 (instead of 2019 in the current case) and to 67 years by 2021 (instead of 2024 in the current case). The actual results of these pension reforms are not possible to estimate yet, since the pension reforms are gradually instated and hence no retired workers have dealt with the full consequence of these reforms. In other words, no revealed preference data exists to investigate the effects of the current pension reforms. However, it is possible to use stated preference experiments to estimate the expected effects of the previously mentioned reforms.

4 Financial Incentives and Retirement Age

4.1 Revealed Preference

Many studies have investigated the relationship between financial incentives and retirement age, however, only a few consider the difference between price and income effect in depth. For instance Euwals et al. (2010) use revealed preference data of Dutch workers between 1989 and 2000 to investigate the price effect and income effect after the Dutch early retirement scheme, VUT, was changed to the less attractive pre-pension arrangements. They estimate the price effect and income effect with a hazard rate model, with which they find that a decrease of 250,000 euros in the base pension wealth results in one year delay of retirement. Similarly a worker is also inclined to work for one more year when his peak value (the difference between the maximum pension wealth one can achieve by working longer and the pension wealth he would receive by retiring immediately) is decreased by 150,000 euros. A decrease in base wealth is considered an income effect and an increase in the peak value is considered a price effect. Therefore according to their results a price effect is more efficient than an income effect. However, they do not investigate whether the price and income effect alter over different retirement ages. Only a limited amount of papers use revealed preference data to investigate the effect of a change in the statutory retirement age on the actual retirement age of workers, because revealed preference data is limited available. Mastrobuoni (2009), for instance, find by analyzing the actual retirement behavior of American individuals, that an increase of the statutory retirement age by two months leads to an increase of the average retirement age by one month. Staubli and Zweimüller (2012) also use revealed preference data to examine the effects of an increase of the statutory retirement age. They find that an increase of the Austrian statutory retirement age from 60 years to 62 years and two months for men and from 55 years to 57 years and two months for women leads to a decrease of the probability on retirement of men and women. They find that the chance on retirement drops by 19 percentage point for men and 25 percentage point for women. Revealed preference data is only suitable after a reform of interest is applied in a country. But even then most data is not suitable, because most reforms are introduced together with other reforms. In these cases it is difficult to distinguish the effects of the different measures. Other studies, therefore, use stated preference data to analyze the effects of financial incentives on retirement age.

4.2 Stated Preference

In this paper we will use stated preference experiments to analyze the effects of different pension reforms. Stated preference data are decisions and valuations of individuals to hypothetical scenarios or vignettes or decisions and valuations of scenarios in the future (Louviere, Hensher, & Swait, 2000). The main advantage of stated preference experiments is that the researcher has full control over the scenarios which have to be evaluated. Researchers can, therefore, evaluate, the effects of certain scenarios more precisely. In the case of financial benefits and retirement age, researchers can for instance distinguish between changes in the statutory retirement age, changes in partly retirement possibilities and changes in early retirement schemes by separating these reforms in the vignettes. However, next to the usual assumptions which are made when working with revealed preferences (preferences displayed by actions in real life), other assumptions have to be made to correctly analyze stated preference data. The preferences in these hypothetical systems have to be similar to decisions which are made in real life when certain scenarios occur. Namely, individuals have to be able to consistently evaluate certain hypothetical scenarios (Louviere et al., 2000). Bruinshoofd and Grob (2006) investigate this assumption by framing their scenarios in different ways. They find that the framing of the scenarios change the results significantly, which provides evidence against the assumption mentioned above. Although, evidence exists that individuals cannot evaluate hypothetical pension systems, several papers, have used stated preference to analyze the effects of financial benefits on the retirement age of workers.

Bruinshoofd and Grob (2006) ask participants of their questionnaire whether they are willing to stay in the labor force longer if this would increase their pension benefits by 5 percentage points. Secondly they ask whether they are inclined to pay higher pension contributions for this increase in annual pension benefits. Finally they ask these same questions in a different way. The results of their analysis is that shifting the standard retirement age by 1 year results in an increase of the real retirement age by 5 to 6 months. Next to this result, however, they notice that the framing of the questions has a significant effect on the results. This is evidence against the use of stated preference in this context. Van Soest, Kapteyn, and Zissimopoulos (2007) ask a sample of Dutch workers their valuations of certain retirement scenarios. These scenarios differ in retirement age, replacement rates and the option to partially retire before full retirement. These valuations are then used in a utility life-cycle system in order to estimate the age at which someone retires. The results of this paper firstly show that it is hard to motivate people to work beyond the age of 65 in the Netherlands. Secondly results show that workers in the Netherlands are willing to work longer if they are able to work part-time before retiring completely. Hence, stimulating workers to work longer works best by offering them partly retirement schemes. Nelissen (2001) investigate whether a change in early retirement schemes, making early retirement schemes actuarially more fair, affect the labor force participation rate of workers between the age of 55 and 65. Participants have to decide at which age they want to retire for different pension schemes. The schemes are based on actual pension schemes used in the Netherlands. Moving from the actuarially less fair system (VUT) to the actuarially more fair system (pre-pensioen) results in a 5% increase of the labor force participation over 10 years. Kerkhofs, Fouarge, and Ester (2007) investigate, first of all, whether changes in early retirement schemes and an overall reduction in pension benefits affect the retirement age. Secondly they investigate whether the possibility of working part-time before exiting the labor force completely has an effect on the retirement age. Thirdly they investigate which pension scheme workers prefer. In their questionnaire participants are asked to evaluate hypothetical pension systems by choosing their retirement age in these systems and secondly grading these pension systems. The retirement plans differ in the implicit tax on earlier retirement, overall benefits and the possibility of retiring gradually by working part-time before retiring. They find that both an increase of the implicit tax on earlier retirement and a decrease in pension benefits overall result in a higher overall retirement age. However, a reduction in the tax on earlier retirement has a larger effect than an overall reduction in pension benefits. Secondly they find that individuals prefer to retire completely at once when earlier retirement is penalized more and individuals prefer to retire gradually if pension benefits are reduced over all possible retirement ages.

5 Replacement Rates and Lifetime Income

In this paper we want to investigate the effects on retirement decisions due to a shift or rotation of the net replacement rate curve. A net replacement rate curve is a curve which depicts someone's yearly pension benefits by a percentage of his or her yearly net wage. Manoli, Mullen, Wagner, and Alberto (2009) provide a technical analysis of the income effect and price effect in retirement decisions. In their paper lifetime income curves are used to depict these effects. The effect on retirement age due to a shift of the lifetime income curve is called an income effect and the effect on retirement age due to a change in the slope of the curve is called a price effect. Figure 1 represents the two effects graphically. The definitions used in this paper are conform the Consumer Choice Theory (Perloff, 2004). However, in our paper we will use replacement rate curves instead of lifetime income curves. To clearly see the difference between the two a simplified example will be shown.

Several assumptions will be made in order to make this example understandable. First of all we assume that our individual is a male worker who earns a net wage of 40,000 euro per year. Secondly we will assume that the worker dies at 82, which is around the life expectancy of a 62 year old male living in the Netherlands. Thirdly in this simplified example, no pay rise will occur in the remainder of his career and we consider a discount rate of 4%. Lastly his pension benefits depend on the replacement rates depicted in table 3 and graphically displayed in figure 2. Note that, scheme 2 corresponds to a shift downwards of scheme 1 and scheme 3 rotates the replacement rate curve of scheme 1. Now we can calculate his lifetime income from 62 onwards by discounting his future income and see the differences between replacement rates and lifetime income.

Lifetime income at each age for all replacement rate schemes are displayed in table 4 and graphically depicted in figure 2b. First of all, note that, the lifetime income curve is non-linear. Secondly a shift in the replacement rate curve does not correspond to a pure shift in the lifetime income curve. Although, the lifetime income curve does shift downwards, a rotation of the curve is also in place. Hence, a shift of the replacement rates is not a pure income effect, but a combined effect of an income effect and price effect. However, the downward shift seems to be the largest change in the lifetime income curve. A rotation of the replacement rate results in a rotation of the lifetime income curve. Hence, the effect of a rotation of the replacement rate curve is a price effect.

According to Hall et al. (2002) it is important that vignettes are clear to the individuals in order to receive accurate valuations. To make our vignettes clear we use net replacement rates in our hypothetical pension systems instead of lifetime income curves. Although a shift of the replacement rate curve does not result in a pure income effect, a small price effect is also in place, we adopt the terminology used by Kerkhofs et al. (2007). The effect on retirement age due to a shift of the replacement rate curve, we will call an income effect and the effect on retirement age due to a rotation of the replacement rate curve, we will call a price effect.

6 Data

6.1 Description

The data set used in this research contains 57,641 individuals. All these individuals received a regular mail by the Dutch pension fund for public sector employees (ABP) and were asked to participate in this questionnaire by firstly providing their e-mail address. In total around 20,000 individuals provided us with their e-mail address, to all these employees an e-mail was sent with a link to the web-based survey. Of these approximately 20,000 individuals around 6,000 participated in the survey, of these 6,000 only 4,025 participants were of interest.

The main part of the questionnaire consists of a stated preference experiment. In this experiment participants have to decide at which age they want to retire based on a hypothetical pension system. In the questionnaire a total of five pension schemes are considered, which are presented by a list of possible retirement ages and the corresponding net replacement rates. Note that, the state pension is already incorporated into these figures. Table 5 shows the possible retirement ages and their corresponding net replacement rates for all five pension schemes.

System 1 grants workers, who retire at 67 years, 100% of their current yearly net income as yearly pension benefits. For every year a participant wants to retire earlier than 67 his pension benefits are reduced by 7% of his current net wage. However, for every year a worker works longer than the age of 67 7% of his current net wage is added to his yearly pension benefits. Hence, when a worker retires at 66 he or she will receive a yearly pension benefit equal to 93% of his current net wage. A worker retiring at 68 receives a yearly pension benefit of 107% of his pre-pension wage. We end up with the following formula for the replacement rates in this pension system: $RR = 1 + 0.07(RA - 67)$ or $RR = -3.69 + 0.07RA$, where RR is the replacement rate and RA is the retirement age.

The net replacement rates in system 2 move up one year compared to system 2. In other words a worker who retires at 68 has a net replacement rate of 100%. For each year a worker retires earlier, the net replacement rates are decreased by 7 percentage points, similar to system 1. Also like in system 1, late retirement is encouraged by increasing the replacement rate by 7 percentage points for each year he or she works past 68. Hence when a participant of the questionnaire decides to retire at 65 he or she will receive 79% (100% - 3*7%) of his current net wage as yearly pension benefits. Retiring at age 70 results in pension benefits equal to 114% (100% + 2*7%) of his current net wage. The formula for calculating replacement rates in this system is: $RR = -4.39 + 0.07RA$.

System 3 is comparable to system 2, however, the replacement rates are moved up by one more year. Hence, a replacement rate of 100% is now achieved by retiring at 69 instead of 68 in system 2 and 67 in system 1. The increments for retiring one year later is equal to the increments in system 1 and 2, namely 7 percentage points of the replacement rates. This results in a replacement rate of 93% at a retirement age of 67 and a replacement rate of 107% at age 70. The following formula is used to calculate the replacement rates at each retirement age: $RR = -5.09 + 0.07RA$ Both systems result in a shift of the replacement rates curve downwards (Figure 2a).

System 4 grants workers the same replacement rates at 67 as in system 1. Hence, at 67 a worker receives a replacement rate of 100%. The increments, however, for every year someone works longer is now 9 percentage points of the replacement rate. This means that retiring one year earlier will result in a reduction of the yearly pension benefits by 9% of his current wage. Similarly working one year longer results in an increase of the pension benefits by 9% of the current wage. The formula for Replacement rates is now equal to $RR = -5.03 + 0.09RA$. This will result in a shift of the slope of the replacement rates by 2 percentage points, graphically represented by figure 2b.

Compared to system 4, system 5 increases the slope of the replacement rate curve even more. In this case working for one more year results in an increase of the yearly pension benefits by 11% of the workers current wage. The retirement age at which one receives a replacement rate of 100% is equal to 67, as is the case in system 1 and system 4. The formula for the replacement rates is now equal to: $RR = -6.37 + 0.11RA$. In other words, the slope of the replacement rates curve has increased by 4 percentage point compared to pension system 1 (figure 2b).

System 1 is known as the base pension system, firstly because this system is evaluated by all participants and secondly because the other systems are deviations from this system. Note that, the base system reflects the current pension system of ABP (the pension system all participants are enrolled in). Since in both cases overall wealth is decreased by 7% of the current wage of an individual in system 2 and 14% in system 3, system 2 and 3 are designed to measure income effects. In figure 2a this change can be seen as a downward shift of the entire curve. System 3 and 4 are designed to measure price effect, the combination of an income effect and a substitution effect due to a change in price of leisure. The substitution effect is in place, because working for one more year results in a higher increment in pension benefits compared to system 1, in other words, the opportunity costs of leisure have increased. The substitution effect is the change in retirement age due to the change in the opportunity costs keeping the same independence curve. However, in the 2 schemes income changes as well due to the change in the increments. Since we can not distinguish the two effects, we will estimate the price effect, the summation of the substitution effect and the income effect.

The participants in the questionnaire do not evaluate all five pension systems. In fact each individual only evaluates three of the above mentioned pension systems. The sample is therefore divided into six groups. Each group evaluates a different set of three pension systems and in a different order. Table 6 shows the pension systems each group has to evaluate and in which order they are presented.

Next to the variables measuring hypothetical retirement ages, our data set contains several other variables. The variables which we will use in the rest of this paper are: age, age^2 , gender (1 = male, 0 = female), the natural logarithm of the participant's yearly income, Marital Status (1 = Married or living together with partner, 0 = living by themselves), monthly income of the individual's partner (0 = Partner has no income, 1 = Income is less than 1500, 2 = Income is between 1500 and 2500, 3 = Income is between 2500 and 3500, 4

= Income is between 3500 and 4500, 5 = Income is between 4500 and 5500, 6 =Income is between 5500 and 6500 and 7 = Income is larger than 6500), Three binary variables stating whether an individual has a high level of eduation (1 = finished an hbo level study or higher, 0 = otherwise), intermediate level of education (1 = finished havo or vwo or mbo study, 0 = otherwise) or low level of education (1 = finished primary school or vmbo, 0 = otherwise), a binary variable stating whether someone invested in other products to finance his or her retirement besides the first two pillars of the Dutch Pension System (1 = yes, 0 = no). An ordinal variable measuring someones perceived health (1 = very healthy, 5 = very poor health) and finally a variable denoting someones expected retirement age in real life.

Only 2,689 individuals answered all questions of interest. To check whether just considering this group of 2,689 participants instead of the sample containing 4,025 employees would result in a selection bias, a probit analysis is conducted (Table 7). As one can see all coefficients with respect to the different groups are insignificant at a 5% significance level. To receive more information about the distributions of the variables in the different groups, descriptive statistics can be discussed.

In table 8 the mean and standard deviation of several variables of interest is given in each group. It appears that all variables have similar means and standard deviations in each group. To test whether all variables are not significantly different amongst groups, ANOVA tests are conducted. Table 9 reports the results of these tests. Almost all ANOVA tests fail to reject the null at a 5% significance level, only the variable, which reports the income of the participant's partner differs. Since almost all ANOVA test reject the null hypothesis we conclude that the six groups are indeed randomly divided in the sample of 2,689. That is why in the rest of this paper only the sub sample of 2,689 participants will be used in the analysis.

7 Model

The main goal of this paper is to measure the effects of pension reforms on the retirement age of individuals. Therefore, the dependent variable in our regression analysis will be the expected retirement age of an individual based on a hypothetical pension system. Since every participant in our questionnaire has to evaluate three different pension systems by providing their corresponding expected retirement age, one issue arises. Due to possible individual-specific effects that influence the retirement age, unobserved heterogeneity can arise (Wooldridge, 2010). Luckily, several methods can deal with this issue.

Wooldrigde (2002) proposes two methods to deal with the issue of unobserved heterogeneity due to individual specific effects. The first is a fixed effects regression which eliminates the so called individual effects by subtracting the mean of all variables in the regression. This method is consistent, but possibly less efficient than the second method. The second method is to incorporate the individual effects into the regression by using a random effects regression, but accounting for the unobserved heterogeneity by adding several individual specific variables, which cause the unobserved heterogeneity. This method is consistent and more efficient if the unobserved heterogeneity is accounted for by the individual specific variables. However, if this is not the case, this method is inconsistent. To see which of the two methods is preferred a Hausman specification test can be used to compare these two methods. In the case of a rejection of the Hausman test the first method is preferred, since the second method is not consistent. However, when the Hausman test is not rejected, the second method is preferred, since the second method is more efficient than the first.

These two methods can be applied in a linear setting, however, the dependent variable of interest is not continuous. Namely, participants in the questionnaire can only choose retirement ages which are integer and between 62 and 70. To overcome this problem one can also look at the effects of the pension systems in specific cases, for instance early retirement and late retirement. That is why the dependent variable is also transformed into two binary dependent variables. The first one, measuring early retirements, is divided into retirements before 65 and retirements after and including 65. The second binary variable, measuring late retirement, divides the retirement ages before 68 and after and including 68.

To account for unobserved heterogeneity in the binary cases two methods will be adopted, which are again provided by Wooldrigde (2002). These methods are called the fixed effects logit analysis and the random effects logit analysis. The fixed effects model again uses a transformation to eliminate the unobserved effects from the estimation equation. In the random effects case we again hope to capture the heterogeneity by including several individual-specific variables into the regression. One major downfall of the fixed effects logit analysis is that it disregards individuals with a constant dependent variable. On the other hand, if the individual specific variables do not capture the unobserved heterogeneity, the random effects logit analysis is a biased estimator. However, if a substantial part of the sample is lost due to this issue a random effects logit analysis is preferred.

8 Results

8.1 Graphical Analysis

Figure 5a till 5f display a total of 18 bar charts of the retirement age in each group and each hypothetical pension system. Each figure displays the expected retirement ages of each group for all three evaluated pension systems. The order of the bar charts is the same as the order in which the groups evaluate the pension systems. Group 1 (Figure 5a) first evaluates the base system, after which they evaluate the pension scheme were all replacement rates are moved up one year. Lastly they evaluate the pension system which moves all replacement rates up two years. In the base system workers tend to retire between 62 and 67, with peaks at 63, 65 and 67. These retirement ages correspond with a replacement rate of around 70% (63), the old official retirement age (65) and a replacement rate of 100% (67). Retirement ages change due to the changes in pension benefits. Firstly one can see that the number of early retirements at age 62 and 63 are decreased when we shift the replacement rates curve down by 7 percentage point. Secondly more people tend to retire between 65 and 67 and finally a substantial increase in the amount retirees at 68 can be seen. However, changes in retirements after 68 are minimal. A shift of the replacement rates curve by 14 percentage points result in similar results. Again early retirements are decreased at age 62 till 64. Also more people tend to retire between 65 and 67. Finally the number of retirees at 68 and 69 are increased by a substantial amount. Note that retirement after 69 does not change drastically. This shows that people are not inclined to work another year when receiving a replacement rate of 100%.

Group 2 (Figure 5b) start with system 5, the replacement rates are 14% percentage point lower than the base system, then evaluate the system with a decrease of 7 percentage point in comparison to the base system and finally evaluate the base system. Note that although this group evaluates the same pension systems as group 1, substantial differences occur in the distribution of retirement ages. However, the general remarks made about group 1 are similar to group 2. Again a downward shift of 7 percentage point in the replacement rate curve result in a decrease in early retirements at 62 and 63. Again more people tend to retire between the ages of 65 and 67 when considering the latter system. Thirdly a substantial increase in the amount of retirees at 68 is established. Similarly, a downward shift of 14 percentage points result in a decrease of the number of early retirees at 62, 63 and 64. Also more people tend to retire between 65 and 67 and finally at the age of 68 and 69 the number of retirements increases. Note again that no changes occur at retirement ages corresponding to replacement rates above 100%. Although the general remarks are similar, the size of the changes are different. For instance, it appears that in group 1 the increase of retirements at 68 are larger than the increase in group 2.

In the bar charts of group 3 and 4 (Figure 5c and 5d) we can see the effects of a change in the slope of the replacement rate curve. Similar to figure 5a and 5b, early retirement decreases at age 62 and 63. The number of retirees between 65 and 67 also increase, however, the effect seems to be higher than in figure 5a and 5b. A clear difference between the first two figures and figure 5c and 5d occur at retirement ages after 67. In figure 5a and 5b substantial increases in retirees at 68 and 69 occur. In figure 5c and 5d, however, no concrete changes occur at retirement ages of 68 and 69. These ages again correspond to replacement rates above 100%. Hence, the increased incentive to work another year, due to a change in the slope of the replacement rate curve, has no effect on retirements corresponding to replacement rates above 100%.

Group 4 and 5 evaluate the base system, a system with income effect and a pension scheme with a price effect. In these figures one can see the differences between a shift in the replacement rate curve and a change in the slope of a replacement rate curve. Again we see that in both cases the number of early retirements decrease. However, the number of retirements between 65 and 67 tend to increase more when applying a change in the slope of the replacement rate curve. Finally a change in the slope of the replacement rate curve does not influence retirements after 67. A shift of the replacement rate curve does, however, change retirements after 67.

It is noteworthy that almost no changes occur at ages where an individual receives more than 100% of his or her income as pension benefits. Not even a price effect of 4% motivates people to retire beyond this point. In this case a worker would increase his benefits by 11 percentage points when retiring one year later. Apparently most individuals are not interested in pension benefits above 100% of their current income. All in all it seems that a change in the slope of the pension benefit structure only has an effect on early retirees and not on late retirees. Hence, when a government wants to reduce the number of early retirements, a change of the slope of the pension system might be the best action. If on the other hand a government also wants to increase the retirement age at older ages a shift in the pension benefit structure is more appropriate. Such a reform namely has a clear effect on the number of people retiring at 68 and 69. Changes in the slope have no visible effect on retirement rates at these ages. However, more sophisticated methods are needed to analyze these effect formally.

To see whether workers can consistently evaluate pension schemes in a stated preference experiment we look at the differences in retirement age between the groups in the base pension scheme. Figure 6a displays the bar charts of group 1 and group 3. Both groups evaluate the base scheme first. As expected no clear differences occur between these two distributions. However, when we look at all groups clear differences arise (Figure 6b). At every retirement age we can see clear differences between the number of retirements in each group. This provides evidence that the order in which the pension schemes are presented affect the decisions of members of our sample. This means that people are not able to evaluate their preferences in hypothetical pension schemes consistently. Secondly the income effect and price effect are different when the order of the pension schemes is different. For instance, the income effect on retirements at ages between 65 and 67 is larger in group 1 than in group 2. Again this provides evidence that the results of our stated preference experiment depend on the order in which we represent the pension schemes. However, more sophisticated methods are needed to analyze these effects. In the next section such an analysis analysis is conducted to see the effects of the order in which the pension systems are presented as well as the size of the income effect and price effect.

8.2 Statistical Analysis

Next to the graphical analysis supplied in the previous segment, a more formal analysis of the data will be applied by using the models explained in the model section. So first of all, we will treat the dependent variable, the retirement age, as a continuous variable and perform a fixed effect analysis and a random effect analysis on the data. Secondly we will assume that expected retirement is represented by a linear relation between the expected retirement age and the different pension systems and characteristic variables. After this analysis we will relax the assumption of linearity and investigate whether price and income effects have different effects at different expected retirement ages, more specifically are the income and price effects different for early and late retirement.

8.2.1 Linear estimation

To decide whether a fixed effects regression or random effects regression is preferred in this model, a Hausman test is performed. According to this test the random effects regression is preferred, since the null hypothesis cannot be rejected. For completeness, however, the results of the fixed effects are still reported in table 10. Table 11 displays the results of the random effects regression for expected retirement age. Note that the base pension system is also the base in the regression. This means that the coefficients of each system represent the average difference in expected retirement age between the base system and the corresponding pension system. First of all, note that the constant is estimated to be equal to 64.7 years. Secondly, we see that System 2 has a coefficient of 0.58. Hence, the average expected retirement age in pension system 2 lies 0.58 years higher than the average expected retirement age in the base system. In other words, the results show that a downwards shift of the replacement rate curve by 7 percentage points results in an average increase of the expected retirement age of 0.58 years. System 3's coefficient is equal to 1.2, which means that the difference in the average expected retirement age between the base system and system 3 is 1.18 years. The expected income effect caused by a shift of the pension benefits by 2 years, therefore, is equal to 1.2 years. Bruinshoofd and Grob (2006); Kerkhofs et al. (2007) both find that a shift of the height of the pension benefits by one year leads to an increase of average retirement age by 5 months. According to our results, a similar change would lead to an increase of the average expected retirement age by 7 months. However, a shift of the retirement benefits by one year results in a 5 percentage point decrease of an individual's pension wealth in the investigation of Bruinshoofd and Grob and Kerkhofs et al.. Since in our analysis a delay of one year corresponds with a decrease of 7 percentage points in an individual's pension wealth the results obtained by Bruinshoofd and Grob and Kerkhofs et al. are similar to the results found in our analysis.

The coefficients of System 4 and 5 are both positive and significant at a 5% significance level. The results suggest that increasing the slope of the replacement rate curve results in a higher expected retirement age of individuals. More specifically, increasing the slope by 2 percentage points results in an average increase of 0.43 years. An increase in the slope by 4 percentage points results in an average increase of 0.79 years. In other words, increasing the penalty for retiring one year early or increasing the bonus for retiring one year later by 2 percentage points of the net replacement rate leads to an increase of the average expected retirement age by 0.42 years. Increasing the penalty of retiring one year earlier by 4 percentage points leads to an increase of the expected retirement age by 0.79 years. Kerkhofs et al. (2007) find that by increasing the height of the penalties for retiring one year early by two percent, the expected average retirement age increases by 9 months. In our case, however, we find that the effect of a similar reform is just 5 months. It appears that the coefficients of System 3 and 5 are approximately twice as large as the coefficients of System 2 and 4, respectively. Hence, a twice as large change in the penalties for early retirement or a twice as large drop in pension wealth results in a twice as large effect. According to two Wald tests this hypothesis cannot be rejected.

Next to discussing the estimation of the price and income effect, we can look at the effect of characteristic variables on the overall retirement age. First of all, age has a significant non-linear effect on the expected retirement age. The results show that older workers tend to retire earlier than younger workers. A possible explanation for this results is that older workers tend to have a clearer understanding about their pension and retire earlier. Also older workers have experienced the work force for a longer time period and therefore value leisure more than younger workers. Secondly we find that male workers expect to retire at a later age than female workers. On average a male worker expects to retire 0.24 years later than a female worker. (De Grip et al., 2013) also find that on average male workers expect to retire at a later age. Thirdly the height of an individual's yearly income has a significant negative effect on the retirement age. Hence, on average individuals with a higher yearly salary expect to retire earlier than individuals with a lower yearly salary. A higher salary in general means a higher pension wealth, which means that workers with higher wages can afford to retire earlier. Similarly the income of someone's partner has a significant negative effect on the expected retirement age. De Grip et al. (2013) find no significant effect of the income of someone's partner on the expected retirement age. The fifth significant effect we see in our results is that higher educated people want to retire earlier than people with a low level of education or intermediate level of education. This is inconsistent with the findings of Kerkhofs et al. (2007) and De Grip et al. (2013) in which they find that overall highly educated workers tend to work longer than lower educated workers. D. J. Fouarge, Grip, and Montizaan (2012) find that higher educated workers expect to retire at a later age than people with an intermediate level of education. A possible explanation of their results is that lower educated workers have a less clear view of their pension benefits and therefore do not know whether retiring at an earlier age is actually financially viable. Sixthly, people who live together with a partner expect to retire earlier than single people. On average an individual who is single retires 0.26 years later than an individual who lives together with a partner. D. J. Fouarge et al. (2012) find that one reason for retiring at a later age is the loss of social interaction with colleagues. This effect is most likely stronger when an individual is single, which is a possible reason for the results of our paper. The state of someones health has a positive effect on the expected retirement age. D. J. Fouarge et al. (2012) and Kerkhofs et al. (2007) have found that individuals find it of utmost importance to retire healthy. Hence, workers expect and want to retire earlier if their state of health is declining, in order to be healthy when retiring. Whether someone has also invested in products in the third pillar has a negative effect on the expected retirement age. An investment in a product in the third pillar increases someone pension benefits and he or she can, therefore, afford to retire earlier. People who expect to retire at a later age in real life, expect to retire at a later age in a different pension system.

Next to the effects of the characteristic variables, the effects of the 6 groups in our analysis are investigated. In other words, does the order in which the pension systems are presented affect the expected retirement age of an individual. Unfortunately the results depict a problem, since most coefficients for the groups are significant. This means that the expected retirement age also depends on the order in which the pension systems are presented to the participant. When we look at the different coefficients it seems that presenting the participant with a pension system where the pension benefits are lower overall (group 2, group 4, group 5 and group 6) at the beginning, makes the participant report earlier expected retirement ages for all retirement plans.

Next to the effects of the individual specific variables on retirement age, we can also look at the interaction terms between the socio-economic variables and our variables of interest. In other words, is the income effect of female workers different from the income effect of male workers and is the price effect of a married worker different from the price effect of a single worker. Table 12 presents the result of this regression. Only significant interaction effects are included into the regression. First of all, gender has no effect on the size of the income and price effect. Previous research by D. Fouarge, de Grip, and Montizaan (2012) finds, however, that the income effect of men is significantly lower than the income effect of women. They even find that the income effect is not significant for men. Based on our results, however, we do not find such evidence.

Several interaction terms in our estimation are, however, significant. First of all the interaction term between age and system 3 is negative and significant at a 5% significance level. This means that if we shift the pension benefits by two years, older workers tend to retire even earlier on average than younger people. When we look at the interaction terms of the education level of an individual and the different pension systems, we see that the income effect is even larger for highly educated people than for people with an intermediate level of education. On the other hand, low educated people tend to retire even earlier than medium educated people in pension systems which either rotate the replacement rate curve or shift the replacement rate curve downwards by 14 percentage points. In other words, individuals with a low level of education have a lower price effect on the expected retirement age than individuals with an intermediate level of education.

8.2.2 Early Retirement Late Retirement

Previous research (Kerkhofs et al., 2007; Bruinshoofd & Grob, 2006) has assumed that the effects of pension reforms are linear with respect to the retirement age. However, in the graphical analysis of this paper we found evidence that the pension reforms have different effects on early retirement (retirement between 62 and 64) and late retirement (retirement between 68 and 70). To test this more formally we transform our dependent variable (retirement age) into two binary variables, Early Retirement and Late Retirement. Early Retirement is equal to zero if the individual wishes to retire at an age between 62 and 64 and one otherwise. Late retirement, on the other hand, is equal to one if the individual wishes to retire after the age of 67 when considering a certain pension system. We will use a random effects logit analysis to test these two cases separately, since a use of a fixed effects logit regression leads to a loss of more than two thousand individuals in our sample. For completeness, however, the results of the fixed effects logit regression for late retirement is still reported in table 13.

The results of the random effects regression for early retirement is reported in table 14. One benefit of the random effects logit regression is that we do not disregard the individuals which we disregarded in the fixed effects logit analysis. When we look at the results provided in table 14, we see that the coefficients of system 2 and system 4 are close to each other. Also the coefficients of system 3 and 5 seem to be similar. When we test whether these coefficients are equal to each other by applying two Wald tests, we see that the hypothesis that the coefficients of system 2 and 4 are equal cannot be rejected. However, the hypothesis that the coefficient of system 3 and system 5 are equal is rejected. In the linear case we saw a clear difference between the price effects and income effects due to the transformation in the hypothetical pension systems. In the early retirement case, however, these differences are not that clear. In other words, it seems that the price effects and income effects are closer to each other in the case of early retirement than in the case of the overall expected retirement age.

The coefficients of the characteristic variables are similar to the signs of the coefficients in the analysis of the overall expected retirement age. Age still has a non-linear effect on early retirement and the sign of the coefficients of age and age^2 is still the same. In this case we can conclude that on average more older individuals expect to retire between the age of 62 and 64 than younger individuals. The chance that a male worker retires between the age of 62 and 64 is smaller than the chance that a female worker will. This is similar to the results in the linear setting, where we found that on average male workers expect to retire at a later age than female workers. The coefficient of an individuals yearly income and the coefficient of the height of the income of an individual's partner is negative. This was also the case in the analysis of the overall expected retirement age. Married people or people living together with a partner have a larger chance to retire between 62 and 64 than single people. Again this is similar to the findings in the linear setting, where we found that marital status has a negative effect on the overall retirement age. Also, on average more individuals with poor health expect to retire between 62 and 64 years old than healthy people, which is again similar to the findings in the linear setting. We also find evidence that a larger portion of higher educated workers expect to retire at an earlier age (between 62 and 64). In the linear setting we found a negative effect of the education level on the overall expected retirement age. Lastly, it appears that participants who expect to retire earlier in real life have a higher chance to retire early in the hypothetical retirement plans.

Note that the coefficients of the dummy variables for group 2 and 6 are again significant. Hence also in this setting the order in which the hypothetical pension systems are presented in the questionnaire has an effect on the dependent variable. This again provides evidence that individuals cannot consistently estimate their expected retirement age. Bruinshoofd and Grob (2006) in their study confirm these results. They find that by phrasing the hypothetical pension reforms differently, the expected retirement age of individuals changes. However, no revealed preference data exists which is comparable to our data set. The previous analysis shows that characteristic variables do not appear to have different effects on early retirement than on the overall retirement age. The previous analysis shows that characteristic variables do not appear to have different effects on early retirement than on the overall retirement age. To investigate whether the interaction terms, on the other hand, do have different effects on early retirement, we add interaction terms to our analysis.

To investigate whether the price effect and income effect on early retirement depend on the characteristic variables, interaction terms are added to the random effects logit regression. Table 15 displays the results of this estimation. In the linear regressions we found no significant difference in the size of the income and price effect between male and female workers. In the results of the regression for early retirement, however, the coefficients of the interaction terms between gender and system 2 and 3 are significant and positive. This means that the income effect on early retirement is higher for male workers than the income effect of female workers on early retirement. This appears to be contradicting to the results found in previous research (D. Fouarge et al., 2012; Kerkhofs et al., 2007), which finds that the income effect of male workers is lower than the income effect of female workers. These papers, however, look at the overall expected retirement age and not on the specific case of early retirement. Hence, our findings conclude that due to an overall decrease of the replacement rate curve, male individuals on average expect to retire with a higher probability between the ages of 62 and 64 than female individuals.

Note that, opposite to the income and price effects on the overall retirement age, the income and price effects on early retirement are not affected by age and health status. It also appears that the level of education has no significant effect on the size of the income effect on early retirement. In the linear setting, a high level of education had a positive effect on the income effect on the expected retirement age. However, we still find that a low level of education has a negative effect on the price effect on early retirement. To see whether these results differ for different retirement ages, we perform a similar analysis for late retirement.

8.2.3 Late Retirement

In the graphical analysis, we found that a rotation of the replacement rate curve had little to no effect on the number of late retirements. To analyze whether these findings are accurate, a random effects logit regression will be estimated. Table 17 show the results of the random effects logit regression of late retirement. Note that, the coefficient of system 4 is not significant. This result provides evidence for the findings in the graphical analysis. Namely, a positive shift of the slope of the replacement rate curve by two percentage point has no significant effect on the number of late retirements. Additionally, the size of the coefficient of System 5 is substantially lower than the coefficient of system 3, again this supports the previously mentioned findings. Hence, the results provide evidence that the price effect on late retirements is small or not existent. The income effect on the number of late retirements, however, is still significant and positive.

Several differences can also be seen between the effects of the characteristic variables on the number of early retirements and the number of late retirements. Several variables are, namely, not significant anymore. These variables are age, the height of the income of a participant's partner and a dummy variable stating whether someone has other sources of income for his pension besides the first two pillars. As before, however, gender, health status and someone's expected retirement age in real life still have a positive effect on the number of late retirements. The height of someone's yearly income and marital status again have a negative effect on the number of late retirements. These findings are similar to the findings in the analysis of the number of expected early retirements.

When we add interaction terms to the regression, we see that only a low education has a negative effect on the income effect on late retirement. In contrast, in the early retirement setting, we found that low educated individuals have a lower price effect instead of a lower income effect. Other characteristic variables have no significant effect on the price effect and income effect on the number of late retirements.

When we compare the results of the analysis of early retirement with the results of the analysis of late retirement we see several clear differences. Especially the size of the price effect differ greatly between the two settings. An increase of the implicit tax on earlier retirement, namely, has a significant negative effect on the number of early retirements, while it only has a small positive effect or no effect at all on the number of late retirements. This means that the price effect on the overall retirement age cannot be estimated by a linear model. This is supported by the findings that the interaction effects of characteristic variables and an increase of the implicit tax on earlier retirement differ between the two regressions. This result can explain the difference on the size of the price effect found in existing literature and the price effect in this paper. For instance, Kerkhofs et al. (2007) present retirement plans with overall higher net replacement rates in the base system. Therefore, the expected retirement age in the base system is lower than in our base system. Since the price effects is stronger on lower retirement ages, we expect that the price effect in their analysis is higher than ours. This is indeed the case, since Kerkhofs et al. find that an increase of the implicit tax on earlier retirement leads to an increase of the average expected retirement age by 9 months. We only find an expected increase of 5 months on the average retirement rate because of a similar reform of the pension system.

9 Conclusion

Almost all industrialized countries are currently implementing drastic reforms of their pension systems in order to make their pension systems financially sustainable. These countries, however, adopt different types of pension reforms to increase the retirement age of its population. It is important to know what the effects of these different types of reforms are on the retirement decisions of individuals. This paper, therefore, analyses the effects of two different types of pension reforms by using stated preference experiments (The ABP representative survey 2013 and administrative data). Due to the construction of the hypothetical pension reforms, which are evaluated by participants in the questionnaire, we could measure the income effect, caused by a decrease in the overall pension wealth by 7 and 14 percentage point, and the price effect, caused by a decrease in the implicit tax on pension postponement by 2 and 4 percentage point. Because the data set contains several characteristic variables as well, we could estimate the effects of these variables on retirement age and on the price effects and income effects. Lastly we investigated whether the price effect and income effect differ at retirement ages. More specifically, we investigated whether the price effect and income effect on early retirement differs from the price effect and income effect on late retirement.

Previous research (D. Fouarge et al., 2012; Kerkhofs et al., 2007; Bruinshoofd & Grob, 2006) has shown that a decrease in pension wealth by 5 percentage points results in an increase in the average retirement rate of 5 months. The results in this paper support these findings. In this paper, namely, we found that a decrease in pension wealth by 7 percentage points and 14 percentage points results in an increase of the average expected retirement age by 7 months and 14 months respectively. Hence, this paper as well as existing literature have found that on average a decrease of the overall pension wealth by one percent results in an increase of the expected retirement age by one month. Next to the size of the income effect, we found that the effect due to an increase of the implicit tax on earlier retirement by 2 percentage points and 4 percentage points, is equal to 5 months and 9.5 months respectively. Kerkhofs et al. (2007), however, find that an increase of the implicit tax on earlier retirement by 2 percentage points leads to an average increase of the retirement age by 9 months.

We also find that several socio-economic variables have a significant effect on the expected retirement age. Age, the height of someone's wage and the height of the wage of one's partner have a negative effect on the expected retirement age. Own perceived health and the expected retirement age in real life have a positive effect on the expected retirement age in our hypothetical pension systems. Moreover, men expect to retire at a later age than women, highly educated people expect to retire earlier and whether someone has invested in products in the third pillar has a positive effect on the retirement age. Most of these findings are consistent with the existing literature, except for the effect of education on retirement age and the effect of the income of someone's partner (Kerkhofs et al., 2007).

The results of this paper show no significant effects of gender on the size of the price effect and income effect, which is contrary to the findings by Kerkhofs et al. (2007); De Grip et al. (2013). Their results show, namely, that men have a significant lower income effect than women. Several other interaction terms are significant. For instance, older individuals tend to retire even earlier when confronted with a decrease of the pension wealth by 14 percentage points. Low education has a significant negative effect on the price effect on retirement age. While high education has a positive and significant effect on the size of the income effect. Lastly the price effect of unhealthy people is higher than the price effect of healthy people.

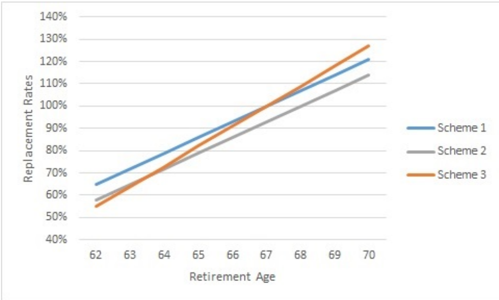
Previous research, such as Kerkhofs et al. (2007), has treated the effects of pension reforms as linear. However, we found evidence that the price effects on retirement cannot be estimated by linear models. More specifically, the effects of a decrease in the implicit tax on pension postponement by 2 percentage points has no effect on the number of expected late retirements. On the other hand, the same pension reform has a significant negative effect on the number of early retirements. Similarly a decrease of the implicit tax on pension postponement by 4 percentage points has almost no effect on the number of late retirements. The same reform does have a large effect on the number of early retirements. We did not find conclusive evidence that the income effect, caused by a decrease of the pension wealth, is non-linear. In order to conclude that the income effect is non-linear or linear, further research is needed.

The results of the effects of the characteristic variables also differ greatly between early retirement and late retirement. In the early retirement setting we find the same effects as in the linear case. In the regression of late retirement, however, several characteristic variables have no significant effect anymore. The effects of the interaction terms differ as well. No interaction term has a significant effect on late retirement. The price effect on early retirement still depends on the level of education of an individual. Low educated people tend to retire between the age of 62 and 64 more often when confronted with an increase in the implicit tax on earlier retirement. Male individuals expect to retire less often between the age of 62 and 64 than female individuals when confronted with a downward shift of pension wealth by 7 percentage points and 14 percentage points . This is contrary to the findings of Kerkhofs et al. (2007); D. Fouarge et al. (2012). These papers, however, investigate the effect of gender on the price and income effect on the overall retirement age.

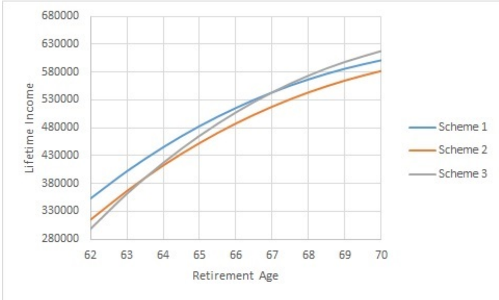
The findings, that the price effect is different for early retirements and late retirements, leads to important implications on policies regarding pension reforms. First of all we expect that a bonus for postponement of retirement beyond the statutory age, has no to a very low effect on retirement. Note that, similar pension reforms are currently being implemented by for instance France and Spain (OECD, 2013). Secondly governments have to know the distribution of the current retirement age to predict the effects of their pension reforms, because of the non-linearity of the retirement behavior.

Appendix

Figures

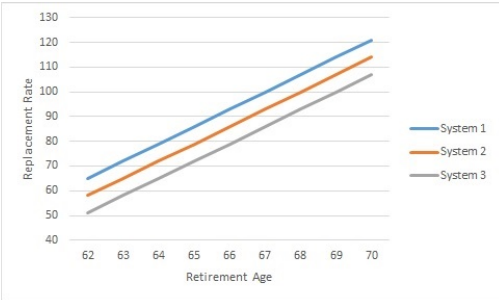


(a) Replacement Rate Curves

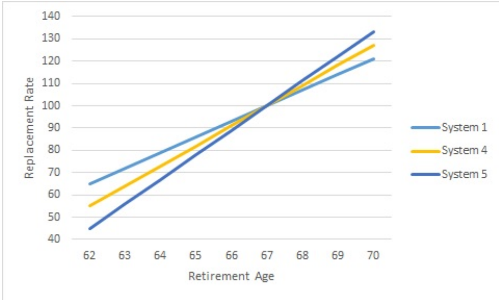


(b) Lifetime Income Curves

Figure 1: Difference between Replacement Rates and Lifetime Income Curves

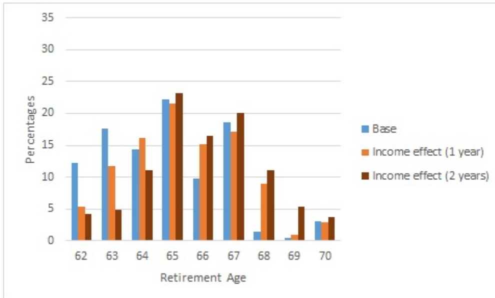


(a) Replacement Rates in system 1, 2 and 3

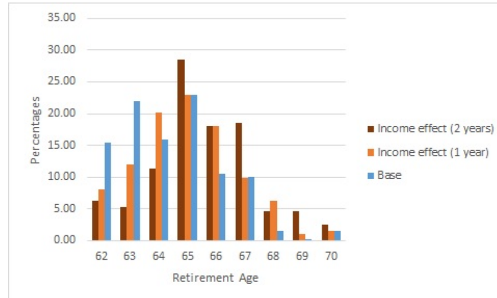


(b) Replacement Rates in system 1, 4 and 5

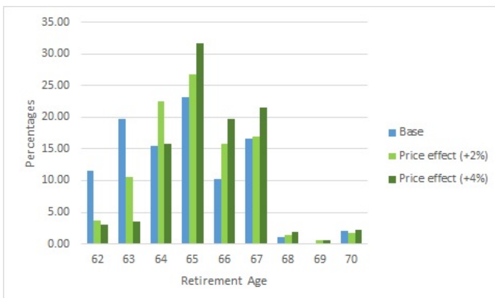
Figure 2: Replacement Rates of the 5 hypothetical pension systems



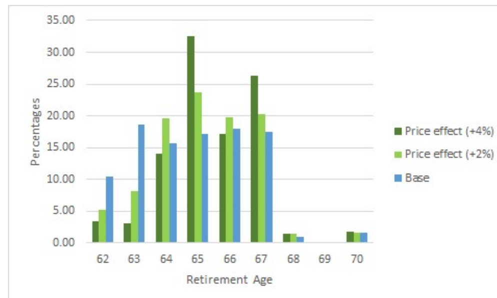
(a) Group 1



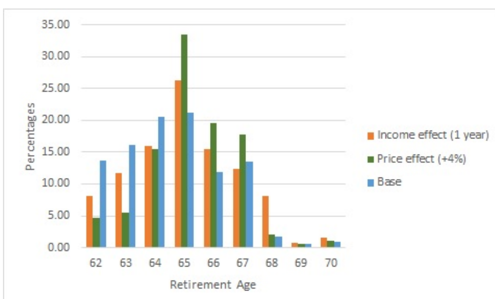
(b) Group 2



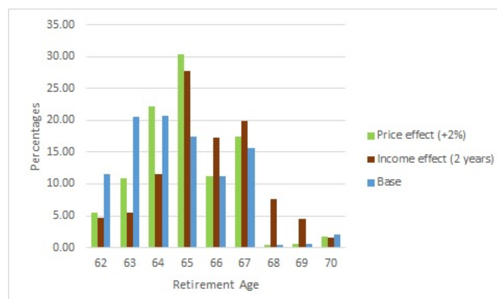
(c) Group 3



(d) Group 4

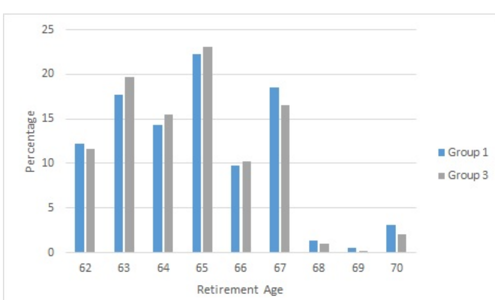


(e) Group 5

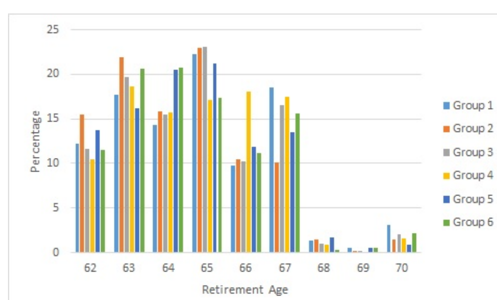


(f) Group 6

Figure 3: Histograms of the Retirement Age



(a) Base System for Group 1 and 2



(b) Base System for all Groups

Figure 4: Histograms of Retirement Age in Base Systems per Group

Tables

Table 1: Current AOW age scheme

Born	**AOW age**
before January 1 1948	65
1 January 1948 − 30 November 1948	65 + 1 Month
1 December 1948 − 31 October 1949	65 + 2 Month
1 November 1949 − 30 September 1950	65 + 3 Months
1 October 1950 − 31 July 1951	65 + 5 Months
1 August 1951 − 31 May 1952	65 + 7 Months
1 June 1952 − 31 March 1953	65 + 9 Months
1 April 1953 − 31 December 1953	66
1 January 1954 − 30 September 1954	66 + 3 Months
1 October 1954 − 30 June 1955	66 + 6 Months
1 July 1955 − 31 March 1956	66 + 9 Months
1 April 1956 − 31 December 1956	67
1 January 1957 and onwards	Unknown

Table 2: AOW age scheme Rutte-Asscher

Born	Age when individual receives AOW
before January 1 1948	65
1 January 1948 − 30 November 1948	65 + 1 Month
1 December 1948 − 31 October 1949	65 + 2 Month
1 November 1949 − 30 September 1950	65 + 3 Months
1 October 1950 − 30 June 1951	65 + 6 Months
1 July 1951 − 31 March 1952	65 + 9 Months
1 April 1952 − 31 December 1952	66
1 January 1953 − 31 August 1953	66 + 4 Months
1 September 1953 − 30 April 1954	66 + 8 Months
1 May 1954 − 31 December 1954	67
1 January 1955 and onwards	Unknown

Table 3: Replacement Rates of three schemes

retirement age	scheme 1	scheme 2	scheme 3
62	65%	58%	55%
63	72%	65%	64%
64	79%	72%	73%
65	86%	79%	82%
66	93%	86%	91%
67	100%	93%	100%
68	107%	100%	109%
69	114%	107%	118%
70	121%	114%	127%

Table 4: Lifetime Income curves of three schemes

retirement age	scheme 1	scheme 2	scheme 3
62	353,348	315,296	298,987
63	402,171	366,810	361,759
64	445,298	412,526	417,207
65	483,048	452,765	465,743
66	515,724	487,835	507,756
67	543,613	518,025	543,613
68	566,988	543,613	573,667
69	586,107	564,860	598,249
70	601,217	582,016	617,675

Table 5: Pension Systems (Pension is equal to the listed percentage of the last salary)

Retirement age	System 1	System 2	System 3	System 4	System 5
62	65	58	51	58	45
63	72	65	58	65	56
64	79	72	65	72	67
65	86	79	72	79	78
66	93	86	79	86	89
67	100	93	86	100	100
68	107	100	93	109	111
69	114	107	100	118	122
70	121	114	107	127	133

Table 6: Order of pension systems in the different groups

	First	Second	Third
Group 1	Base	System 2	System 3
Group 2	System 3	System 2	Basis
Group 3	Base	System 4	System 5
Group 4	System 5	System 4	Basis
Group 5	System 2	System 5	Basis
Group 6	System 4	System 3	Basis

Table 7: Probit analysis for selection bias

	Coefficient	Standard Error	p-value
Group 2	0.101	0.0749	0.178
Group 3	-0.0363	0.0737	0.623
Group 4	0.0131	0.0734	0.858
Group 5	-0.0733	0.0731	0.316
Group 6	-0.0382	0.0736	0.604
Constant	-0.692	0.0513	0.000
Observations	4,025		

Table 8: Mean and (Standard Deviations) of variables of interest in each group

Variable	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Expected Retirement Age in Real Life	65.1	65.2	65.1	65.2	65.0	65.1
	(2.37)	(2.48)	(2.49)	(2.38)	(2.41)	(2.33)
Natural Logarithm of Yearly Income	10.9	10.9	10.9	10.9	10.9	10.9
	(0.284)	(0.287)	(0.277)	(0.294)	(0.269)	(0.278)
Age	53.4	53.5	53.2	53.7	54.1	53.7
	(6.52)	(6.01)	(6.49)	(6.16)	(5.88)	(5.88)
Gender (1 = male)	0.561	0.599	0.591	0.628	0.577	0.583
	(0.497)	(0.491)	(0.492)	(0.484)	(0.495)	(0.494)
Health	1.89	1.95	1.98	1.92	1.87	1.95
	(0.673)	(0.675)	(0.695)	(0.710)	(0.660)	(0.680)
Other Sources of Income for Pension(1 = yes)	0.378	0.369	0.355	0.385	0.384	0.377
	(0.485)	(0.483)	(0.479)	(0.487)	(0.487)	(0.485)
Education Level	4.92	4.87	4.86	4.84	4.96	4.83
	(1.08)	(1.21)	(1.13)	(1.13)	(1.08)	(1.14)
Marital Status	0.790	0.827	0.806	0.779	0.809	0.809
	(0.408)	(0.379)	(0.396)	(0.416)	(0.393)	(0.394)
Income Partner	1.88	1.94	1.76	1.55	1.83	1.80
	(1.83)	(1.88)	(1.75)	(1.56)	(1.76)	(1.78)

Table 9: ANOVA Results

Response Variable	Factor	F(5,2683) value	P-value
Expected Retirement Age in Real Life	Group	0.54	0.7480
Natural Logarithm of Income	Group	0.64	0.6660
Age	Group	1.20	0.3073
Gender	Group	0.99	0.4201
Health	Group	1.70	0.1307
Other Sources of Income for Pension	Group	0.24	0.9441
Education Level	Group	0.88	0.4968
Marital Status	Group	0.77	0.5705
Income Partner	Group	2.63	0.0224

Table 10: Fixed Effects Regression of Retirement Age

Retirement Age	Coefficient	Standard Error	p-values
System 2	0.584	0.0218	0.000
System 3	1.18	0.0215	0.000
System 4	0.426	0.0212	0.000
System 5	0.786	0.0215	0.000
Constant	64.7	0.0114	0.000
Observations	8067		
Individuals	2689		

Table 11: Random Effects Regression of Retirement Age

Retirement Age	Coefficient	Standard Error	p-values
System 2	0.584	0.0218	0.000
System 3	1.178	0.0215	0.000
System 4	0.426	0.0212	0.000
System 5	0.786	0.0215	0.000
Age	-0.170	0.0650	0.009
Age^2	0.00152	0.000648	0.019
Gender (1 = male)	0.238	0.0647	0.000
Natural Logarithm of Yearly Income	-0.286	0.120	0.017
Other Sources of Income for Pension (1 = yes)	-0.149	0.0566	0.009
Marital Status	-0.255	0.0855	0.003
Income Partner	-0.0390	0.0194	0.045
Education			
High	-0.126	0.0740	0.089
Low	0.0553	0.148	0.708
Health (1 = very good, 5 = very poor)	-0.135	0.0404	0.001
Expected Retirement in Real Life	0.367	0.0115	0.000
Groups			
Group 2	-0.378	0.0960	0.000
Group 3	-0.123	0.0922	0.183
Group 4	-0.118	0.0928	0.203
Group 5	-0.206	0.0933	0.027
Group 6	-0.203	0.0912	0.026
Constant	49.26	2.146	0.000
Observations	8067		
Individuals	2689		

Table 12: Random Effects Regression with Interaction Terms of Retirement Age

Retirement Age	Coefficient	Standard Error	p-values
System 2	0.586	0.196	0.003
System 3	1.388	0.193	0.000
System 4	0.142	0.192	0.459
System 5	0.307	0.194	0.114
Age	-0.170	0.0650	0.009
Age^2	0.00153	0.000648	0.018
Gender	0.239	0.0647	0.000
Natural Logarithm of Yearly Income	-0.287	0.120	0.017
Other Sources of Income for Pension (yes = 1)	-0.150	0.0567	0.008
Marital Status	-0.258	0.0856	0.003
Income Partner	-0.0387	0.0194	0.046
Education			
High	-0.177	0.0771	0.022
Low	0.207	0.156	0.184
Health (very good = 1, very poor = 5)	-0.184	0.0427	0.000
Expected Retirement Age in Real Life	0.367	0.0115	0.000
Interaction terms age			
Age and System 2	-0.00253	0.00354	0.475
Age and System 3	-0.00723	0.00350	0.039
Age and System 4	0.00228	0.00343	0.506
Age and System 5	0.00375	0.00346	0.279
Interaction terms Education			
High Education and System 2	0.110	0.0510	0.031
High Education and System 3	0.0829	0.0494	0.093
High Education and System 4	0.0468	0.0487	0.336
High Education and System 5	0.0738	0.0502	0.141
Low Education and System 2	0.00433	0.121	0.972
Low Education and System 3	-0.383	0.113	0.001
Low Education and System 4	-0.279	0.110	0.011
Low Education and System 5	-0.215	0.118	0.067
Interaction terms Health			
Health and System 2	0.0284	0.0326	0.384
Health and System 3	0.0697	0.0319	0.029
Health and System 4	0.0724	0.0306	0.018
Health and System 5	0.121	0.0312	0.000
Groups			
Group 2	-0.378	0.0960	0.000
Group 3	-0.121	0.0922	0.189
Group 4	-0.117	0.0929	0.206
Group 5	-0.205	0.0934	0.028
Group 6	-0.202	0.0912	0.027
Constant	49.37	(2.148)	0.000
Observations	8067		
Individuals	2689		

Table 13: Fixed Effects Logit Regression of Early Retirement

Early Retirement	Coefficients	Standard Error	p-values
System 2	2.591	0.246	0.000
System 3	5.682	0.365	0.000
System 4	2.409	0.231	0.000
System 5	5.063	0.313	0.000
Observations	2331		
Individuals	277		

Table 14: Random Effects Logit Regression of Early Retirement

Early Retirement	Coefficient	Standard Error	p-value
System 2	2.533	0.203	0.000
System 3	6.006	0.317	0.000
System 4	2.256	0.190	0.000
System 5	5.070	0.279	0.000
Age	-1.227	0.336	0.000
Age^2	0.0119	0.00335	0.000
Gender (1 = male)	1.181	0.328	0.000
Natural Logarithm of Yearly Income	-1.996	0.612	0.001
Other Sources of Income for Pension (1 = yes)	-1.281	0.290	0.000
Marital Status	-0.749	0.424	0.077
Income Partner	-0.209	0.100	0.037
Education			
High	-1.066	0.364	0.003
Low	0.444	0.701	0.526
Health (1 = very good, 5 = very poor)	-0.519	0.203	0.010
Expected Retirement Age in Real Life	1.649	0.0794	0.000
Groups			
Group 2	-1.544	0.491	0.002
Group 3	-0.542	0.463	0.242
Group 4	-0.358	0.461	0.438
Group 5	-0.793	0.470	0.092
Group 6	-1.047	0.457	0.022
Constant	-50.95	11.02	0.000
lnsig2u			
Constant	3.624	0.0883	
Observations	8067		
Individuals	2689		

Table 15: Random effects logit regression for early retirement with interaction effects

Early Retirement	Coefficient	Standar Error	p-value
System 2	1.880	0.427	0.000
System 3	4.723	0.562	0.000
System 4	2.266	0.441	0.000
System 5	5.371	0.610	0.000
Age	-1.240	0.343	0.000
Age^2	0.0120	0.00342	0.000
Gender (1 = male)	0.742	0.360	0.039
Natural logarithm of yearly income	-2.068	0.629	0.001
Other sources of income for pension (1 = yes)	-1.331	0.297	0.000
Marital Status	-0.734	0.434	0.091
Income Partner	-0.216	0.104	0.038
Education			
High	-1.171	0.400	0.003
Low	1.404	0.751	0.062
Health (1 = very good health, 5 = very poor health)	-0.527	0.207	0.011
Expected Retirement Age in Real Life	1.707	0.0816	0.000
Interaction terms Gender			
Gender and System 2	0.862	0.368	0.019
Gender and System 3	1.444	0.491	0.003
Gender and System 4	0.382	0.353	0.279
Gender and System 5	0.724	0.449	0.107
Interaction terms Education			
High Education and System 2	0.318	0.421	0.451
High Education and System 2	1.060	0.550	0.054
High Education and System 2	-0.116	0.417	0.781
High Education and System 2	-0.665	0.556	0.231
Low Education and System 2	0.434	1.038	0.676
Low Education and System 2	-2.031	1.047	0.052
Low Education and System 2	-2.162	0.837	0.010
Low Education and System 2	-2.964	1.166	0.011
Groups			
Group 2	-1.632	0.503	0.001
Group 3	-0.539	0.473	0.255
Group 4	-0.368	0.472	0.435
Group 5	-0.804	0.481	0.095
Group 6	-1.103	0.468	0.018
Constant	-53.22	11.26	0.000
lnsig2u			
Constant	3.685	0.0888	
Observations	8067		
Individuals	2689		

Table 16: Random Effects Logit Regression of Late Retirement

Late Retirement	Coefficients	Standard Error	p-value
System 2	3.925	0.368	0.000
System 3	5.475	0.413	0.000
System 4	0.204	0.374	0.585
System 5	0.857	0.359	0.017
Gender (1 = male)	0.935	0.344	0.007
Natural Logarithm of Yearly Income	-1.660	0.597	0.005
Marital Status	-1.767	0.374	0.000
Health (1 = very good, 5 = very poor)	-0.585	0.246	0.018
Expected Retirement in Real Life	1.431	0.130	0.000
Groups			
Group 2	-1.393	0.465	0.003
Group 3	-0.0719	0.628	0.909
Group 4	-1.282	0.755	0.089
Group 5	-0.515	0.523	0.324
Group 6	-1.082	0.474	0.022
Constant	-84.71	9.790	0.000
lnsig2u			
Constant	3.443	0.0903	
Observations	8067		
Individuals	2689		

Table 17: Random effects logit regression for Late retirement with interaction terms

Late Retirement	Coefficient	Standard Error	p-value
System 2	5.416	0.945	0.000
System 3	8.260	1.004	0.000
System 4	0.970	0.905	0.284
System 5	2.186	0.922	0.018
Gender (1 = male)	1.033	0.367	0.005
Natural logarithm of yearly income	-2.055	0.754	0.006
Marital Status	-1.812	0.388	0.000
Education			
High	2.680	0.955	0.005
Low	2.436	1.754	0.165
Health (1 = very good, 5 = very poor)	-0.604	0.253	0.017
Expected retirement age in real life	1.462	0.141	0.000
Interaction terms education			
High education and system 2	-1.648	0.952	0.083
High education and system 3	-3.294	0.964	0.001
High education and system 4	-0.835	0.997	0.402
High education and system 5	-1.511	0.996	0.129
Low education and system 2	-0.943	1.822	0.605
Low education and system 3	-3.228	1.787	0.071
Low education and system 4	-2.390	2.626	0.363
Low education and system 5	-3.284	2.844	0.248
Groups			
Group 2	-1.438	0.477	0.003
Group 3	-0.0498	0.649	0.939
Group 4	-1.266	0.803	0.115
Group 5	-0.587	0.538	0.275
Group 6	-1.102	0.486	0.023
Constant	-84.91	11.29	0.000
lnsig2u			
Constant	3.504	0.0999	
Observations	8067		
Individuals	2689		

References

Bruinshoofd, A., & Grob, S. (2006). *Do changes in pension incentives affect retirement? a stated preferences approach to dutch retirement consideration* (Tech. Rep.). Amsterdam: Netherlands Central Bank, Research Department.

Commission, E. (2011). Demography report 2010. older, more numerous and diverse europeans. *Commission Staff Working Document*.

Commission, E. (2012). White paper. an agenda for adequate, safe and sustainable pensions. *Commission Staff Working Document*.

De Grip, A., Fouarge, D., & Montizaan, R. (2013). How sensitive are individual retirement expectations to raising the retirement age? *De Economist*, *161*(3), 225–251.

Euwals, R., van Vuuren, D., & Wolthoff, R. (2010). Early retirement behaviour in the netherlands: Evidence from a policy reform. *De Economist*, *158*(3), 209-236. Retrieved from `http://dx.doi.org/10.1007/s10645-010-9139-0` doi: 10.1007/s10645-010-9139-0

Fouarge, D., de Grip, A., & Montizaan, R. (2012). Hoe gevoelig is de uittredeleeftijd voor veranderingen in het pensioenstelsel. *Netspar design paper*, *7*.

Fouarge, D. J., Grip, A., & Montizaan, R. (2012). *Pensioenverwachtingen en personeelsbeleid: verslag van de roa enquête 2011.* Researchcentrum voor Onderwijs en Arbeidsmarkt, School of Business and Economics, Maastricht University.

Gruber, J., & Wise, D. (1998). Social security and retirement: An international comparison. *American Economic Review*, 158–163.

Gruber, J., & Wise, D. A. (2002, December). *Social security programs and retirement around the world: Micro estimation* (Working Paper No. 9407). National Bureau of Economic Research. Retrieved from `http://www.nber.org/papers/w9407` doi: 10.3386/w9407

Hall, J., Kenny, P., King, M., Louviere, J., Viney, R., & Yeoh, A. (2002). Using stated preference discrete choice modelling to evaluate the introduction of varicella vaccination. *Health Economics*, *11*(5), 457–465.

Kerkhofs, M., Fouarge, D., & Ester, P. (2007). Financiële prikkels en voorkeuren bij uittreding: resultaten uit een experimenteel onderzoek. *OSA-Publikaties*, *223*.

Louviere, J. J., Hensher, D. A., & Swait, J. D. (2000). *Stated choice methods: analysis and applications.* Cambridge University Press.

Manoli, D., Mullen, K., Wagner, M., & Alberto, C. C. (2009). Pension benefits & retirement decisions: Income vs. price elasticities. *September*, *28*, 2009.

Mastrobuoni, G. (2009). Labor supply effects of the recent social security benefit cuts: Empirical estimates using cohort discontinuities. *Journal of Public Economics*, *93*(11), 1224–1233.

Nelissen, J. (2001). Het effect van wijzigingen in vervroegde uittredingsregelingen op de arbeidsparticipatie van oudere werknemers. *Ministry of Social Affairs and Employment*.

OECD. (2013). *Pensions at a glance 2013.* OECD Publishing. Retrieved from `/content/book/pension_glance-2013-en` doi: http://dx.doi.org/10.1787/pension_glance-2013-en

Perloff, J. M. (2004). *Microeconomics.* Pearson Addison Wesley, Boston.

Staubli, S., & Zweimüller, J. (2012). *Does raising the retirement age increase employment of older workers?* (Tech. Rep.). Zurich: Working Paper Series, Department of Economics, University of Zurich.

Van Soest, A., Kapteyn, A., & Zissimopoulos, J. M. (2007). Using stated preferences data to analyze preferences for full and partial retirement. *IZA Discussion Papers*, *2785*.

Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data.* MIT press.