The Increase of the Statutory Retirement Age and its Impact on the Effective Retirement Age in the Netherlands

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1. Introduction

Pensions systems in the West have been under discussion for quite some time. Life expectancies are increasing and governments are struggling how to deal with financing their pension systems. The life expectancy of inhabitants of OECD countries who reach the age of 65 in the present day is approximately five years higher than those who reached this age in the 1970s (OECD, 2018, p. 8) Higher life expectancies indicate that retired individuals receive pension benefits for a longer time than individuals did several decades earlier (Rijksoverheid, n.d.-a). The pension system in the Netherlands therefore also is under a lot of discussion. Currently, the challenges mostly concern the first and second pillar. The reform of the first pillar, the Algemene Ouderdoms Wet (AOW), is of main interest in this paper. The AOW encompasses the benefits that all Dutch citizens receive once they reach the Statutory Retirement Age (SRA). Since its financing occurs through a pay-as-you-go system, increasing life expectancies result in the outcome that the labour market finances the pension of a relatively larger group of retirees (Koolmees, 2019; Rijksoverheid, n.d.-a).

Different measures to face these challenges have been proposed. One of these measures is the increase of the SRA, which implies a change of the first pillar of the pension system. By increasing the SRA, the expected outcome by the Dutch government is that individuals become more inclined to work for a longer period and that the costs for the current labour force to pay for retirees would decline. Employees could effectively retire before reaching the SRA by making use of insurances that are part of the second pillar of the Dutch pension system, while self-employed individuals who have been self-employed their whole lives cannot do this, since they have not participated in the second pillar (Nagore García et al., 2018, p. 9). In 2012, the law for the increase of the SRA was passed. Since 2013, the SRA has

been increasing gradually for different birth cohorts. At the time of writing this paper, the maximum SRA will be that of 67 years and three months till 2024 (Rijksoverheid, n.d.-a).

Different actors hold different opinions about the increase of the SRA. Labour unions, such as the FNV and the CNV for example, have come together and have organized several manifestations against the increase of the SRA (NOS, 2018a). Employees from various sectors, such as the police and port workers are against the increase of the SRA (NOS, 2018b). In the government however, that currently consists of the political parties CDA, ChristenUnie, D66 and VVD and could be classified as a center-right coalition, the main idea is that the AOW should be connected to life expectancy, and should therefore rise if it is the case that the life expectancy (is expected to) rise as well. This is why in November 2017 it was decided that the SRA will not increase in 2023 (Rijksoverheid, n.d.-b).

Political parties that are not part of the government are more skeptical about the increase of the SRA. The GroenLinks for example, a left party, states on its website that it is against a 1:1 linkage between the life expectancy and the SRA (GroenLinks, n.d.). Rising life expectancies instead should mean that individuals can “enjoy” their pension benefits for a longer time. Moreover, the party states that employees working in more physically demanding industries should be able to quit working “on time” (GroenLinks, n.d.). The political party 50 Plus, a party directed to individuals aged 50 or above, states that the SRA should go back to the age of 65 (50 Plus, n.d.). Thus, in both society and politics, there is no agreement on what the Dutch pension system should look like. This makes it important and relevant to evaluate the effects of the measures that the Dutch government has already taken.

In this paper, effects of the increase of the SRA on retirement decisions of individuals born between 1948 and 1952, who are part of the baby boom generation, are analyzed. It is

analyzed whether individuals actually effectively retire later due to the increase of the SRA. To analyze this, I will conduct a regression discontinuity analysis. Through making use of a regression discontinuity approach, it should become clear whether individuals with different birth dates, and thus a different SRA, have (significantly) different effective retirement ages. This will also be compared to the effective retirement age of individuals with birth years that have not been affected by the policy change but still are comparable, namely individuals born in 1946 and 1947. The research question of this paper therefore is:

'To what extent has the increase of the Statutory Retirement Age impacted the effective retirement age?'

This paper is organized as follows. In the first section, 'Literature Review and Theoretical Framework', relevant literature and research that tackle the relationship between retirement policies and (effective) retirement and other related outcomes are discussed. Through this analysis, the relevance of using a regression discontinuity approach becomes clear. The hypothesis of this paper is also introduced and discussed in this section. In the following section, 'Institutional Context', the institutional context surrounding the SRA and relevant components and reforms of the Dutch pension system are discussed. The three pillars of the pension system are covered next to the effects of the main policy reform of interest, namely that of 2012, on the SRA of individuals born after 1947. Another relevant reform of 2006 and its impact on the interpretation of the results of the analyses will also be discussed.

Following the 'Institutional Context' section, the data and methodology of this paper are discussed. In this paper use is made of data of the DNB Household Survey. The descriptive statistics of the variables that are included in the analyses of this paper are provided in the

‘Data’ section. Subsequently, the methodology of the paper is discussed followed by the results from the regressions. The results suggest that the effective retirement age of individuals who have been affected by the increase of the SRA in general is higher than that of individuals who have not been affected by the reform and are born in 1946. However, this outcome is not found at all affected birth years, which goes against the hypothesis. Moreover, in all models the average effective retirement age of individuals who have been affected by the reform is not significantly different from that of individuals born in 1947, who like individuals born in 1946 are not affected by the reform of 2012. Therefore, the outcome is that the hypothesis is partly supported in this paper. Through a subgroup analysis based on gender it becomes clear that the found outcomes mostly correspond to the outcomes of males and seem to differ to a greater extent from those of women. Finally, a conclusion follows with a discussion of different limitations in the conducted research and an overview of ideas for future research.

2. Literature Review and Theoretical Framework

The impact of the change of the SRA on the effective retirement age of individuals born between 1948 and 1952 is the main research topic of this paper. What follows in this section is a review of different literature that cover a similar topic and put this paper into perspective, namely literature related to retirement regulations and their impact on different outcome variables.

In 2015, the increase of the Full Retirement Age (FRA) of the first pillar and its impact "on labor force participation, income, and mortality" (Lalive & Staubli, 2015, p. 2) among the female Swiss population was researched. The FRA is the age at which an individual receives the full pension. The FRA increased two times by a year due to the introduction of a reform that started in 1997. In that year, the FRA "increased by on year for women born between 1939 and 1941" (Lalive & Staubli, 2015, p. 9). The FRA was again increased by one year for women born after 1941 (Lalive & Staubli, 2015, p. 9). Thus, overall, the FRA had increased in two phases from the age of 62 to 64. It was possible for the affected women to continue to claim pension benefits at age 62 instead of 64, however they would face a reduction of 3.4% of the full pension "for every year of claiming before the new FRA" (Lalive & Staubli, 2015, p. 2). The reduction was even larger for women born after 1947, namely a reduction of 6.8% for each year that they retired before reaching the FRA. This differs from the Dutch pension system, where it is not possible to defer receiving the first pillar pension benefits or to receive them before reaching the SRA (Lalive & Staubli, 2015, p. 2; OECD, 2017a).

A regression discontinuity analysis was conducted, since the policy change had a clear cutoff (Lalive & Staubli, 2015, pp. 2-3). Because the FRA increased twice by a year, this was a "drastic increase" that would allow the effects of a discontinuity to become clear (Lalive &

Staubli, 2015, p. 5). Data from the Swiss Social Security Data (SSSD) was used from different data sources (Lalive & Staubli, 2015, p. 13). Through the use of this data, it became possible to create the outcome variables 'Exit Age', which is the final age at which an individual has earned positive income and 'Claiming Age', the age at which an individual begins to claim old-age pension or disability pension. Disability pension first is included for the 'Claiming Age' variable, since applying for and receiving disability benefits could be considered a way to receive benefits before reaching the FRA (Lalive & Staubli, 2015, pp. 12-14). Since these old-age and disability pension programs are different, a distinction between the two was also made in the research (Lalive & Staubli, 2015, pp. 23-25).

Through conducting the regression discontinuity analysis, it becomes clear that due to the increase of the FRA by one year for women born just after 1938, the labour force exit date was delayed by approximately 0.5 years in comparison to women born (just) before 1939. Since the background characteristics of the treatment and control groups are similar, this difference is likely to have been caused by the exogenous reform (Lalive & Staubli, 2015, pp. 2-21). The "old age pension claiming age" increased from 62 years to 62.7 years, while the "all pension claiming age" increased from the age of 61.5 to 62.0 due to the increase of the FRA from 62 to 63 years. Thus, the effect of the increase of the FRA was larger on the "old age pension claiming age" than on the "all pension claiming age" (Lalive & Staubli, 2015, p. 24).

This research demonstrates that increasing the FRA has significantly increased the labour force exit age and the claiming age of women (Lalive & Staubli, 2015, p. 34). However, there are several elements of the Swiss pension system that are different from that of the Netherlands. One important difference between the increase of the FRA in Switzerland and

the SRA in the Netherlands is that in Switzerland the FRA increased twice by a year over a period of three years, while in the Netherlands the SRA has been increasing more gradually over a longer period. This increase has become less gradual throughout the years (Belastingdienst, n.d.). As mentioned earlier in this section, the increase of the FRA by a year was considered a good trait to conduct the regression discontinuity analysis (Lalive & Staubli, 2015, p. 5). However, the fact that the SRA increased more gradually in the Netherlands, does not mean that there is no use in applying an analysis on its impact.

For example, in 2013, the impact of the gradual increase of the Early Retirement Age (ERA) in Austria on benefit claiming and employment rates was researched. The outcome of the difference-in-difference analysis was that even the gradual increase had an impact (Staubli & Zweimüller, 2013, p. 25). The increase of the ERA had led to a significant delay on claims of retirement benefits and to an increase in claims of unemployment benefits (Staubli & Zweimüller, 2013, pp. 17-24). Healthy individuals tended to increase employment due to the increase of the ERA, while individuals who had poor health were more likely to effectively retire through the existing Disability Insurance (DI) program or through making use of unemployment benefits (Staubli & Zweimüller, 2013, p. 31).

Furthermore, the CBS, the Statistics Netherlands, stated in May 2018 that between 2016 and 2017, the effective retirement age of individuals who had retired in those years had increased by five months. For why this has happened, the CBS states that it is likely due to law and regulatory amendments (CBS, 2018a). The gradual increase of the SRA is also mentioned as a reason for why the effective retirement age has increased. This also supports the argument that a gradual increase of the SRA is a relevant explanatory factor to take into account when analyzing factors that impact the effective retirement age, and makes it relevant to research

whether the results of the CBS are reflected in the analyses of this paper by making use of data from the DNB Household Survey (CBS, 2018a).

The SRA has also been used in regression discontinuity analyses where the regression discontinuity design was applied to the characteristics of the Dutch pension system. This approach was used to find out what the impact of reaching the SRA is on the likelihood of effective retirement among self-employed individuals. While 'regular' employees are more likely to mandatorily retire when reaching the SRA, self-employed individuals are not constrained by this in the decision to continue to work or not (Nagore García, Rossi & Van Soest, 2018, p. 1). Therefore, it was relevant to research "the effect of reaching the SRA (and receiving AOW) on the transition probability into retirement" (Nagore García et al., 2018, p. 5), while controlling for age. It eventually became clear that significantly higher probabilities existed that self-employed individuals would retire upon reaching the SRA (Nagore García et al., 2018, pp. 18-19).

The life cycle model was tested in this research. According to the (standard) life cycle model, rational self-employed individuals, who seek to maximize their utility during their lifetime, should not discontinuously change their labour supply when the SRA is reached since individuals know in advance what kind of changes to income occur when reaching the SRA. The intensity of work by a self-employed individual could change due to other age-related factors (Nagore García et al., 2018, pp. 2-6). This is to a certain extent related to the argument that Staubli and Zweimüller (2013) made regarding consumption smoothing, when an increase of the early retirement age is known by younger birth cohorts (p. 18). When a distinction is made in terms of wealth, it is argued that wealthier self-employed individuals

respond less to reaching the SRA than less wealthy self-employed individuals "who are liquidity constrained" (Nagore García et al., 2018, p. 3).

With the life-cycle model in mind, a (large) increase of retirement at the age of 65 could then be interpreted as a phenomenon that also is (partly) affected by social norms. The self-employed, who as discussed above generally do not face mandatory retirement when reaching the SRA, could still become more likely to retire because of the fact that other 'regular' employees tend to retire around the age of 65, or because they were already facing liquidity constraints (Nagore García et al., 2018, pp. 1-3). However, liquidity constraints as explanation turned out to be unsatisfactory, due to the pattern that was found in the probability of retiring upon reaching the SRA across the different income quintiles. Self-employed individuals in the second and fourth income quintile namely responded the strongest to reaching the SRA, while according to the mentioned logic it was expected that individuals from the first, and thus lowest income quintile would respond the strongest (Nagore García et al., 2018, pp. 20-21).

In another research, the regression discontinuity approach was used to assess the effects of a retirement policy reform in the Netherlands on mental health (De Grip, Lindeboom & Montizaan, 2011). In 2006, a policy reform that affected the second pillar of both public and private sector workers to stimulate "the labour force participation of older workers" (De Grip et al., 2011, p. 4) was introduced. The focus in the research was only on male individuals who worked in the public sector. This new reform made it impossible for public sector employees born after 1949 to "retire at age 62 years and three months with a replacement rate of 70% of their average yearly earnings since 2004" (De Grip et al., 2011, p. 1). Instead they would have to work one year and one month extra to receive the same replacement rate (De Grip et al., 2011, p. 1). Moreover, the age at which it was made possible to effectively retire earlier was

increased from 55 to 60. This policy reform “came as a surprise to public sector employees when it was announced on 5 July 2005” (De Grip et al., 2011, p. 4).

To find the impact of the policy on depression rates of individuals by comparing the control group (male public sector workers born just before 1950) and the treatment group (male public sector workers born just after 1949), a regression discontinuity analysis was conducted. Through this analysis it became clear that individuals born just after 1949 were significantly more likely to be depressed than individuals with a birth date just below the cutoff. This effect remained when the age bandwidth of the respondents was made more limited, which supports the effect only more (De Grip et al., 2011, pp. 12-21). Because of this research, the argument that (increases of) policies related to retirement, of which an increase of the SRA is one, could have drastic impacts on different aspects of the lives of employees who almost have an age that is close to retirement is supported (De Grip et al., 2011, p. 21). Thus, this article also supports the relevance of finding out whether the increase of the SRA actually has an impact on the age at which an individual effectively retires. Due to the relevance of the reform of 2006 in assessing the impact of the reform of 2012, it will be discussed further in the following section, ‘Institutional Context’, and the reform will be taken into account with in the interpretation of the results of the analyses of this paper.

Overall, the discussed literature supports the plausibility of the statement that changes to retirement policies, that could cover the eligibility for pension benefits, have an actual impact on behaviour concerning retirement by employees. Moreover, it supports the use of a regression discontinuity approach to research the proposed effects. The research in this paper contributes to the above literature, since it is an application of similar techniques from the

regression discontinuity design to a relatively recent policy reform in the Netherlands. It is therefore possible to identify the following hypothesis.

Hypothesis:

Individuals with a birth date after a specific SRA-cutoff have a (significantly) higher effective retirement age than individuals with a birth date below the specific SRA-cutoff.

This is expected since an increase of the SRA means that an individual should extend the duration of his work life to limit the negative consequences of retiring before reaching the SRA, namely receiving lower total pension benefits and less favorable taxes (Rijksoverheid, n.d.-c). Because of this, a rational individual born between 1948 and 1952 who has relatively less time to adjust to this new policy reform than future generations, would retire later in this new situation. Therefore, the average effective retirement age should increase. Moreover, research discussed above supports the positive impact of the increase of the SRA on the effective retirement age (Lalive & Staubli, 2015; Staubli & Zweimüller, 2013). Since research on retirement decisions by 'pure' self-employed individuals demonstrates an increased likelihood of retirement upon reaching the SRA, this hypothesis also applies to the self-employed individuals (Nagore García et al., 2018, p. 18).

The impact of the change of the SRA on the effective retirement age on its own is relevant to explore, because of its relatedness to various other important components of society, such as the current labour force. This is why it is only this hypothesis that is explored in this paper. If certain effects come forward, in future research other components and/or relevant outcomes could be researched in addition or in relation to this reform.

3. Institutional Context

3.1 The Three Pillars of the Dutch Pension System

To conduct the proposed research and test the hypothesis of interest, it is important that it is clear how relevant components of the Dutch pension system are organized. The pension system of the Netherlands is organized in three pillars. The first pillar consists of the Algemene Ouderdomswet (AOW). This is the General Old Age Act, and consists of a basic income (Rijksoverheid, n.d.-d). It only is possible to start to receive the AOW after an individual has reached the SRA (OECD, 2017a). The AOW is a pay-as-you go system. This means that the current working population is contributing to the AOW of individuals who are currently receiving it (Rijksoverheid, n.d.-a). The AOW is not based on the income of an individual during his working career and is a flat-rate pension. This does not automatically mean that the AOW is comprised the same for every individual.

The height of the AOW depends on two factors. The first is the number of years an individual has worked or lived in the Netherlands. For every year that an individual has worked or lived in the Netherlands, two percent are built up to the height of the AOW pension. The second factor that impacts the height of the AOW pension concerns the household situation of an individual. An individual who receives the AOW and lives alone, receives 70 percent of the net minimum wage, while an individual living with their spouse receives 50 percent of the net minimum wage of the Netherlands. This means that a retired couple together receives 100 percent of the net minimum wage (Sociale Verzekeringsbank, n.d.-a).

The second pillar consists of the pensions that an individual has built up through the years in which he was employed, which is called the occupational pension. Almost all providers of work (90 percent) in the Netherlands have a supplementary pension scheme for their

employees (Rijksoverheid, n.d.-d). The income from this pillar supplements the income from the first pillar, the AOW, and helps individuals to continue the lifestyle that they had before retirement. In general, this pillar is not applicable to individuals who have been self-employed through their whole work life (Nagore García et al., 2018, pp. 4-9). It is mainly the second pillar that makes it possible for employees to retire before reaching the SRA, since this is not possible through the first pillar (De Grip et al., 2013, p. 230; Sociale Verzekeringsbank, n.d.-b).

The third pillar of the Dutch pension system consists of private pensions. Individuals could invest money in a specific insurance. It is not mandatory for an individual to have a private pension. An example of an insurance that falls under the third pillar is a life insurance. For an individual who plans to retire before reaching the SRA it is also possible to be insured under this pillar to bridge the time between the moment he leaves the labour market and the moment he reaches the SRA (Rijksoverheid, n.d.-d). Self-employed individuals could also make use of this pillar, to receive another pension in addition to the AOW when they have decided to retire, since self-employed individuals who have been self-employed their whole lives generally have not contributed, and therefore will not receive benefits through the second pillar (Nagore García et al., 2018, pp. 4-12). Compared to other countries, the third pillar of the Netherlands is "less well developed" due to the "well-established first two pillars of the Dutch pension system" (De Grip et al., 2013, p. 229).

For the individuals from the birth cohorts of interest in this paper, namely individuals born between 1946 and 1952, it is possible to effectively retire before, when or after reaching the SRA, since a definition of self-assessed retirement is used (Beehr & Bowling, 2012, pp. 49-50). The Dutch government does not provide ways to effectively retire through the first pillar

before reaching the SRA, which differs from other countries, such as Austria (OECD, 2017a, p. 2; OECD, 2017b, p. 2). Individuals could effectively retire through the second and/or third pillar before reaching the SRA, and therefore have an effective retirement age that is below their SRA. The percentage of individuals who do this has been decreasing through the recent years, which is related to the reform of 2006 (CBS, 2012a; Rijksoverheid, n.d.-d).

Moreover, individuals born between 1946 and 1952 still could work while they have effectively retired before reaching the SRA if they retired after the age of 59. If an individual chooses to continue to work after reaching the SRA, he cannot prevent receiving the AOW pension benefits. However, they could, if relevant, make changes to the level of benefits from the second pillar and could even delay receiving it up to five years after reaching the SRA (Rijksoverheid, n.d.-d; Pensioenfonds Zorg & Welzijn, n.d.; Nibud, n.d.). Since relevant information could be missed when assessing retirement as the moment an individual leaves the labour force, the subjective definition of retirement therefore is useful.

3.2 The Reform of the First Pension Pillar in 2012

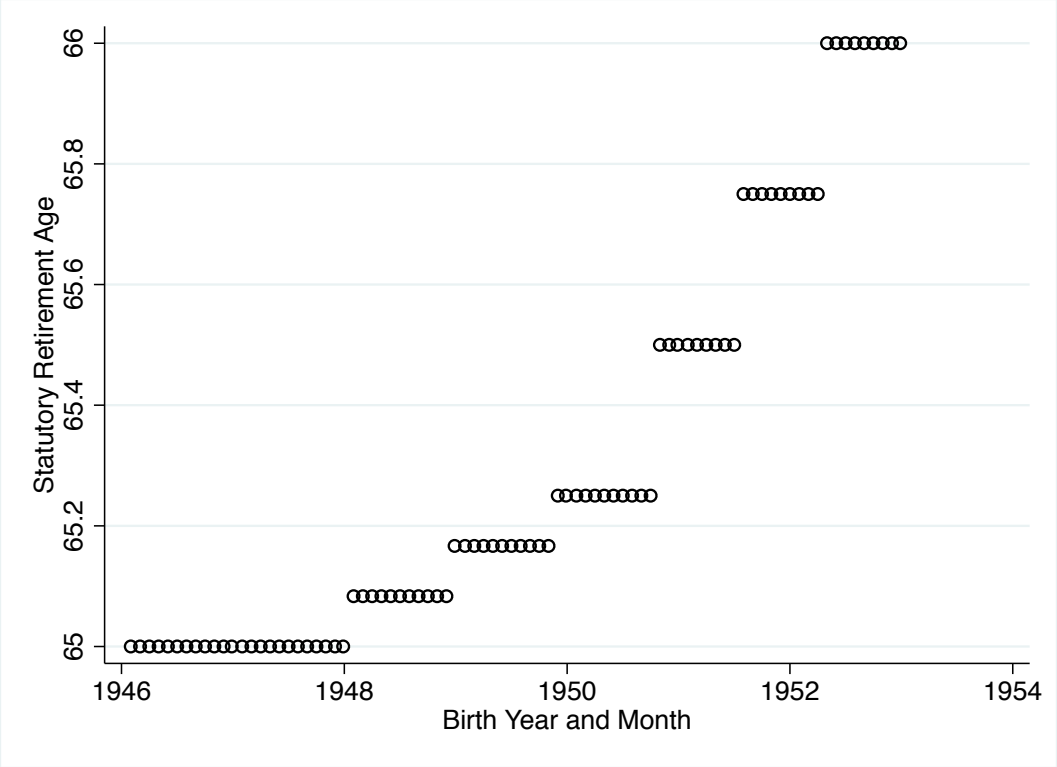
In 2012, the law for the increase of the SRA passed through the two chambers of the Dutch Parliament (Overheid, n.d.). This is in line with the increase of the old-age pension age that has taken place through pension reforms in multiple other European countries such as France and Germany (Finnish Centre for Pensions, 2019). The Dutch government mainly has two reasons for the increase of the SRA. The first is to encourage people to work longer. The second reason, which is related to the first, is to make it feasible to continue to finance the AOW. Since the life expectancy is increasing, it becomes more expensive to pay for the AOW by the people who currently are part of the labour force, since there is a pay-as-you-go system, as is described in the previous sections (CBS, 2018b; Rijksoverheid, n.d.-a). The SRA

increased by a month every eleven months from 2013 till 2016. From 2016 till 2019, the SRA has increased by three months every nine months. From 2019 till 2022, the SRA will increase by four months every eight months. In Table 1, it is possible to find the SRA for individuals born till 1953 (Belastingdienst, n.d.). In 2022, the SRA will be at the age of 67 years and three months and will remain so till at least 2024. The reason for this is that life expectancy has not increased to an extent that was expected (Rijksoverheid, n.d.-a). To provide an example of the impact of the reform on the SRA: an individual who was born after the 31st of December 1947 and before the 1st of December 1948, has the SRA of 65 years and a month, while someone born one day later, on the 1st of December 1948, has a SRA of 65 years and two months (Belastingdienst, n.d.). In Figure 1, the increase of the SRA is visualized. It reflects the pattern that through the birth years the SRA has increased more rapidly and to a greater extent.

Table 1. The Statutory Retirement Age per birth cohort

Birth cohort	Year	SRA
Until December 31, 1947	2012	65
1st of Jan. 1948 – 30st of Nov. 1948	2013	65 years and one month
1st of Dec. 1948 – 31st of Oct. 1949	2014	65 years and two months
1st of Nov. 1949 – 30th of Sep. 1950	2015	65 years and three months
1st of Oct. 1950 – 30th of Jun. 1951	2016	65 years and six months
1st of July 1951– 31th of March 1952	2017	65 years and nine months
1st of Apr. 1952 – 31th of Dec 1952	2018	66 years

Figure 1. Visualization of the Statutory Retirement Age in decimal for individuals born in 1946-1952



3.3 Other Relevant Institutional Factors

Two other institutional factors are important to highlight, before going further into discussing the data and methodology of this paper. The first is the reform of 2006, that has already been mentioned under the 'Literature Review and Theoretical Framework' section. The reform made it less attractive for employees born after 1949 to retire earlier through the second pillar, compared to individuals born before 1950 (De Grip et al., 2011). This has effects on the interpretation of the results from the regression discontinuity analyses that are conducted in this paper. When assessing the impact of the change in the SRA on the effective retirement age, individuals born between 1946 and 1949 namely are less comparable to individuals born between 1950 and 1952 due to this reform. Therefore, the impact of the increase of the SRA could be better compared within the two groups than between the two groups. Moreover, this reform was the reason for researchers on the impact of increased retirement ages on

retirement expectations to only create control and treatment groups among individuals born after 1949, since they are more comparable (De Grip, Fouarge & Montizaan, 2013, pp. 232-233). The relevant discontinuities between the different birth cohorts should only be that of the SRA, to be able to assess the effects of the discontinuous change of the SRA in the research of this paper.

Thus, the reform of 2006 should be taken into account with when interpreting the results of the regressions, since the reform of 2006 could influence the outcome variable of interest of this paper, in addition to the reform of 2012 for individuals born after 1949. Especially comparisons of coefficients of individuals born after 1949 and individuals born before 1950 should therefore not ignore this policy.

Related to this reform, another institutional trait that is worth mentioning is that self-employed individuals generally are less affected by changes to the second pillar, compared to 'regular' employees. A self-employed individual who has never worked as an employee at a firm, generally does not build up benefits in the second pillar (Nagore García et al., 2018, pp. 9-12). The first and third pillar are of more relevance to them. This means that they are also not or relatively less affected by the policy reform of 2006 compared to 'regular' employees. All individuals, regardless of employment history, however, are affected by the policy change that is of main interest in this paper, since the change only involves the first pillar. However, since the policy reform of 2006 could impact the same outcome variable, the effective retirement age, the type of employment of respondents will be controlled for (De Grip et al., 2011, p. 4).

4. Data

4.1 De Nederlandsche Bank Household Survey

To be able to conduct the analysis that is introduced in the previous sections, it is important to make use of a data source that contains useful information on retirement and background characteristics that are related to both the personal life and employment history of individuals. Therefore, the data source that is used to examine to what extent the increase of the SRA has influenced the effective retirement age is the DNB Household Survey (DHS) from the non-profit research institute CentERdata, located at Tilburg University (CentERdata, n.d.-a). Since 1993, this survey has been filled in yearly by an unbalanced panel, that is part of the representative CentERpanel, consisting of approximately 2000 households (CentERdata, n.d.-b). The micro-level surveys contain information that makes it possible to conduct studies on "both psychological and economic aspects of financial behavior" (CentERdata, n.d.-c). The survey covers different topics. For this paper, parts of the questionnaires on the household, health and income of the individuals are used. These topics are useful since they contain the variables that make it possible to assess the impact of the increase of the SRA on the effective retirement age while controlling for relevant factors.

For the analyses in this paper, the waves from the surveys from 2013 to 2018 are used. Since the panel is unbalanced, relevant information on retirement of individuals who filled in the surveys in the previous years could be missed when only the most recent wave, that of 2018, is used. When the observations of these waves are combined, and only the most recent filled-in surveys by the households are selected, there is a total of 9675 observations in the first 'general' survey on basic household information, while approximately 3500 individuals have filled in the other surveys. Individuals who participate in the DHS are representative of the Dutch society (CentERdata, n.d.-b).

4.2 Operationalization of the Outcome Variable

In this paper, the effective retirement age is defined as the age at which an individual has indicated that he has retired. Thus, effective retirement is operationalized as self-assessed retirement. One variable from the DHS survey reflects this definition, since individuals who have indicated a value faced the question: "At what age did you retire or did you make use of an early retirement arrangement?" (CentERdata, 2018, p. 36). The age that respondents indicate on effective retirement could be lower, equal to, or higher than their SRA. 328 respondents born between 1946 and 1952 in the waves from 2013 to 2018 have stated their effective retirement age, while 77 respondents born in these years have indicated that they do not know their effective retirement age or that the question is not applicable to them. One most likely incorrect outlier is removed, which brings the total number of useful observations to 327. The value of a related variable that reflects the month of effective retirement and has been included in the survey since the 2015 wave is converted into decimals and subsequently combined with the age of effective retirement in years variable into a newly created variable, through which the age of effective retirement becomes clear that now is as specific to the month.

A limitation of this definition of retirement is that it is unclear what exactly individuals consider as being retired (Beehr & Bowling, 2012, p. 50). An alternative definition for the effective retirement age could have been operationalized by combining the variables that indicate the year and month in which an individual has stopped working, into a new variable. This is a popular operationalization that has been used in various research (Beehr & Bowling, 2012, pp. 45-46). However, in this paper, as discussed in the previous section, retired individuals who are still working are also of interest when assessing their effective retirement age.

4.3 Operationalization of the Explanatory Variables

The key explanatory variables in this paper are the birth years of the respondents. These are dummies that are derived from the variable that indicates the birth year of the respondent in the DHS survey. Thus, for all birth years from 1946 to 1952, dummies are created. Ideally, the dummy variables would have been more specific, to reflect the actual birth cohorts that face a different SRA as stated in Table 1, but these dummies resemble the actual cutoffs the most given the available information in the DHS dataset. By including the birth years as dummy variables, it becomes possible to see whether there is a (significant) difference in the effective retirement ages of the individuals born in the different years, which could suggest an impact of the increase of the SRA that could be explored more precisely in future research.

4.4 Operationalization of the Control Variables

To deal with birth cohort effects, different control variables that are related to both the personal and work life of the respondents are added to the analyses. These variables could be correlated with both the birth years and the effective retirement age. If they are strongly correlated, the coefficients of the explanatory variables will change to a great extent after including them (Angrist & Pischke, 2014, pp. 126-129). The health status is one of the included control variables. It is possible to argue that the individuals who were born just after the end of the World War II have been facing different health conditions compared to individuals born at the beginning of the 1950s (CBS, 2012b). In addition, health could be related to the effective retirement age since it is possible to argue that the effective retirement age is more likely to be lower for individuals with bad health conditions. Moreover, one type of employment, such as being a permanent employee, could be more common to individuals born in the birth years of interest compared to individuals born before or after them. Likewise, it is possible to argue that an individual who mostly has worked as a permanent employee throughout his work career is more likely to effectively retire earlier than an individual who

mostly has worked temporarily. The permanent employee namely has been more able to continuously contribute to the second pillar compared to a temporarily employed individual (Rijksoverheid, n.d.-d).

A few of the control variables that are used in this paper are applied directly to the analyses and therefore their interpretation is straightforward. However, for most of the included control variables it was necessary to make some changes. To keep as many useful observations as possible, and to approximate the number of observations to the 327 observations that originally exist regarding the effective retirement age of individuals born between 1946 and 1952, certain changes were necessary. For example, the variable that indicates the employment sector of the respondent has been supplemented with an extra category, to prevent the loss of relevant observations (CentERdata, 2018, p. 25).

The total net household income variable is transformed from a continuous variable into a categorical variable with six categories. The variable that indicates the number of years a respondent has worked at least 32 hours a week is also transformed into a categorical variable, but with three categories. The variable on how many hours the respondent actually worked in a week, which is indicated in different variables for ‘regular’ employees and non-regular employees such as the self-employed, is a newly created categorical variable with three levels as well (CentERdata, 2018).

In addition to transforming continuous variables into categorical variables, new variables have also been created, for example a dummy variable that indicates whether the partner of a household head or spouse is retired or not. Instead of the variable on the effective retirement age, the variable that indicates the primary occupation of the respondent is used. The

assessment of retirement through this variable also is subjective. The variable on the effective retirement age is not used because it is not fully certain that a respondent is not retired if he has not indicated a value at this variable. This is different from the variable on the primary occupation of the respondent, since almost all partners of the 327 respondents born between 1946 and 1952 have indicated their primary occupation, thus also their possible pension status through this variable. Therefore, this variable indicates with more certainty whether the partner of a respondent is retired or not (CentERdata, 2018, p. 15).

It is important to point out that while, for example, the employment sector variable is changed in order to prevent losing relevant observations, it was not possible to prevent the loss of observations after including more control variables, since certain respondents 'simply' have not filled in answers at certain questions, or even whole questionnaires. The number of observations at each regression therefore is also stated in the tables. In the appendix, the operationalization of the control variables that have been changed and not discussed in this section is provided.

Finally, because of the inclusion of the year of the wave variable as a control variable, which is important for panel regressions, it is not possible to also include the age of the respondents as a control variable. This is the case since the explanatory variables are the birth years, which together with the year of the wave variable indirectly indicate the age of the respondents. Therefore, "age is a perfect linear combination of birth year and survey period" (Dohmen, Falk, Golsteyn, Huffman & Sunde, 2017, p. 95) which prevents its inclusion.

4.5 Descriptive Statistics

In Table 2, the descriptive statistics of the variables that are included in the analyses of this paper are provided. It is possible to conclude the following. At all birth years, the average

effective retirement age is lower than the SRA that is faced by the individuals born in those years (Belastingdienst, n.d.). Moreover, it is possible to see that the average effective retirement age has been increasing among individuals born in 1946 to 1950, except for 1948. This is surprising since individuals born in 1948 are part of the first cohort that is affected by the policy reform of 2012. The stability of the standard deviation among individuals born between 1946 and 1950 suggests that the differences in the effective retirement ages have not been caused by extreme outliers. The standard deviation is higher for individuals born in 1951 and 1952, which is not extremely surprising. These individuals namely have most recently reached the SRA. It is more likely that among these individuals, relatively more individuals have not effectively retired yet and are not included in this variable. This could also explain why the average effective retirement age is lower for individuals born in 1952 compared to that of individuals born in all other analyzed birth years and why the average effective retirement age of individuals born in 1951 is lower than that of individuals born in 1950. The relative limited number of observations of individuals with the birth years 1951 and 1952, namely respectively 40 and 18, also supports this possible explanation.

Table 2 also shows that the majority of observations of the analyses in this paper are from the most recent wave. This is the case because, as mentioned earlier in this section, only the most recent information on the household, health and income situation of the respondents is used instead of information from all of the earlier years a respondent participated in the surveys. The effective retirement age should be permanent and unlikely to change for an individual, which makes the most recent provided information about it the most relevant. If households have participated in the surveys in multiple waves, which the majority of households have done, their information provided in earlier waves therefore is excluded. This reduces the total number of observations in the regressions of this paper.

When taking into account the background variables, it is possible to argue that the individuals on average are similar. It is the most important that the individuals around the cutoffs, thus a birth year later or before have similar characteristics. The male/female ratio seems to be quite similar across the birth years, except for 1946. Moreover, the highest completed education level has remained relatively stable throughout the birth years. The average values for individuals born in 1950 only seem to differ to a greater extent. High school is the most attended and completed education level by individuals born between 1946 and 1952. Most respondents have indicated that they think that their health is good and do share a household with their partner, whether married or registered. When assessing the work-related variables, it is possible to see that on average individuals have worked full-time between 21 and 40 years, and that the largest share of individuals was permanently employed. The finding that the individuals in the different birth cohorts are similar, supports the internal validity of the research in this paper (De Grip et al., 2011, p. 3).

Table 2. Descriptive statistics of the included variables

Birth year	1946	1947	1948	1949	1950	1951	1952	*Obs.*
A. Outcome variable								
Effective retirement age	61.53 (3.01)	62.47 (2.66)	61.95 (2.74)	62.86 (2.96)	63.72 (2.52)	63.64 (4.19)	61.44 (4.03)	***327***
B. Control variables								
Year of the wave								
2013	0.03	0.04	0.02	0.02	0.02	0.05	-	*9*
2014	0.06	-	0.09	0.02	-	-	-	9
2015	0.03	0.04	0.04	0.02	0.02	0.03	0.06	*10*
2016	0.06	0.10	0.02	0.03	0.06	-	-	*15*
2017	0.06	0.06	0.02	0.07	0.08	0.03	-	*17*
2018	0.76	0.75	0.80	0.85	0.82	0.90	0.94	*267*
								327
Personal background variables								
Gender								
Male	0.79	0.65	0.61	0.62	0.65	0.70	0.67	*220*

(reference category)								
Female	0.21	0.35	0.39	0.38	0.35	0.30	0.33	*107*
								327
Health status								
Excellent health	0.12	0.09	0.17	0.08	0.09	0.11	0.06	*31*
Good health	0.67	0.57	0.67	0.66	0.58	0.58	0.76	*189*
Fair health	0.17	0.30	0.17	0.21	0.18	0.24	0.12	*60*
Not so good health	0.05	0.02	-	0.06	0.16	0.08	0.06	*18*
Poor health	-	0.02	-	-	-	-	-	*1*
								299
Highest completed level of education								
Special education	-	-	-	-	-	-	-	-
Primary school	0.03	-	0.04	0.03	0.02	0.03	-	*8*
High school	0.42	0.46	0.35	0.45	0.59	0.40	0.33	*144*
MBO	0.11	0.21	0.15	0.22	0.04	0.20	0.28	*52*
Tertiary education	0.44	0.33	0.46	0.28	0.33	0.38	0.39	*121*
No education (yet)	-	-	-	-	-	-	-	-
Other	-	-	-	0.02	0.02	-	-	*2*
								327
Marital status								
Married or registered partnership and living together	0.71	0.75	0.61	0.58	0.64	0.68	0.72	*217*
Married or registered partnership and not living together	0.08	0.06	0.11	0.07	0.04	0.05	0.06	*22*
Divorced	0.09	0.08	0.11	0.13	0.10	0.10	0.06	*33*
Living together with partner	0.02	0.02	0.07	0.03	0.06	-	0.11	*12*
Widowed	0.09	0.08	0.04	0.07	0.08	0.03	0.06	*22*
Never married	0.02	-	0.07	0.12	0.08	0.15	-	*21*
								327
Number of children								
Mean	1.72 (1.50)	1.94 (1.19)	1.54 (1.20)	1.22 (1.14)	1.67 (1.41)	1.68 (1.54)	1.22 (1.17)	***327***
Grandchildren dummy								
Has grandchildren	0.79	0.77	0.72	0.57	0.65	0.65	0.53	*223*
(reference category)								
Has no grandchildren	0.21	0.23	0.28	0.43	0.35	0.35	0.47	*103*
								326
Work-related background variables								
Number of years working full-time								
0 to 20 years	0.24	0.25	0.17	0.30	0.16	0.35	0.17	*79*
21 to 40 years	0.44	0.40	0.46	0.40	0.47	0.40	0.56	*142*
41 years or more	0.32	0.35	0.37	0.30	0.37	0.25	0.28	*106*
								327
Actual no. hours worked a week								
0 to 20 hours	0.14	0.16	0.21	0.11	0.27	0.25	0.18	*57*
21 to 40 hours	0.51	0.50	0.54	0.55	0.51	0.53	0.59	*162*

41 hours or more	0.35	0.33	0.26	0.35	0.22	0.23	0.24	*90*
								309
Type of employment								
Permanently employed	0.83	0.81	0.74	0.87	0.86	0.85	0.89	*272*
Temporary employed	0.03	-	-	0.02	0.02	0.05	-	*6*
Stand-by	0.02	0.02	0.02	0.02	0.06	0.03	0.06	*9*
Temporary agency worker	-	0.02	0.02	0.02	-	-	-	*3*
Self-employed	0.12	0.15	0.22	0.08	0.06	0.08	0.06	*37*
								327
Employment sector								
Employed by the government	0.33	0.23	0.09	0.23	0.09	0.12	0.20	*65*
Employed by the private sector	0.26	0.38	0.28	0.38	0.28	0.37	0.33	*107*
Employed by another institution	0.27	0.21	0.37	0.21	0.37	0.40	0.35	*106*
Not-applicable	0.14	0.19	0.26	0.19	0.26	0.12	0.12	*49*
								327
Total net household income								
0 to 25k	0.21	0.36	0.32	0.27	0.12	0.18	0.29	*71*
26k to 50k	0.42	0.29	0.24	0.27	0.49	0.37	0.35	*101*
51k to 75k	0.09	0.05	0.05	0.12	0.02	0.13	0.18	*24*
76k to 100k	-	-	-	-	0.05	-	-	*2*
101k or more	-	-	0.02	-	-	-	-	*1*
Do not know	0.28	0.31	0.37	0.35	0.33	0.32	0.18	*91*
								290
Partner retirement status								
Non-retired partner (reference category)	0.58	0.42	0.60	0.62	0.53	0.65	0.56	*185*
Retired partner	0.42	0.58	0.40	0.38	0.47	0.35	0.44	*142*
								327

Note: Standard deviation in parentheses.

Plotting a graph that demonstrates the relationship between the birth year and the effective retirement age of individuals from the birth cohorts of interest suggests a positive increase of the average effective retirement age through the birth years, which is possible to see in Figure 2. Moreover, it shows that on average respondents have retired before reaching their respective SRA.

Figure 2. Scatter plot with the effective retirement age of respondents born in 1946-1952

When also taking into account the effective retirement age of individuals born since 1940, the pattern of their effective retirement age becomes clear, as is possible to see in Figure 3. The pattern is relatively stable, which is not a surprise, since these individuals have not been affected by the increase of the SRA (Belastingdienst, n.d.). However, these individuals are less comparable to the individuals that are the focus of the analyses in this paper, since individuals born before 1946 are not part of the baby boom generation (CBS, 2012b, p. 6). Overall, the possibility that that an exogenous change, such as a policy reform, took place that affects individuals born after 1947 and has impacted their effective retirement age is supported by the two figures.

Figure 3. Scatter plot with the effective retirement age of respondents born in 1940-1952

A simple regression analysis among different birth cohorts and the effective retirement age, stated in Table 3, also suggests an increasing pattern of the effective retirement age across individuals who are affected by the increase of the SRA. Among the birth cohorts of interest in this paper, there is a positive significant relationship. When dividing the birth years of the 1940s into two cohorts, it is possible to see a positive but insignificant relationship at the 1940-1944 cohort, while there is a positive significant relationship at the 1945-1949 cohort. Overall, the descriptive statistics suggest that the hypothesis of this paper could be supported.

Table 3. Results of the regressions of different birth cohorts with birth year as the explanatory variable, effective retirement age as the outcome variable

Variable	1946-1952	1940-1944	1945-1949
Birth year	0.29***	0.19	0.41***

Note: ** indicates significance at $p < 0.05$, *** indicates significance at $p < 0.01$.

5. Methodology

5.1 Research Approach

To analyze whether the increase of the SRA has led to an increase of the effective retirement age, a regression discontinuity approach is used and applied. When a regression discontinuity approach is used, different elements are of importance. For example, it is important that there is a running variable that makes it clear whether an observation falls under the treatment or control group (Angrist & Pischke, 2014, p. 244). In the case of the SRA and its impact on the effective retirement age, the running variable is the birth date. An individual with a birth date (just) above a specific cutoff does not receive the AOW at a given age with full certainty, while an individual with a birth date (just) below a specific cutoff will receive it with full certainty (Sociale Verzekeringsbank, n.d.-b).

For a running variable it is important that it is not possible or very difficult to manipulate its value. With birth dates, manipulation seems to be difficult, since no way exists through which individuals could influence their own birth dates (De Grip et al., 2013, p. 227). It could be the case, however, that the parents of the individuals have purposefully chosen to start a family after the World War II. Significantly more babies were born after the World War II between 1946 and 1955, which is why it is called the baby boom generation. The population growth in the Netherlands was the highest in Western Europe till 1956 (De Grip et al., 2011, p. 7; Lalive & Staubli, 2015, p. 19; CBS, 2012b). However, parents have not chosen to start a family with the existence of this policy in their minds, since the AOW exists since 1957 (De Grip et al., 2013, p. 229).

The birth dates of the individuals from the surveys are used to assign them to a treatment or "control" group. For this it is important that other than the exogenous reform, the respondents

are similar around the cutoffs in regard to other relevant factors, which is the case as is possible to see in the descriptive statistics in the previous section (Lalive & Staubli, 2015, p. 19). Since all individuals born after 1947 are affected by an increase of the SRA, they all form part of a treatment group at one point. However, the distinction between being treated or not concerns the specific cutoff that is analyzed. Individuals who are not affected by the specific change of the SRA fall under a "control" group. Thus, it depends on the type of comparison that is being made, whether it is possible to perceive one birth cohort as being treated or not. Only individuals born in 1946 or in 1947 could be considered part of an actual control group in the analyses of this paper, since they have not been affected by the policy reform and are comparable to individuals who are affected regarding the personal and work-related background variables. Therefore, the first cutoff of interest is that between individuals born before 1948 and individuals born after 1947 (Belastingdienst, n.d.).

It is possible to compare the effective retirement age of individuals born in different years through conducting a regression with the following formula.

$$y_i = \alpha + \beta_1 D_{i,1947} + \beta_2 D_{i,1948} + \beta_3 D_{i,1949} + \beta_4 D_{i,1950} + \beta_5 D_{i,1951} + \beta_6 D_{i,1952} + \gamma A_i + \varepsilon_i$$

The outcome variable of interest in this paper, y_i, is the effective retirement age, which is stated in years for respondents from the wave of 2013 to the wave of 2014, and in years and months for respondents from the wave of 2015 to the wave of 2018. The α stands for the constant/intercept, while the D_i dummy variables represent the birth dates of the individuals that are included as explanatory variables from 1947 to 1952 and are specific to the year of birth. A_i stands for the control variables that are added to the analyses, which are the year of the wave, the gender, the health status, the highest completed level of education, the marital

status, the number of children, a grandchildren dummy, the number of years working full-time, the actual number of hours worked in a week, the type of employment, the employment sector, the total net household income and the retirement status of the partner of the respondent.

Through adding the birth year dummies to the analysis and assigning the dummy variable of 1946 as the reference category, it is possible to compare the effective retirement age of individuals both in comparison to the reference category of 1946 and to the other birth years. The results of the regressions are complemented by a graph that reflects the explanatory coefficients found in the analyses with their corresponding confidence intervals. The confidence intervals namely also suggest whether there is a significant difference in the effective retirement age between the individuals with different birth years (Ranstam, 2012, p. 807).

6. Results

The analyses of this paper are conducted as follows. First, a regression is conducted with only the birth years as explanatory dummy variables, while controlling for the year of the survey. This is the baseline model. Through this baseline model, a pattern could become clear among the specific cutoffs and among individuals with a larger difference in birth year. Subsequently, a regression is conducted where the personal characteristics variables are included. It is analyzed whether, and to what extent the coefficients of the birth years change because of this addition. A coefficient is considered significant in this paper if its p-value is less than 0.05. A third analysis is conducted to which also the work-related characteristics variables are added for the same reason as the personal variables. Finally, the third analysis is conducted again, for women and men separately, to see whether different conclusions result from this. To all the analyses a graph is added, with a visualization of the coefficients of the birth year dummy variables, together with their confidence intervals. It is important to note that in all regressions, the birth year 1946 is the reference category.

The results are discussed as follows. First, an overall comparison is made to the reference category of 1946 and the confidence intervals stated the graphs are discussed. For this it is important to keep in mind that the coefficients found at the birth years from 1950 to 1952 are less comparable to the reference category of 1946 due to the reform of 2006, as discussed in the 'Institutional Context' section. This is followed by a discussion of the coefficients at the birth year cutoffs, which increases the comparability of the analyzed groups, though there also is a more limited difference in the SRA between the birth years in this comparison. Therefore, it is possible to argue that in the comparisons that are made, there is a trade-off between comparability and the intensity of the reform. This section is concluded with final remarks on the results.

6.1 First Model

In the first model, where only the birth years are included as the explanatory variables and where is controlled for year, the following becomes clear. While there is an increasing pattern in the effective retirement age among individuals born in 1948 to 1951, none of the coefficients of individuals born between 1947 and 1952 are significantly different from each other. This is reflected by the coefficients in Table 4 and the confidence intervals in Figure 4. The effective retirement age of individuals born in 1947 is higher compared to that of individuals born in 1946, though this difference is not significant. This is in line with the hypothesis, since individuals born in 1946 and individuals born in 1947 face the same SRA. That the positive coefficient of individuals born in 1948 is insignificant is unexpected, since 1948 is the first cohort that faces an increased SRA (Belastingdienst, n.d.). The effective retirement ages of individuals born in 1949, 1950 and 1951 on average are significantly higher than that of individuals born in 1946. Individuals born in 1949 on average retire 1.15 years later than individuals born in 1946. Individuals born in 1950 and 1951 on average even retire two years later than individuals born in 1946. However, individuals born in 1950 and in 1951 are less comparable to individuals born in 1946 compared to individuals born between 1947 and 1949, since the former group of respondents faces a larger difference in the SRA and is affected by the policy reform of 2006. Thus, while significant differences are found, the comparability between the two groups of respondents is limited.

When making comparisons among the different birth year cutoffs, it is possible to conclude the following. The average effective retirement age of individuals born in 1948 is lower than that of individuals born in 1947, which goes against the hypothesis. However, that the effective retirement age of individuals born in 1948 is lower to a larger extent than that of individuals born in 1949 supports the hypothesis. There also is a strong difference between

the effective retirement age of individuals born in 1949 and individuals born in 1950, though it is difficult to assign this solely to the increase of the SRA due to the reform of 2006, which makes these two birth cohorts less comparable (De Grip et al., 2011). That the effective retirement ages of individuals born in 1950 and individuals born in 1951 are not differing to a great extent from each other also goes against the hypothesis. However, since the 1950-1951 cutoff is less similar to the actual cutoff compared to the analyzed cutoffs among individuals born between 1946 and 1949, this is a less meaningful outcome (Belastingdienst, n.d.).

The coefficient from individuals born in 1952 also goes against the hypothesis, since this coefficient is even negative. However, as mentioned in the 'Data' section, this negative and insignificant coefficient could be explained by the fact that not all individuals born in 1952 had reached their SRA at the time of the survey interviews, and that the individuals who have chosen to prolong their work careers, had not retired yet and therefore not indicated their effective retirement age in the DHS survey. Therefore, it is possible to state that the hypothesis is partly supported after the baseline analysis.

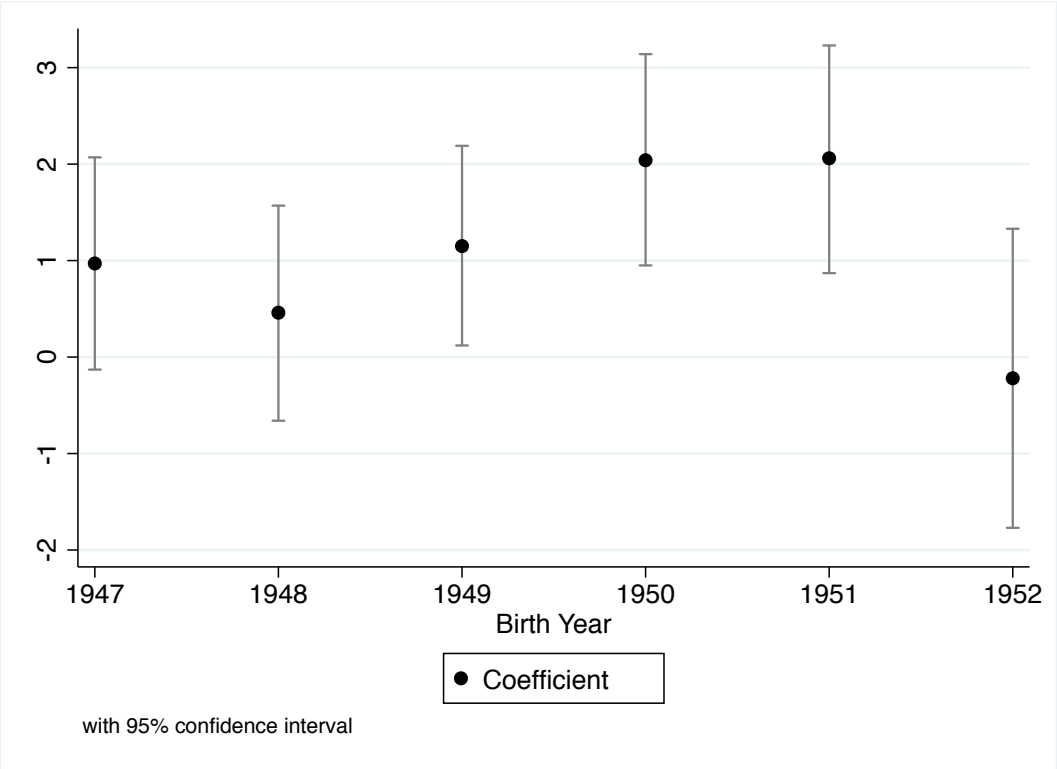
Table 4. Results of the regression discontinuity analysis on the effective retirement age

Variable	Coefficient	Standard Error
Birth year		
1946 (reference category)	-	-
1947	0.97	0.56
1948	0.46	0.57
1949	1.15**	0.53
1950	2.04***	0.56
1951	2.06***	0.60
1952	-0.22	0.79
Year of the wave		
2013 (reference category)	-	-
2014	2.64	1.40

2015		-0.39	1.35
2016		3.76***	1.25
2017		3.46***	1.22
2018		3.99***	1.00
Constant		57.92***	1.03
R-squared	0.17		
Total obs.	327		

Note: ** indicates significance at p < 0.05, *** indicates significance at p < 0.01.

Figure 4. Coefficients from the regression with confidence intervals, 1946 as the reference category



6.2 Second Model

In the second model, personal characteristics are included as control variables. Personal control variables are important to include as control variables, since they could be related to both the birth year and the effective retirement age of a respondent, as explained under the 'Data' section. If these correlations are strong, the coefficients at the explanatory variables should change because of the addition of these variables (Angrist & Pischke, 2014, pp. 126-

129). As stated in Table 5, the coefficients of the explanatory variables have changed compared to the previous model, however not to a great extent. The positive significant coefficients found at the birth years of 1949, 1950 and 1951 have remained positive and significant. The other coefficients have also remained similar. The coefficient at the birth year 1952 remains negative and insignificant, which is in line with the possible explanation for it, namely that not all individuals with that birth year had retired yet and thus indicated their effective retirement age. The confidence intervals of the coefficients of the birth year dummies from 1947 to 1952 in Figure 5 also overlap in this model, which indicates an insignificant difference in the effective retirement age among individuals born in these years.

When making comparisons among the birth year cutoffs, it is possible to argue the same as in the previous analysis, except for the finding that the positive significant coefficient of individuals born in 1951 is below that of individuals born in 1950. The difference between the two coefficients, however, remains small. Therefore, it is still possible to state that the hypothesis is partly supported after including personal characteristics as control variables. The positive significant coefficients at the birth years of 1949 to 1951 namely support the proposition that something exogenous, such as a policy reform has positively impacted the effective retirement age of individuals who face a higher SRA. Moreover, the hypothesis is now even more supported, since this effect has persisted after adding important personal control variables, such as health and the highest completed education level, that could have been correlated with both the birth year and the effective retirement age of the respondents.

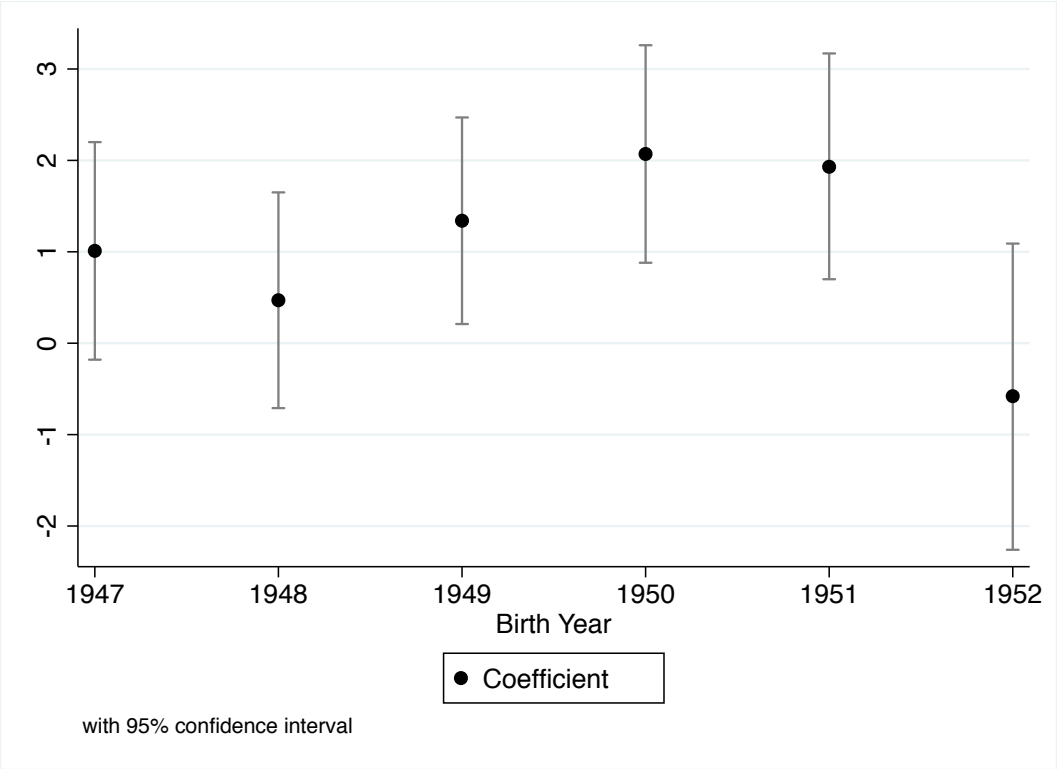
Table 5. Results of the regression discontinuity analysis on the effective retirement age, personal characteristics included

Cutoff	Coefficient	Standard Error
Birth year		
1946 (reference category)	-	-
1947	1.01	0.60
1948	0.47	0.60
1949	1.34**	0.57
1950	2.07***	0.60
1951	1.93***	0.63
1952	-0.58	0.85
Year of the wave		
2013 (reference category)	-	-
2014	2.68	1.48
2015	-0.08	1.49
2016	3.51**	1.42
2017	3.62**	1.45
2018	4.15***	1.06
Personal background variables		
Gender		
Male (reference category)	-	-
Female	-0.06	0.40
Health status		
Excellent health (reference category)	-	-
Good health	-0.48	0.59
Fair health	-0.16	0.68
Not so good health	0.26	0.93
Poor health	-1.59	3.16
Highest completed level of education		
Special education	-	-
Primary school (reference category)	-	-
High school	-0.35	1.16
MBO	0.33	1.21
Tertiary education	0.42	1.16
No education yet	-	-

Other		0.54	3.30
Marital status			
Married or registered partnership and living together (reference category)		-	-
Married or registered partnership and not living together		0.20	0.69
Divorced		1.90***	0.64
Living together with partner		0.02	0.89
Widowed		1.04	0.73
Never married		0.00	0.85
Number of children		-0.09	0.15
Grandchildren dummy			
Has grandchildren (reference category)		-	-
Has no grandchildren		0.13	0.44
Constant		57.90***	1.73
R-squared	0.23		
No. observations	298		

Notes: ** indicates significance at $p < 0.05$, *** indicates significance at $p < 0.01$.
At the 'Highest completed level of education' variable, the reference category is 'Primary school', since none of the respondents have indicated that special education is the highest level of education that they have completed.

Figure 5. Coefficients from the regression with confidence intervals, 1946 as the reference category



6.3 Third Model

Compared to the previous model, the coefficients of the explanatory variables have changed to a greater extent after adding work related control variables next to the personal control variables, which is possible to see in Table 6. The work-related control variables are added since they also could be related to both the birth year of respondents and the effective retirement age, as discussed in the 'Data' section. The coefficient at the 1948 birth year variable has become negative, though it remains insignificant. Moreover, the positive coefficient at the 1949 birth year variable is still positive, but now it has become insignificant. Thus, it is not possible to state that the effective retirement age of individuals born in 1949 differs significantly from that of individuals born in 1946. The coefficients of individuals born in 1950 and 1951 have remained positive and significant, though they have become lower. Similar to the previous models, all confidence intervals of the birth year dummies of 1947 to

1952 in Figure 6 overlap, which indicates no significant differences in the effective retirement age among individuals born these years.

When making comparisons among the birth year cutoffs, a similar conclusion to that of the previous analyses follows. The average effective retirement age of individuals born in 1948 and individuals born in 1949 again differ strongly from each other, now even by one year. This supports the possibility that the effective retirement age is higher among individuals born in 1949 due to the higher SRA that individuals born in 1949 generally face. The average effective retirement ages of individuals born in 1950 and 1951 again do not differ a lot from each other, which is reflected in both the coefficients and confidence intervals in Figure 6. Overall, it is possible to state that in this model the hypothesis is again partly supported, however a bit less compared to the previous model due to the lower positive significant coefficients, the now insignificant coefficient at the 1949 birth year variable and the coefficient at the 1948 birth year variable that has become negative albeit remained insignificant.

Table 6. Results of the regression discontinuity analysis on the effective retirement age, personal and work-related characteristics included

	Coefficient	Standard Error
Birth year		
1946 (reference category)	-	-
1947	0.40	0.66
1948	-0.08	0.67
1949	1.12	0.63
1950	1.67**	0.66
1951	1.63**	0.67
1952	-0.35	0.91
Year of the wave		
2013 (reference category)	-	-
2014	2.74	1.63
2015	-0.07	1.55

2016	2.83	1.68
2017	3.71**	1.60
2018	4.62***	1.11
Personal background variables		
Gender		
Male (reference category)	-	-
Female	-0.42	0.57
Health status		
Excellent health (reference category)	-	-
Good health	-0.41	0.64
Fair health	-0.25	0.73
Not so good health	0.18	0.99
Poor health	-	-
Highest completed level of education		
Special education	-	-
Primary school (reference category)	-	-
High school	-0.47	1.22
MBO	0.34	1.28
Tertiary education	0.67	1.24
Other	1.07	3.41
Marital status		
Married or registered partnership and living together (reference category)	-	-
Married or registered partnership and not living together	0.15	0.86
Divorced	2.17***	0.77
Living together with partner	-0.07	0.99
Widowed	1.09	0.89
Never married	0.46	0.98
Number of children	-0.05	0.16
Grandchildren dummy		
Has grandchildren (reference category)	-	-
Has no grandchildren	0.01	0.48

Work related background variables		
Years worked full-time		
0 – 20 years (reference category)	-	-
21 – 40 years	-0.42	0.60
41 years and more	0.48	0.64
Actual no. hours worked a week		
0 – 20 hours (reference category)	-	-
21 – 40 hours	-0.30	0.68
41 hours and more	-0.56	0.74
Type of employment		
Permanently employed (reference category)	-	-
Temporary employed	0.14	1.48
Stand-by	-1.98	1.31
Temporary agency worker	1.04	3.41
Self-employed	-0.53	0.91
Employment sector		
Employed by the government (reference category)	-	-
Employed in the private sector	-0.35	0.56
Employed at an institution, public limited company, foundation etc.	-0.54	0.54
Not applicable (stand-by, temporary, self-employed)	-	-
Total net household income		
0k – 25k (reference category)	-	-
26k-50k	-0.34	0.52
51k – 75k	-0.22	0.82
76k – 100k	2.73	2.26
101k and more	-1.02	3.05
Do not know	-0.12	0.52
Partner retirement		

status			
Non-retired partner (reference category)		-	-
Retired partner		-0.11	0.46
Constant		58.71***	2.02
R-squared	0.26		
No. observations	273		

Notes: ** indicates significance at $p < 0.05$, *** indicates significance at $p < 0.01$.
At the 'Highest completed level of education' variable, the reference category is 'Primary school', since none of the respondents have indicated that special education is the highest level of education that they have completed.
The 'Not applicable' category of the 'Employment sector' variable is omitted, since it correlates strongly with the final three categories of the 'Type of employment' variable.
The 'Poor health' category is omitted at the 'Health status' variable, since the sole respondent who indicated that they have poor health has not indicated values at all other work-related background variables.

Figure 6. Coefficients from the regression with confidence intervals, 1946 as the reference category

6.4 Subgroup analysis based on gender

In different research related to pension systems, like that discussed in the 'Literature Review and Theoretical Framework' section, different selections are made. In one of the discussed researches, only self-employed individuals were analyzed, because of their specific characteristics (Nagore García et al., 2018, p. 4). In the discussed research on the impact of

the reform of the first pillar in Switzerland in 1997, only women were included in the study, while in the research on the impact of the reform of the second pillar in the Netherlands in 2006 on the likelihood of depression, only male public sector employees were included (Lalive & Staubli, 2015; De Grip et al., 2011). It is also relevant to make distinctions in this paper, because more specific information could be found among the different subgroups that are analyzed. Due to the limited number of observations, the only subgroup analysis made in this paper is based on gender. The control variables that are included in the third model are also included in this subgroup analysis.

The distinction in gender is important, since in general men and women differently experience their work careers. Women, on average, are more occupied with their household, receive lower wages compared to men, along with other differences, though these differences have become smaller through the years (Sayer, 2005, pp. 285-287). Moreover, while the men/women ratio was on average similar across the birth years, as is possible to see in Table 2, the ratio itself was not 50/50. On average, one-third of the respondents per birth year was female.

As it is possible to see in Table 7 and Figure 7, the results have changed compared to those in the third model after making a distinction in gender. However, the coefficients found at the male subgroup analysis generally are similar to those of the third model. The coefficients at the birth years 1950 and 1951 have remained positive and significantly different from the reference category 1946. The positive coefficient at the 1951 birth year has even become significant at the $p < 0.01$ level. Moreover, the coefficients at the 1950-1951 cutoff differ more from each other in comparison to the previous analyses, which supports the hypothesis. All confidence intervals of the coefficients of individuals born between 1947 and 1952

overlap, which is in line with the previous analyses. The general similarity of the results in this analysis to those of the third model is not unexpected, since the majority of the respondents in the surveys are male, and therefore influence the results in the overall analyses the most.

Table 7. Results of the regression discontinuity analysis on the effective retirement age of men, personal and work-related characteristics included

	Coefficient	Standard Error
Birth year		
1946 (reference category)	-	-
1947	0.49	0.78
1948	-0.16	0.81
1949	1.39	0.75
1950	1.56**	0.77
1951	2.12***	0.78
1952	-0.30	1.11
Year of the wave		
2013 (reference category)	-	-
2014	0.69	1.74
2015	-2.33	1.76
2016	0.74	1.84
2017	1.59	1.76
2018	2.52**	1.18
Personal background variables		
Health status		
Excellent health (reference category)	-	-
Good health	-0.03	0.70
Fair health	0.30	0.83
Not so good health	1.18	1.10
Poor health	-	-
Highest completed level of education		
Special education	-	-
Primary school (reference category)	-	-
High school	-0.51	1.46

MBO	0.19	1.53
Tertiary education	0.72	1.48
Other	1.50	3.50
Marital status		
Married or registered partnership and living together (reference category)	-	-
Married or registered partnership and not living together	1.76	1.11
Divorced	1.89	1.10
Living together with partner	0.65	1.22
Widowed	0.30	1.49
Never married	0.68	1.27
Number of children	0.02	0.18
Grandchildren dummy		
Has grandchildren (reference category)	-	-
Has no grandchildren	-0.06	0.59
Work related background variables		
Years worked full-time		
0 – 20 years (reference category)	-	-
21 – 40 years	-1.23	0.94
41 years and more	-0.18	0.95
Actual no. hours worked a week		
0 – 20 hours (reference category)	-	-
21 – 40 hours	-0.85	1.21
41 hours and more	-1.06	1.24
Type of employment		
Permanently employed (reference category)	-	-
Temporary employed	-1.08	1.94
Stand-by	-2.27	1.60
Temporary agency worker	-1.37	3.65
Self-employed	-1.22	1.25

Employment sector			
Employed by the government (reference category)		-	-
Employed in the private sector		-0.69	0.65
Employed at an institution, public limited company, foundation etc.		-0.83	0.67
Not applicable (stand-by, temporary, self-employed)		-	-
Total net household income			
0k – 25k (reference category)		-	-
26k-50k		-0.79	0.64
51k – 75k		-0.43	0.96
76k – 100k		3.80	3.11
101k and more		-	-
Do not know		-0.50	0.66
Partner retirement status			
Non-retired partner (reference category)		-	-
Retired partner		0.07	0.50
Constant		61.74***	2.42
R-squared	0.30		
No. observations	189		

Notes: ** indicates significance at $p < 0.05$, *** indicates significance at $p < 0.01$.
At the 'Highest completed level of education' variable, the reference category is 'Primary school', since none of the respondents have indicated that special education is the highest level of education that they have completed.
The 'Not applicable' category of the 'Employment sector' variable is omitted, since it correlates strongly with the final three categories of the 'Type of employment' variable.
The 'Poor health' category is omitted at the 'Health status' variable, since the sole respondent who indicated that they have poor health has not indicated values at all other work-related background variables.
The 'Gender' variable is removed in this analysis, since only male respondents are included.
The '101k and more' category is omitted at the 'Total net household income' variable due to the limited number of observations.

Figure 7. Coefficients from the regression with confidence intervals, 1946 as the reference category

When including only women in the regression discontinuity analysis, different conclusions follow. The coefficients found at the explanatory variables stated in Table 8 are less similar to those of the third model compared to the analysis with only male respondents. This is also reflected by the coefficients with their confidence intervals which all overlap, as is shown in Figure 8. Moreover, the coefficients from the birth years 1947 and 1949 have become negative, though remained insignificant. None of the positive coefficients at the birth years 1950 and 1951 have remained significant. This means that the hypothesis of this paper is the least supported when only female respondents are included in the analysis. However, it is important to keep in mind that the more limited number of female respondents also influences the found results.

Table 8. Results of the regression discontinuity analysis on the effective retirement age of women, personal and work-related characteristics included

	Coefficient	Standard Error
Birth year		
1946 (reference category)	-	-
1947	-0.67	1.40
1948	-1.38	1.39
1949	-1.50	1.29
1950	1.43	1.41
1951	0.03	1.46
1952	-0.84	1.82
Year of the wave		
2013 (reference category)	-	-
2014	16.98***	5.89
2015	19.18***	4.90
2016	18.71***	5.48
2017	16.13***	5.31
2018	22.12***	3.92
Personal background variables		
Health status		
Excellent health (reference category)	-	-
Good health	-1.18	1.81
Fair health	-1.08	1.93
Not so good health	-2.20	2.53
Poor health	-	-
Highest completed level of education		
Special education	-	-
Primary school (reference category)	-	-
High school	1.12	2.35
MBO	1.04	2.41
Tertiary education	0.19	2.36
Other	-	-
Marital status		
Married or registered partnership and living together	-	-

(reference category)		
Married or registered partnership and not living together	1.18	1.92
Divorced	0.66	1.98
Living together with partner	-4.00	2.23
Widowed	-1.02	2.09
Never married	0.39	1.93
Number of children	0.20	0.41
Grandchildren dummy		
Has grandchildren (reference category)	-	-
Has no grandchildren	1.28	1.07
Work related background variables		
Years worked full-time		
0 – 20 years (reference category)	-	-
21 – 40 years	1.08	0.96
41 years and more	-1.51	1.41
Actual no. hours worked a week		
0 – 20 hours (reference category)	-	-
21 – 40 hours	0.82	1.01
41 hours and more	0.24	1.35
Type of employment		
Permanently employed (reference category)	-	-
Temporary employed	7.01	3.11
Stand-by	-	-
Temporary agency worker	-	-
Self-employed	1.24	2.12
Employment sector		
Employed by the government (reference category)	-	-
Employed in the private sector	-1.45	1.39
Employed at an institution, public limited company,		

foundation etc.		0.28	1.09
Not applicable (stand-by, temporary, self-employed)		-	-
Total net household income			
0k – 25k (reference category)		-	-
26k-50k		0.58	0.95
51k – 75k		2.56	2.09
76k – 100k		2.45	3.35
101k and more		-2.86	3.46
Do not know		1.18	0.99
Partner retirement status			
Non-retired partner (reference category)		-	-
Retired partner		-1.29	1.71
Constant		40.66***	6.14
R-squared	0.66		
No. observations	84		

Notes: ** indicates significance at $p < 0.05$, *** indicates significance at $p < 0.01$.
At the 'Highest completed level of education' variable, the reference category is 'Primary school', since none of the respondents have indicated that special education is the highest level of education that they have completed.
The 'Not applicable' category of the 'Employment sector' variable is omitted, since it correlates strongly with the final three categories of the 'Type of employment' variable.
The 'Poor health' category is omitted at the 'Health status' variable, since the sole respondent who indicated that they have poor health has not indicated values at all other work-related background variables.
The 'Gender' variable is removed in this analysis, since only female respondents are included.
The 'Stand-by' and 'Temporary agency worker' categories are omitted at the 'Type of employment' variable due to the limited number of observations.

Figure 8. Coefficients from the regression with confidence intervals, 1946 as the reference category

Overall, the results of this subgroup analysis demonstrate why it is important to make a distinction between gender when assessing the impact of the increase of the SRA on the effective retirement age. If this extra analysis would have not been conducted, the conclusions of the first three analyses would be incorrectly assigned to individuals from both genders.

6.5 Final Remarks

After conducting the first three analyses, some of the found outcomes remained stable, while others did not persist after adding control variables. This makes it possible to argue that individuals who face a higher SRA, on average retire later than individuals who do not face it and were born in 1946, with some exceptions, namely for individuals born in 1948 and individuals born in 1952. Among the two cutoffs that are the most similar to the actual birth year cutoffs, namely 1947-1948 and 1948-1949, only the results from the latter cutoff support

the hypothesis (Belastingdienst, n.d.). With the lack of smaller bandwidths due to the only availability of the birth years, it is not possible to assess among which birth months of 1948 the lowest effective retirement ages are found that affects both the difference in the coefficients between the birth year dummies of 1947 and 1948 and the large difference in the coefficients between the variables of 1948 and 1949.

Moreover, due to the overlapping confidence intervals of the coefficients of the birth year dummies that are shown in the figures, it is possible to state that while there is an overall increasing pattern of the effective retirement age, the effective retirement ages of individuals born in 1947 to 1952 are not significantly different from each other. However, since the positive significant coefficients at the birth years 1950 and 1951 persisted through the first three models with the addition of extra control variables, it could demonstrate that the reform actually has a positive impact on the effective retirement age of males, but that it takes some time for this impact to become strong. The final subgroup analysis based on gender namely demonstrates that the found results of the first three analyses mostly correspond to those of men rather than women. Thus, overall, the hypothesis of this paper is partly supported, but not fully and significant room exists for future research.

7. Conclusion and Discussion

In this paper, the impact of the increase of the SRA on the effective retirement age of individuals from the baby boom generation has been researched. First, the relevance of researching this topic is addressed. The SRA is under discussion by various actors in the Netherlands, and no agreement exists on the optimal composition of this age. Since policy reforms already have been introduced, such as the gradual increase of the SRA, it is important to assess the effects of these policy reforms before they are changed further in the future. Therefore, the research question of this paper is: 'To what extent has the increase of the Statutory Retirement Age impacted the effective retirement age?'.

Following this, different research has been discussed, through which the usefulness of using a regression discontinuity approach becomes clear. Subsequently, the institutional context is discussed following with the hypothesis, where it is argued that the increase of the SRA should cause an individual with a birth date after a specific SRA-cutoff to retire (significantly) later. The results of the analyses suggest that the increase of the SRA has led to an increase of the effective retirement age, since individuals with birth years with a higher SRA on average retire later than individuals who face a lower SRA. However, while the effective retirement age of individuals affected by the reform in general was higher than that of individuals born in 1946, there were no significant differences found with the effective retirement age of individuals born in 1947 who also are unaffected by the policy reform of 2012. It also turns out that the results seem to mostly indicate something about the impact of the increase of the SRA on the effective retirement age of men, rather than women. Moreover, due to different limitations of this research, the validity of these results is challenged.

Therefore, it is possible to identify different possibilities for future research. For example, similar research with more extensive data on the same topic would be very valuable. Data that includes both the birth years, birth months and maybe even the birth days of the respondents would increase the internal validity of the research. While the results of this paper partly are in line with the outcomes of the discussed research on the increase of the FRA in Switzerland, the conclusion from this paper is less 'solid' compared to that of the Swiss research due to the limited information on the birth dates of the respondents. Another limitation is found in the recentness of the information on the effective retirement ages. Especially individuals born in 1951 and 1952 are relatively more likely to have not yet retired and are therefore not included in the analyzed information on the effective retirement age. Future research could therefore complement the results found in this paper with more 'complete' information on the individuals born in these years.

The results from the analyses still hold relevant information. Therefore, it is also relevant to find out what results would be found in similar research with other definitions of retirement and with more respondents. If comparable outcomes are found, the robustness of the results in this paper is stronger supported. With more extensive data and the addition of these new definitions, the value of policy recommendations regarding the SRA that are backed up with scientific support increases.

8. References

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9. Appendix

9.1 Appendix A

Operationalization of modified control variables that are not discussed in the main text:

The number of children variable:

The number of children variable is the sum of the variables that respectively indicate the number of children who are part of the household and those who are not.

Highest completed level of education:

In the variable that indicates the highest completed level of education, the categories ‘VMBO’ and ‘HAVO and VWO’ are combined together into the category ‘High school’. The categories ‘HBO’ and ‘WO’ are combined into the category ‘Tertiary education’.