The Effect of Raising the AOW Eligibility Age on Old Age Labour Market Participation

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Abstract

Increasing the statutory retirement age has become an increasingly popular solution among policymakers in an attempt to reduce the rapidly increasing costs of public pension systems. Yet, the validity of such a policy tool is uncertain as the effectiveness of an increase in the statutory retirement age depends on both the ability of individuals to delay their retirement as well as their willingness to actually work for longer. This paper analyses the effect of the Dutch 2012 AOW reform which increased the AOW eligibility age from 65 to 66 and four months between 2012-2021, on affected individuals' labour market participation. Utilising a difference-in-differences design, the analysis finds that increasing the AOW eligibility age does result in a retirement delay among affected individuals but that this delay only partially results in increased employment. The research further finds that these effects are heterogeneous as poorer health individuals display a larger retirement delay response but smaller employment response. Overall, this research suggests that increasing the AOW eligibility age is a valid policy as the reform does succeed in somewhat inducing individuals to delay retirement and work until older.

1. Introduction

The public pension system is a central pillar of the modern welfare system, and it has for a long time allowed individuals to maintain a decent life even after exiting the labour market in old age. However, in recent years following increasing budget constraints and increased life expectancy, many pension systems in mature welfare states have begun to become strained, struggling to balance the budget and the continued demands for generous pensions (OECD, 2021). A common solution has been to increase either the statutory retirement age (SRA)[1] or the early retirement age (ERA)[2] in the hopes that delaying the age until an individual qualifies for a (full) public pension will cause them to delay their retirement and work for longer (Rabaté & Rochut, 2019).

The Dutch pension system is no exception, which is why in 2011 discussions began on how the system could be made more financially sustainable, especially focusing on the rapidly rising costs of the public pension scheme called *Algemene Ouderdomswet* (AOW) which acts as the SRA in the Netherlands. The solution implemented was a reform where the previous AOW eligibility age of 65 would gradually increase to 67, and after that indexed to life expectancy for future retirees. The AOW reform was implemented with the belief that an increased eligibility age would cause individuals to delay their retirement, allowing the system to maintain its benefit level whilst also strengthening its finances through increased income taxes and a reduced claiming rate (Kamerstuk II, 33290 nr. 3, 2012)[3].

However, despite these expectations, the extent to which the reform actually succeeded in changing Dutch individuals' behaviour is less than certain. Simply increasing the eligibility age does not mean that individuals will choose to delay retirement and work for longer. There are several reasons why individuals might not want, nor be able to delay retirement after 65, even less continue to work. Therefore because of private wealth or accessible social benefits, an increase in the AOW eligibility age could simply result in increased inactivity, early retirement, or a substitution towards other social benefits, rather than the desired increase in employment.

As this is not a novel question, but one faced by policymakers in other countries as well, there is already a growing body of SRA and ERA reform literature to potentially answer this

[1] Refers to the age when an individual is eligible for full pension benefits
[2] Refers to the age when an individual is first eligible for pension benefits
[3] Cited in accordance with the Hogeschool Rotterdam APA guide for official documents. https://www.hogeschoolrotterdam.nl/globalassets/mediatheek/downloads/apa-verwijswijzer.pdf

question. Several analyses of Austrian (Staubli & Zweimüller, 2013), Italian (Ardito, 2021), French (Rabaté & Rochut, 2019), English (Cribb, Carl, & Tetlow, 2016), and Estonian (Soosaar, Puur, & Leppik, 2021) eligibility age reforms have found that increasing the eligibility age does result in individuals delaying retirement. All these authors do also find increasing the eligibility age does at the same time have a positive effect on employment, however, it is consistently smaller than the delay in retirement.

Seeking to explain why retirement rates go down further than employment rates go up, increasing the SRA is also found to affect the claiming rate of alternative social benefits. Individuals unwilling or unable to work are found to respond to an eligibility age increase by simply claiming a different sort of benefit until they reach their new eligibility age (Oguzoglu, Polidano, & Vu, 2020; Rabaté & Rochut, 2019; Staubli & Zweimüller, 2013). According to the authors, the access to other social benefits allows an individual to ignore the eligibility age increase, and rather than continue to work as expected, simply shift the social costs onto some other welfare programme such as unemployment insurance (UI) or disability insurance (DI) instead (Staubli & Zweimüller, 2013).

Rarely in the central focus of the research, many of the above-mentioned studies do still seek to assess the heterogeneous effects of an SRA or ERA reform (Ardito, 2021; Cribb, Carl, & Tetlow, 2016; Rabaté & Rochut, 2019; Soosaar, Puur, & Leppik, 2021; Staubli & Zweimüller, 2013). Despite the inconsistent choices for what individual factors to analyse, some studies found that the effects on retirement and employment are stronger for individuals with poor health (Rabaté & Rochut, 2019; Staubli & Zweimüller, 2013), individuals with straining work (Ardito, 2021), and individuals with higher wealth (Cribb, Carl, & Tetlow, 2016). These findings are further supported by the broader literature on retirement behaviour which finds that all these factors negatively affect old-age employment and increase the probability to retire early (Bloemen, 2016; Coulibaly, 2006; Kuhn, Wrzaczek, Prskawetz, & Feichtinger, 2015).

Although the consistency of earlier findings already gives an indication of what to expect it is important to note that the results between these studies are quite volatile, with both the effect on employment and the effect on the retirement delay differing substantially between the various reforms and national contexts (Ardito, 2021; Cribb, Carl, & Tetlow, 2016; Geyer & Welteke, 2019; Rabaté & Rochut, 2019; Soosaar, Puur, & Leppik, 2021; Staubli & Zweimüller, 2013). Theorising why this is, some authors attribute their differential results to the country context (Soosaar, Puur, & Leppik, 2021), the pension systems context (Ardito, 2021; Rabaté

& Rochut, 2019), the reform itself (Mastrobuoni, 2009), or the sample studied (Staubli & Zweimüller, 2013).

Synthesizing the above research, this thesis seeks to contribute to the literature in two major ways. First, it builds on the general literature of SRA and ERA research, by researching the effects on employment and retirement delay of to the authors' knowledge of a previously non-research reform and national context. Whilst the 2012 AOW reform is not exceptional by any means, researching it nevertheless contributes to a more comprehensive account of the effects of increasing the SRA in a wider range of national and pension systems contexts. This is important as the volatile results from earlier research demonstrate that one cannot draw conclusions from other countries, to determine the exact effects of the Dutch AOW reform. Rather, any analysis of its validity as a policy tool should be based on evidence from its own national and institutional context. Any findings will be relevant for policymakers in the Netherlands who can use them to assess whether the AOW reform indeed has the desired effect. Theoretically, findings from this research also contribute by indicating the role that institutional factors rare internationally but present within the AOW system (not defined by contributions, no early withdrawal) play in affecting the effectiveness of the reform.

Secondly, this research seeks to bridge the gap between research on general retirement behaviour, and the effect of an SRA increase, to find if there are any heterogeneous responses to an increase in the AOW eligibility age. This research thus seeks to apply some key findings of the general retirement literature on an SRA reform. The purpose of this will be to see to what extent the retirement delay and effect on employment of the AOW reform are heterogeneous between groups defined by socio-economic characteristics. Such findings are of high practical and theoretical importance as they indicate whether some groups of society are less able to adapt to the reform than others.

Thus, embedding this research in the existing two strands of literature, the following research question guides the subsequent analysis. **How has the AOW reform affected the labour market participation of old-age individuals?**

The research question will be analysed through a difference-in-differences (DID) analysis based on the Longitudinal Internet Studies for the Social Sciences (LISS) panel. The empirical design borrows heavily from Ardito (2021) as the models used to answer the above question are taken from her paper and adapted slightly to fit the data.

The purpose of this approach is to compare how both the proportions of retired and employed individuals differ across ages between birth cohorts now facing different AOW eligibility ages. Assuming that these birth cohorts are similar in every other way, this would allow for an isolation of the effect of the reform on the two outcomes (Angrist & Pischke, 2015). It is important to analyse the effects on both the retirement delay and employment since based above literature they are not expected to be the same. The effect on retirement will answer to what extent the AOW reform changed the labour market participation of individuals, whilst the effect on employment answer what part of said change is the desired productive participation.

The result of this thesis suggests that the 2012 AOW did indeed affect the labour market participation of affected individuals. Individuals' ineligible for AOW had on average a 23.1 percentage point lower probability of being retired compared to individuals eligible for AOW across all ages. At the same time individual ineligible for AOW also had a 12.3 percentage point higher probability of being employed compared to individuals eligible for AOW across all ages. The imbalance between increased employment and delayed retirement shows that whilst the AOW reform did increase employment, a substantial number of individuals chose to stay in the labour market, but not as workers. Whilst this indicates that the AOW reform could have resulted in some substitution towards other social benefits such as UI or DI, the shape and size, of this increase is not established in this research. Finally, the results also find some heterogeneity between individuals based on health. Individuals with poor health reported a much larger retirement delay response and lower positive employment response than their healthier counterparts.

The thesis is organised in the following way. Section 2 explains the institutional structure of the Dutch pension system and the substance of the 2012 AOW reform of interest. Section 3 contains a literature review. A brief overview of earlier studies of other SRA and ERA reforms is provided, summarizing the findings and their individual contributions to the literature. The section also reviews the broader literature on general retirement behaviour, focusing on the effects of health wealth, and occupation on old age employment. Section 4 establishes a theoretical framework based on the life-cycle model and develops concrete hypotheses of the effects of the AOW reform to be assessed during the research. Section 5 describes the overall research design, including the choice of data and variables. Finishing that section is a detailed explanation of the DID design used during the analysis. The actual research of this thesis begins with section 6 which provides descriptive statistics, assessing the shape of data and its implications for the analysis. The section also contains a test for parallel trends a key

assumption for DID design to be valid. Section 7 then presents the relevant results of both the average effect of the AOW reform as well as a heterogeneity analysis. Section 8 then discusses the results in relation to the hypotheses developed in section 4. Finally, the paper concludes with section 8 which provides a concrete answer to the research question, discusses the limitations of the research, and highlights both the academic and social implications of the results.

2. Institutional Background

2.1 The Dutch Pension System

Before any research on the AOW reform can be conducted, the organisation of the Dutch pension system must first be explained. The Dutch pension system is composed of three so-called pillars, one public, one occupational, and one private, each organised separately with different rules (García, Rossi, & van Soest, 2018). The three pension pillars are supposed to form a complete pension at retirement, amounting to, on average, a pension of approximately 70% of the earlier gross wage, at a full pension (European Commission, 2021).

The first pillar is the state-organised public pension called *Algemene Ouderdomswet* (AOW), composed of a tax-funded pay-as-you-go pension connected to the minimum wage. An important aspect of the AOW is that it is not connected to any sort of contribution. Instead, it is a flat rate benefit that accumulates at a rate of two percentage points per year of residence (European Commission, 2021). Although the benefits are flat, they do differ between single individuals and couple individuals, with single individuals receiving 70% of the minimum wage whilst couples receive 50% of the minimum wage (100% combined). Importantly the AOW pension cannot be withdrawn earlier at a reduced rate, but it is only accessible once a person reaches the statutory retirement age (de Grip, Fouarge, & Montizaan, 2013). Reaching the statutory AOW eligibility age has further legal implications as employees have their contract automatically terminated and, must have their contracts actively renewed to continue working afterwards. Furthermore, once reaching the AOW eligibility age, a person loses eligibility for many other social benefits such as unemployment insurance and disability insurance (Mulders, 2018).

The second pillar is composed of an occupational or company-specific pension which is funded by the employer and employee together and whose amount depends on the wage. The allocated salary is then invested into a specified industry or company pension fund (European

Commission, 2021). Although not legally required, 9/10 of employers participate in a type of fund (Rijksoverheid, n.d.). These funds are privately organised but supported by the government through preferential tax benefits (Euwals, van Vuren, & van Vuuren, 2012). The accrued occupational pension is paid out once a person retires based on a set average wage indexation, although benefits can change due to funding issues. Important to note is that, unlike the AOW, this pillar has no legal restriction on withdrawals so if allowed by the fund, a person can retire earlier and draw from their fund sooner, albeit at a reduced pension level (Westerhout, Ponds, & Zwaneveld, 2021).

The third pillar of the Dutch pension system is individual savings which can be invested through various defined schemes. Up to 1.875% of a person's income can be invested tax-free to incentivise private savings, although it is not mandatory to do any sort of private saving. Because of how present the first two pillars are within Dutch society, private retirement savings have been largely crowded out, with the third pillar making up a relatively small part of an average Dutch pension (de Grip, Fouarge, & Montizaan, 2013). The one exception to this is for self-employed who by not having access to the second pillar are more reliant on private pension savings (García, Rossi, & van Soest, 2018).

Other than the formal pension system itself, the Dutch welfare state also contains a series of other welfare programmes that can act as a type of release valve, allowing a person to exit the labour market early. Several social benefits thus allow for what is called "alternative pathways" enabling a person to either leave the labour market at an age completely independent of the AOW eligibility age or to use the policies as a transition between the end of one's career and the new increased AOW eligibility age (Rabaté & Rochut, 2019). Although these social benefits are not formally part of the pension system, in practice they make up a part of a broader system of retirement planning and should thus be accounted for (Ardito, 2021).

Unemployment insurance (UI) is one such pathway as it allows a person to in practice exit the labour market up to three years before one reaches the AOW age, although this is dependent on both the individual's work history and the year of utilization. Individuals are granted 75% of their salary for the first three months of unemployment after which the replacement rate drops to 70%. The length of which these benefits could be collected was 5 years until 2006 when it was reduced to 3.2 years. In 2016 this was further reduced to only 2 years. To qualify for unemployment benefits, an individual needs to have involuntarily left their job and have worked 26 out of the last 36 weeks (de Groot & van der Klaauw, 2019).

Individuals can also exit the labour market through DI which grants an individual up to 75% of their previous earnings if they are fully, permanently disabled. Partly disabled individuals can receive a lower benefit which is dependent on earlier wage, employment history, and the assessed future working capabilities (Koning & Lindeboom, 2015). In 2006 the eligibility criteria for DI benefits were restricted not only making it harder to qualify, but also broadening the working requirements for partially disabled people, leading to a sharp decline in its claiming rate (Koning & Lindeboom, 2015).

Finally, from 2006 to 2021 a life-course savings scheme existed that allowed individuals to save a max of 12% of gross salary per annum for periods of unpaid leave (such as early retirement) at a preferential tax rate (University of Twente, n.d.). It was closed in 2012 for new individuals but participants with more than 3000 € in their account could still utilise the scheme (Centraal Bureau voor de Statistiek, 2012).

2.2 The 2012 Reform

Since the creation of the first pillar (AOW) in 1957, it has functioned as the SRA in the Netherlands and has been set at 65 ever since its establishment. In 2011 however, the financial feasibility of the AOW was increasingly questioned. With increased life expectancy, declining birth rates, and unstable financial markets, the AOW fund would run out of money in the long term. This is because people were predicted to withdraw pension benefits for longer than the fund and the declining productive population could sustain it for (de Grip, Fouarge, & Montizaan, 2013). This caused the Dutch government to legislate a reform package that among other things would increase the AOW eligibility age from 2013 and onwards. The primary goal of the AOW reform was to both make the current AOW system financially stable but also to encourage people to work until an older age (Kamerstuk II, 33290, nr. 3, 2012). Initially, the reform was to be phased in slowly between birth cohorts separated by eleven months, increasing by only one month per year (de Grip, Fouarge, & Montizaan, 2013). However, in 2012 this was modified and the speed by which the AOW eligibility age rose was increased to three months between each cohort, starting in 2015. It was also decided that from the year 2021, the AOW eligibility age would be indexed to life expectancy, ensuring that it would not rise too fast (de Grip, Fouarge, & Montizaan, 2013).

In 2019 the reform was partially loosened. Seeing that an increasing number of people suffered financially and struggled to adapt to the rapidly increasing AOW eligibility age, the decision was made to slow the increase down (Irwin, 2019). Before 2019 it was planned that by 2021

the AOW eligibility age would be 67 years and from there it would increase 1:1 with life expectancy. The 2019 proposal slowed the increase down so that an AOW eligibility age of 67 would only be reached in 2024, delaying the increase by two years. At the same time also decided that the coupling to life-expectancy would not be a 1:1 ratio, but rather that for every one year in increased life expectancy, the SRA would increase by eight months (Rijksoverheid, 2019a). The already reached AOW eligibility ages as of the year 2022 and their corresponding birth cohorts can be seen in Table 1.

Table 1: AOW eligibility age by year of retirement and birth cohort

Birth-cohort	Year of AOW eligibility	AOW eligibility age
Pre-31-12-1947	Pre-2013	65
01-01-1948 to 30-11-1948	2013	65 + one month
01-12-1948 to 31-10-1949	2014	65 + two months
01-11-1949 to 30-09-1950	2015	65 + three months
01-10-1950 to 30-06-1951	2016	65 + six months
01-07-1951 to 31-03-1952	2017	65 + nine months
01-04-1952 to 31-12-1952	2018	66
01-01-1953 to 31-08-1953	2019	66 + four months
01-09-1953 to 31-08-1954	2020	66 + four months
01-09-1954 to 31-08-1955	2021	66 + four months
01-09-1955 to 31-06-1956	2022	66 + seven months

Source: Rijksoverheid (2019b)

3. Literature Review

The labour market participation effects of increasing the SRA is a research question that although not new, has not been applied to too many reforms in too many different national contexts. Nevertheless, some literature has developed with the explicit purpose of analysing the labour market participation effects of increasing the SRA, and whose contributions are relevant for this research. Furthermore, although theoretically underdeveloped within the literature on SRA reforms, most research on this topic does address the heterogeneous effects on sub-samples of the population. Interestingly though, is that the theorised source of this heterogeneity is rarely consistent between the various studies[4], nor consistently justified, resulting in a discontinuity between the broader literature on retirement behaviour and the effects of SRA literature. Therefore, below follows a literature review that is broadly organised between literature discussing the labour market participation effect of increasing the SRA or

[4] See for example Ardito (2021), Rabaté and Rochut (2019) and Soosaar et al (2021)

ERA, and literature addressing how individual characteristics affect labour market participation with an emphasis on health, wealth, and occupation.

3.1 Effect of Raising the Retirement Age

Several studies have examined the ex-post effects of raising the SRA or ERA on labour market participation. Existing studies do find that increasing the retirement age does increase the labour market participation rate of older workers. However, as argued by Ardito (2021), because of alternative exit routes and private incentives to deviate, the impact of increasing the SRA on employment is not as large as the overall decrease in retirement.

Perhaps the most fundamental study on retirement eligibility reforms was conducted by Staubli and Zweimüller (2013), who conducted an ex-post DID analysis on the effect of the Austrian 2000-2003 ERA reform. They found that increasing the ERA from 60 to 62 (55 to 58.25 for women) had a positive effect on employment by increasing it by 9.75 and 11 percentage points for affected individuals. These findings were found to be contingent on good health as almost the entire effect disappeared within the subgroup with poor health.

The Staubli and Zweimüller (2013) article is however most famous for its methodological innovations. They were the first project to use a DID analysis to combine the effects of a gradual ERA increase for different birth cohorts to find the average effect, rather than simply analysing two-period snapshots. They furthermore accounted for a substitution effect, exploring not only how the reform affected employment but also how increasing the ERA affected the claiming of UI and DI benefits, which they found increases as the ERA is increased. Thus, a key finding they make is that whilst retirement age reforms are almost generally for cost-saving reasons (Carone, Eckefeldt, Giamboni, Laine, & Sumner, 2016), increasing the ERA does not lead to all affected individuals working longer. Rather, the positive effect on employment is only marginal, relative to the decrease in retirement, with a number of affected individuals delaying retirement, but simply spilling over into other social programmes (Staubli & Zweimüller, 2013).

The Staubli & Zweimüller (2013) article would become a type of benchmark and its research design would be applied in many following, similar analyses. In an analysis of the French ERA reform of 2010 which increased the ERA from 60 to 62. The authors found that employment increased by 21 percentage points whilst pension claiming decreased by approximately 48 percentage points (Rabaté & Rochut, 2019). Although smaller, similar results were also found

in comparable studies of German and British ERA reforms utilising the same research design (Cribb, Carl, & Tetlow, 2016; Geyer & Welteke, 2019).

Initially developed within the context of ERA reforms, the Staubli and Zweimüller (2013) method has also been applied to SRA reforms in Italy, Austria, Germany, and Estonia. In these studies, similar results of an increase in delayed retirement, partly increased employment, and substitution towards both UI and DI programmes were found (Ardito, 2021; Bottazzi, Jappelli, & Padula, 2006; Etgeton, 2018; Soosaar, Puur, & Leppik, 2021). Seeking to explain why individuals diverge in terms of their employment adjustment to the reform, Mastrobuoni (2009) argues that the time between the announcement and the implementation of the reform is important, as it determines the time an individual has to build a financial buffer before affected.

When explaining why the positive effect on employment was so low in Estonia, Soosaar, Puur and Leppik (2021) argue that the degree to which substitution takes place is dependent on the accessibility to other social benefits as well as the generosity of the pension itself. Generous social benefits but low pensions decouple the relationship between retirement and the SRA meaning that increasing the SRA will have a limited positive effect on the employment rate.

Others instead look at active (a switch) versus passive (staying longer) substitution where they find that the majority of substitution occurring is not individuals switching to social benefits, but rather individuals already in the systems simply collecting the benefits for longer (Oguzoglu, Polidano, & Vu, 2020; Rabaté & Rochut, 2019).

In sum, literature on pension eligibility increases tends to find that increasing the eligibility age causes individuals to delay retirement, somewhat increase employment, and that it leads to some spillover to other social benefits. Important however is that the effect size between the various studies are quite volatile which authors attribute to differences in the pension system (Ardito, 2021; Soosaar, Puur, & Leppik, 2021), the national context (Oguzoglu, Polidano, & Vu, 2020; Rabaté & Rochut, 2019), or the shape of the reform itself (Mastrobuoni, 2009).

3.2 Literature on Retirement Behaviour

Although pension systems can be described as institutions whose rules constrain and guide the retirement behaviour of individuals, within those constraints, there is a remarkable retirement behaviour heterogeneity within societies (OECD, 2021). Seeking to explain why individuals exhibit such different retirement behaviour, much research has already been dedicated to identifying factors causing individuals to participate in the labour market for different

durations. As there is a wide range of potential factors this review limits itself to the commonly seen characteristics in earlier research on SRA/ERA reforms. These are health wealth and occupation.

These characteristics have been found to decrease old-age employment and increase the early retirement rate. Both poor health and a straining occupation make working during old age more costly, as it requires more effort and could affect long-term health. Wealth on the other hand broadens an individual's options, as with high wealth an individual is not as dependent on public pensions as someone with low wealth.

Health

Looking specifically at determinants of early retirement (pre-statutory retirement) several studies point toward the importance of health. For the Dutch labour market, it was found that having a chronic health problem and having a low perception of one's health significantly affects the probability of an individual working until they reach the retirement age (Sewdas, van der Beek, de Wind, van der Zwaan, & Boot, 2018). When looking at Finish individuals, Karpansalo, Manninen, Kauhanen, Lakka, and Salonen (2004), and Ilmakunnas and Ilmakunnas (2018), similarly find that perceived poor health correlates with both an earlier expected retirement age and an earlier actual retirement age.

Rather than looking at subjective health levels, some studies have instead focused on the effects of a more objective measure of health, not relating to personal perceptions, but rather objectively assessed conditions. Gupta and Larsen (2010) find that among Danes, receiving a medical diagnosis drastically reduces the expected retirement age although this can vary depending on the type of diagnosis. Combining both subjective and objective data, McGarry (2002) and Schuring, Burdorf, Kunst, and Mackenbach (2007) finds that despite fears of bias, even when controlling for objective health measures, subjective health still has an effect on actual and expected retirement.

Overall, the evidence from previous research points toward a strong negative effect of poor health on working in old age which some authors argue is stronger than financial incentives (Dwyer & Mitchell, 1999; Gupta & Larsen, 2010).

Wealth

The effect of wealth on the probability of leaving the labour market has been tested in real-world conditions. The argument that wealth increases the probability of retirement was found

to be true in the Dutch (Bloemen, 2016; Bloemen, 2011), American (Beehr, Glazer, Nielson, & Farmer, 2000), and Swiss contexts (Dorn & Sousa-Poza, 2005). These authors argue that private wealth grants an individual more freedom in determining their own retirement age independently of the public pension system.

Looking instead at poor individuals in the United States, Moore, Ghilarducci, and Webb (2019) argue that whilst high wealth can have a liberating effect in that it allows for retirement independently of the pension system, low wealth has the opposing effect in that it constrains an individual to be more bound by the rules set by the public pension system. Kuhn, Grabka, and Suter (2021) similarly find that when looking at early retirement, low-income individuals face liquidity constraints that regardless of their desires, prevent them from stopping working before reaching the SRA in Switzerland and Germany.

At the same time researching the effects of pre-retirement income in Germany, Radl (2016) finds the reverse effect which he attributes to the relatively higher cost of retiring earlier for individuals with higher income. However, when Schils (2008), analysed the effects of income in Germany, the Netherlands, and the UK, he found the results to differ between the countries. This he attributes to the institutional differences in the pension systems with more stratifying systems increasing the disincentives of earlier retirement for high-income individuals.

In conclusion, the literature on the effects of wealth on retirement the findings are mixed. On the one hand, wealth seemingly reduces the constraints on retirement allowing for it to occur compared to poorer individuals lacking said opportunity. On the other hand, early retirement imposes a higher cost for individuals whose wealth stems from a higher income which has been found to disincentivise early retirement. Therefore, if wealth directly stems from income, according to Kuhn, Grabka, and Suter (2021), it is unclear how the effect would express itself.

Occupation

Finally, as the type of sector and work affects the possibility to adapt one's labour in old age, an individual's occupation is found to also have an impact on retirement behaviour. For example, straining occupations can negatively affect a worker's perception of the ability to meet work demands, which in turn affects the expected retirement age (McGonagle, Fisher, Barnes-Farrell, & Grosch, 2015). Looking instead at more objective job characteristics Filer and Petri (1988) found in the United States that jobs characterised by straining tasks similarly tended to have a higher rate of early retirees.

Rather than only looking at strain as a disincentive, Neumark and Song (2018) find that physically straining jobs set a clear boundary where eventually, workers simply cannot meet the requirements asked of them for the job, constraining their ability to work until and after reaching their retirement age. Reaching a similar conclusion, Heyward and Hardy (1985), argue that straining work interacts with declining health and other underlying factors by limiting the possibility for an individual to adapt one's work to new conditions during old age. Finally, connected closely to job satisfaction was found that high-work pressure and high-physical work demand were strong factors in the decision to exit the labour market earlier since it raised the personal cost of working (Sundstrup, et al., 2021; van den Berg, Elders, & Burdorf, 2010).

Whilst all the above research analyses slightly different aspects of an occupation, overall, the general conclusion is that occupation matters for retirement behaviour and that physically demanding or straining work has a negative effect on the probability to work up to or past the retirement age.

4. Theoretical Framework

4.1 Framework Justification

Seeking to explain how the AOW reform would affect the labour market participation of old-age individuals, the life-cycle model is an incredibly versatile and useful tool. It provides a framework for modelling the retirement behaviour of rational individuals who seeks a smooth level of consumption throughout their lifetime (Cooper & John, 2013).

The life-cycle model is by far the most dominant framework in similar research on SRA (Ardito, 2021; Cribb, Carl, & Tetlow, 2016; Rabaté & Rochut, 2019; Soosaar, Puur, & Leppik, 2021; Staubli & Zweimüller, 2013). The reason for its popularity is its relative simplicity allowing for clear answers regarding the direct effects of changes in assumed homogeneous individuals' income or wealth (Radl, 2013).

To maintain simplicity, the life-cycle model assumes that individuals are perfectly rational and only care about their own consumption. Furthermore, the model also assumes perfect information implying that individuals are able to accurately estimate both their total lifetime work income and for how long they will live (Cooper & John, 2013). While these assumptions cannot be fully met in practice, according to Radl (2013), they do help reduce ambiguities and make it possible to attribute a change in behaviour to solely changes in economic incentives. Because all individuals are assumed to be rational utility maximises, these changes in economic

incentives can further be universally applied to societies as any diversity can be rationalised away as non-relevant, unless it explicitly affects the economic incentives.

Despite this simplicity, the life-cycle model is also very versatile in that it does allow for the above assumptions to be slightly relaxed, incorporating both economic and non-economic characteristics which are allowed to vary between individuals (Blundell, French, & Tetlow, 2016). These include, but are not exclusive to, individual preference for leisure, risk aversion, preference for a specific type of good, or exhibiting some socio-economic characteristic (Jappelli & Pistaferri, 2017). The downside of relaxing the above assumptions is however that it becomes harder to identify the direct effect of the theoretically interesting cause, since more heterogenous preferences make the answer more complex (Radl, 2013).

The simplicity of the life-cycle model makes it very useful for assessing the effects of an SRA reform as it is able to disregard any legal, normative, or practical effects, narrowing down the effects of the reform to only how it affects economic incentives through a wealth effect (changes in total lifetime income), a substitution effect (change in the relative value of leisure versus consumption), and liquidity effect (an inability to maintain a smooth consumption by borrowing) (Blundell, French, & Tetlow, 2016). The versatility of the framework is also useful since slightly relaxing the above assumptions allows explanation of varying preferences based on some socio-economic characteristics (Radl, 2013).

An alternative way of researching the effects of the AOW reform would be through the life course theory which views retirement as a part of a grander socially institutionalised life-sequence that shapes when individuals both join and leave the labour market (Radl, 2013). Researching the work-life from a sociological perspective, retirement is seen as the standard final stage of an individual's life-course which always follows after a long spell in the labour market.

Unlike the life-cycle model, this theory does not consider the transition to retirement from employment as a consequence of rational economic behaviour, but rather as something determined by socially constructed norms of age-appropriate behaviour (Radl, 2013). Individuals are not seen as rational utility-maximisers but are instead interested in aligning themselves to an implicit age-appropriate behaviour as determined by society. Proponents of the life course theory further argue that this age-appropriate behaviour is not just an idea, but something formalised through institutions within the welfare state, leading to a constant reinforcement of the socially acceptable age behaviour throughout life (Radl, 2013).

Applying the life course theory to explain behavioural changes caused by an SRA reform, it would view it as a shift in the socially acceptable retirement age of a society (Maltby, de Vroom, Mirabile, & øverbye, 2004). Thus, by increasing the SRA the life course theory would simply explain any behavioural changes as individuals aligning themselves to changing societal expectations where ones should work for longer and retire later (Radl, 2013).

Although clearly useful for analysing the length of labour market participation, the life course theory is of questionable use for assessing a reform that had such a recent and immediate impact. As argued by Vermeer, van Rooij, and van Vuuren (2014), it is not clear within the literature how sticky old norms are and if a change in the socially acceptable retirement age has an immediate or laggard effect. Therefore, it is debatable if the SRA as a formalised socially acceptable retirement age norm can be applied to this case, as it is unclear whether it had time to both change and embed itself in society after such a short time.

Reviewing these two frameworks they both provide solid frameworks for explaining the effects of an SRA increase. This thesis will however exclusively utilise the life-cycle model because in the author's view the life course theory framework contains limitations that preclude it from being used here. Nevertheless, the life-cycle model should be more than sufficient as it contains clear, theoretically consistent explanations for the effects of an SRA reform on the labour market participation of old-age individuals.

4.2 Expected Effects Based on the Life-Cycle Model

The life-cycle model is a theory of consumption which at its core assumes that individuals plan their consumption pattern across their entire life and seek to maintain a similar level of consumption from birth to death. This level of consumption is in turn determined by whatever mix of leisure and consumption that results in the highest level of lifetime utility (Blundell, French, & Tetlow, 2016). Because individuals want to maintain a smooth consumption level, it is assumed that they borrow to consume early in life when their income is low, save money when they are in their prime working years, and then dissave once they are retired with no work income. Facing no uncertainty, this allows an individual to perfectly plan their retirement since it will occur once said individual has accrued sufficient savings from working to maintain their smooth optimal consumption until death (Cooper & John, 2013). Planning was initially theorised to be based on expected life-time work income and life-expectancy, later developments were however made to further incorporate social benefits into the life-cycle

model, meaning that an individual's retirement decision also incorporates expected pension benefits (Blundell, French, & Tetlow, 2016).

Applying the life-cycle model to Dutch society during the AOW reform, three different effects are expected to influence Dutch individuals' labour market participation as a consequence of the reform. First, is a negative wealth effect which refers to an absolute decrease in total lifetime income. The second is a liquidity effect which refers to an inability to maintain a smooth consumption by borrowing. The third is a substitution effect which refers to an increase in the relative value of leisure to labour. (Ardito, 2021).

First and foremost, increasing the AOW eligibility age should result in a negative wealth effect for anyone affected. Delaying the eligibility age reduces the total lifetime amount of pensions an average person can claim. This by extension shrinks the lifetime budget constraint, to the extent where the old optimal level of lifetime consumption might not be possible (Manoli & Weber, 2016).

A rational individual will respond in one out of two ways. They can either increase their labour supply (work for longer) to offset the loss of wealth and therefore be able to still maintain the optimal level of consumption throughout their remaining lifetime. Alternatively, they can reduce earlier consumption and increase savings to build a buffer for smoothing consumption during the benefit eligibility gap created by the reform (Blundell, French, & Tetlow, 2016). Out of these two responses it is expected that most should lean towards delaying retirement and increasing their labour supply. The reason for this is that the implementation of the AOW reform came very close after its announcement, giving affected individuals a relatively short time to react. Individuals who suddenly faced this wealth shock would most likely be unable to absorb it without a drastic unacceptable change in their current consumption level (Mastrobuoni, 2009).

Secondly, there is the liquidity effect which is related to the fact that future public pension tends to be highly illiquid, i.e. a person cannot borrow against it without facing high transaction costs (Ardito, 2021). The liquidity effect means that as public pensions make up a significant part of a Dutch household's retirement income (European Commission, 2021), individuals might simply not be able to stop working and retire before these benefits become available, as they are highly dependent on the AOW pension to maintain a smooth level of consumption. Consequently, once facing the above-mentioned negative wealth shock, individuals could be

forced to continue working until they reach the AOW eligibility age at a later time, unless they have access to other social benefits (Blundell, French, & Tetlow, 2016).

Finally, relating to the wider Dutch welfare system there is also the potential for a substitution effect as other welfare programmes (UI, DI), pension benefit rules, wage opportunities, and age can influence how the individual assesses the general attractiveness of working at different stages in life.

Because the AOW pension level is not connected to any requirement of contributing to the system, there are limited incentives to actually work (and contribute) all the way until the AOW eligibility age. As a consequence, if allowed to incorporate benefits into their lifetime budget constraint, individuals might start to claim other benefits (UI, DI), as it would allow them to enjoy leisure when expected but still maintain a relatively similar level of consumption (Blundell, French, & Tetlow, 2016). As further argued by Blundell, French, and Tetlow (2016) old age also increases the personal cost of working as individuals see a health depreciation and potentially decreased productivity. Individuals might therefore be unwilling to work after a certain age since the utility gained from increased consumption does not outweigh the lost utility of reduced leisure. Therefore, because of potential change in the relative cost of work during an AOW bridge period, even if an individual chose to delay retirement, it is not certain that they will find continued work to be optimal.

Taking these three effects together it is expected that overall, individuals affected by the AOW reform will adjust their labour market behaviour by delaying their retirement and increasing their labour supply, once faced an increased AOW eligibility age. However, because of the substitution effect, the increase in employment should be smaller than the decrease in retirement as some individuals will choose to finance the bridge period in other ways than continued work. Thus, based on life-cycle model it is possible to formulate the following hypotheses:

H1a: The increase in the AOW eligibility age will lead to an overall delay in retirement among individuals affected by the AOW reform.

H1b: The increase in the AOW eligibility age will lead to a smaller overall increase in employment among individuals affected by the AOW reform.

Utilising the same life-cycle model but allowing for more parameters to be included there is the potential for explaining significant heterogeneity in individuals' adjustment, based on the socio-economic characteristics of health, occupation, and wealth.

The inclusion of these socio-economic characteristics does complicate the life-cycle model slightly, since it incorporates diversity in how individuals would respond to the above three effects, by including individual preferences for things other than leisure and consumption (Blundell, French, & Tetlow, 2016).

Several scholars have already sought to develop the life-cycle model's framework to also account for health (Dwyer & Mitchell, 1999; Kuhn, Wrzaczek, Prskawetz, & Feichtinger, 2015; Scholz & Seshadri, 2013). Although their arguments differ slightly, the central idea which is relevant for this research is that health is a good that individuals value. Thus, when individuals plan their retirement and this plan is abruptly altered due to reform, they will not only seek to balance leisure and lifetime consumption but also take into account the impact working for longer will have on their current and future health. The extent to which an individual can be induced to delay retirement and continue to work for longer is therefore highly dependent on their health. Especially poor health is expected to disincentive individuals to both delay retirement and work for longer. This is as, not only does poor health affect the disutility of working (increases the relative value of leisure) (Kuhn, Wrzaczek, Prskawetz, & Feichtinger, 2015), but limits the actual ability to work (Dwyer & Mitchell, 1999), and increases the long term health cost of continued work (Scholz & Seshadri, 2013).

A person's occupation arguably plays a major role in whether an individual will continue to work during old age, up until their new SRA. As age increases, the discrepancy between what a person is able to do and what is required of them increases (Bellaby, 2006). This discrepancy is however not homogenous, as individuals employed in occupations requiring straining labour do not only face this discrepancy earlier, but also to a larger extent (Heyward & Hardy, 1985). Because of the difference between demand and ability, to continue to meet the work requirements it is expected that manual labourers have a higher level of work disutility than individuals working a job that does not require as much physically straining labour (Coulibaly, 2006). At the same time, the possibility exists that the work demand and ability discrepancy become so large that an individual simply becomes unable to (partially) work (Neumark & Song, 2018).

Finally, wealth is expected to affect the adjustment towards an increased AOW eligibility age. Applying the same liquidity effect as before, wealth is expected to affect how much a liquidity constraint, constrains an individual's retirement possibilities. The extent to which an individual relies on public AOW pensions for post-retirement consumption should determine how constrained they are by the AOW eligibility increase. Individuals with more wealth have the possibility to crowd out the public pension through occupational or private schemes (Blundell, French, & Tetlow, 2016). This, in turn, makes them less liquidity constrained since private pensions are available for early withdrawal, so an individual has the option to benefit from it for longer, at a slightly lower consumption level.

Therefore, from the adjusted life cycle model framework, it is expected that the effects of increasing the SRA would result in a heterogeneous adjustment effect. Both occupation and health result in a substitution effect by altering the relative value of leisure and consumption, by making work more costly when the health is poor, or the occupation is straining. Wealth on the other hand mainly affects the behavioural adjustment by negating the liquidity effect. If the wealth is high, there is less need to delay retirement and work for longer.

Thus, further accounting for a series of socio-economic characteristics, one can take the initially expected effect of an increase in the AOW eligibility age and modify it, resulting in the following hypotheses:

H2a: The retirement delay effect will be smaller for wealthier individuals, poor health individuals, and individuals with straining occupations.

H2b: The positive effect on employment will be smaller for wealthier individuals, poor health individuals, and individuals with straining occupations.

5. Research Design

5.1 Data

The research consists of a large-n quantitative study utilizing the Dutch "Longitudinal Internet studies for the Social Sciences" (LISS) panel dataset. The panel consists of survey waves from 2008 to the present with approximately 7,500 individuals from 5,000 households as respondents (Centerdata, n.d.-a). Although it is an unbalanced panel all survey waves are representative of the general Dutch population, as any attrition has not been found to be systematic (de Vos, 2009).

As the dataset consists of several surveys on different topics, not the entire dataset is needed. Data used in this research is delineated to data from the specific surveys "Background Variables", "Health ", "Work and Schooling", and "Economic Situation: Income" as they contain all the relevant variables discussed further below (Centerdata, n.d.-b).

The LISS panel dataset was selected as together, these surveys combined contain sufficient variables for sorting individuals into birth cohorts, measuring the length of treatment, observing the effect of the reform, and sorting individuals into groups based on their health, wealth and occupation. The second more fundamental reason why the LISS panel dataset was chosen is because it surveys respondents on a monthly basis throughout the year. This is important as the separate AOW eligibility increases are quite small, meaning that data in semesters or years would result in inaccurate measurement periods.

5.2 Data Selection

The analysis utilises the monthly "Background Variables" surveys from 2008 to 2021 as the main dataset. Complementing it, the socio-economic characteristics variables will come from the survey "Health ", "Work and Schooling", and "Economic Situation: Income" which are surveyed annually from 2008 to 2021. The one exception to this is 2014 when the survey "Health" was not conducted (Centerdata, n.d.-b).

Table 2: Utilised birth cohorts

Birth-cohort	Year of AOW eligibility	AOW eligibility age
1946	2011	65
1947	2012	65
01-01-1948 to 30-11-1948	2013	65 + one month
01-12-1948 to 31-10-1949	2014	65 + two months
31-10-1949 to 01-10-1950	2015	65 + three months
30-09-1950 to 01-07-1951	2016	65 + six months
30-06-1951 to 01-04-1952	2017	65 + nine months
31-04-1952 to 01-01-1953	2018	66
31-08-1953 to 01-09-1954	2019	66 + four months
31-08-1954 to 01-09-1955	2020	66 + four months

Source: Rijksoverheid (2019b)

The sample of individuals used for the empirical analysis includes all individuals born between 1946 and 01-09-1955 as seen in Table 2. This results in a birth cohort sample of ten distinct birth cohorts. Two birth cohorts (1946, 1947) are designated as the control group as they were not affected by the reform, reaching the AOW eligibility age before the AOW reform could be implemented. There is no AOW eligibility age difference between the two control birth cohorts

as it is 65 for both. They are nevertheless split into two distinct birth cohorts to maintain the same logic as the division of the treated birth cohort which is one year minus the eligibility increase. It is not possible to include any more birth cohorts from an early birth period without also shortening the age range during which individuals are surveyed, thus preventing a larger control group. As treatment group, this analysis utilises individuals from birth cohorts ranging from 01-01-1948 to 01-09-1955 which include eight discrete birth cohorts with seven different eligibility age increases. These increases range from 1 month to 16 months, from older to younger birth cohorts. For the same age range reason as with the control group, it is not possible to include any later birth cohorts in the treatment group.

To ensure that all individuals are observed for an equal duration of time, research will only observe individuals from the age of 62 to the age of 67. It would be preferable to observe individuals from an even earlier age to check for longer parallel trends. However, because the survey only started in 2008, there is no data available for individuals in the oldest birth cohort (1946) before the age of 62, thereby limiting this option.

This results in a final sample of 104,340 observations spread over 2135 separate individuals. This is an unbalanced sample, meaning that all individuals are not measured every period, but this is not an issue for a difference in differences analysis (Angrist & Pischke, 2015). Specifically for the heterogeneity analysis, because of response attritions, only a subsection of this data sample is available. This reduces the number of observations to only those where data on their socio-economic characteristics are available during the age of 62, 63, or 64. Although it varies depending on which variable is included in the regressions, the number of observations ranges from a sample of 78,381 observations to a reduced sample of 46,079 observations for the heterogeneity regressions.

5.3 Dependent Variables

The first outcome of interest is the state of being retired. It is conceptualised as the self-reported state where an individual perceives their primary occupation to be retired (Beehr & Bowling, 2012). This is a slightly different conceptualisation than the one used in similar SRA research where retirement is commonly conceptualised as when an individual begins to claim retirement benefits (Ardito, 2021; Rabaté & Rochut, 2019). Retirement is operationalised through the variable "belbezig" which asks an individual what their primary occupation is from 12 different categories. An individual is classified as retired if they respond with category 9 "Is pensioner ([voluntary] early retirement, old age pension scheme)".

A limitation of using self-perceived retirement is that it does not make it clear what an individual considers to be retired (Beehr & Bowling, 2012). Each respondent could view it differently, which becomes problematic if there is not a shared understanding of what is retirement entails. For example, individuals working part-time and pension collecting benefits could differ on if they consider themselves to be primarily retired or primarily employed.

An alternative conceptualisation that could have been used is whenever an individual has permanently exited the labour market, with no desire or need to ever return (Beehr & Bowling, 2012). This has the benefit of more clearly indicating if an individual is working or retired, as they become exclusionary states. However, a downside of such a conceptualisation is its inability to then distinguish between individuals who are retired, long-term unemployed, or disabled, reducing its usefulness for this research.

The second outcome of interest is the state of being employed, which similarly is conceptualised as a self-reported state where an individual perceives their primary occupation to be employed. Being employed is operationalised using the same "belbezig" variable where responses 1 "Paid employment", 2 "Works or assists in family business" and 3 "Autonomous professional, freelancer, or self-employed" indicate that an individual is employed. These three responses are recoded as response 1 "Paid employment" as functionally they do not differ for this research. Because the rationale behind the AOW reform is to increase employment and save money, individuals volunteering or working as a requirement for UI are not classified as employed since they cannot sustain themselves independently. It is important to note that this variable does not distinguish between part-time and full-time employment. Thus, there is a risk that individuals who work very few hours and primarily rely on private pensions or DI could nevertheless report themselves as primarily employed.

5.4 Independent Variables

To assess the effects of the 2012 AOW reform the independent variables used are age, time period, birth cohort, and age<AOW, the latter being the main treatment variable of interest. The first three variables are not theoretically relevant but are included as fixed effects and are necessary to construct the main treatment variable (age<AOW).

Age as a variable is based on the self-reported survey question "leeftijd" which simply asks the respondents to report their age in full years. This variable is preloaded in every survey which means that it is available for every period observed.

Time period as a variable indicates during what time period the outcomes are observed. It is based on the survey question "wave" which simply indicates which month and year the survey took place between January 2008 and December 2021.

The variable "birth cohort" is a constructed variable that indicates which birth cohort an individual belongs to. Ideally, as these birth cohorts do not perfectly align with birth years, they would be created using the direct date of birth of an individual. However, such detailed information is regrettably unavailable on an individual level, as the dataset only includes the year of birth. Nevertheless, using the age, year of birth, and time period of a survey allows for an approximate inductive identification of the relevant birth cohort for each individual.

By taking the reported age and birth year of an individual during the survey wave closest to the birth cohort cut-off, it is possible to determine if a person is approximately born before or after the cut-off. This can be combined with the year of birth to determine specifically which distinct birth cohort an individual belongs to. Because the surveys are monthly it is possible to determine an individual's age just before the cut-off, resulting in highly accurate birth cohorts. Based on this, a dummy variable is created for each separate birth cohort. Every separate individual in the dataset is given a 1 for the birth cohort dummy variable they belong to and a 0 for all others. These separate dummy variables are then remade into one birth cohort variable, with the birth cohorts being given a value between 0-9 based on birth period, with older cohorts having a lower value.

Finally, the independent variable of primary interest is the treatment variable age<AOW. It indicates the state of being eligible or ineligible for an AOW pension. The variable is binary and is coded as 1 for an individual any time (as determined by their birth cohort) they are below the age where they are eligible for an AOW pension. An important implication of this is that unlike traditional treatment variables where treatment is "switched on" at a certain time period, this treatment variable works in reverse. Individuals are treated from the first time they are observed (age 62) until they reach their AOW eligibility age during which the treatment is "switched off". This means that control birth cohorts are also treated but only until the age of 65, which allows them to still act as a control group for the birth cohorts who are treated for longer as a direct consequence of the AOW reform.

As age is only reported in years, to account for the fact that the eligibility age increased by months, the treatment variable is constructed so that an individual is considered treated until they reach their eligibility age in full years (65, 66) and following X - 1 time periods, depending

on how many months into the full year until they are eligible. For example, an individual with an eligibility age of 65 + 3 months is viewed as treated until they reach the age of 65 and the following two time periods since at that time, they should be approximately 65+3 months of age.

5.5 Socio-economic Characteristics Variables

The first socio-economic characteristic is health, conceptualised as self-perceived health. It is thus not connected to any objective standard but rather an individual's perception of their own health (Ilmakunnas & Ilmakunnas, 2018). Self-perceived health is operationalised by using the survey question "chXXY004" in the survey "health" which asks the respondent to rank their health. The response is measured on a 1-5 ordinal scale with 5 being "excellent health" and 1 being "poor health". Due to a lack of individual respondents who categorised their health as "very poor" (only 24) and "excellent" (only 32), the variable was recorded into only three categories of "moderate-poor health" (1-2) "good health" (3), and "very good health" (4-5).

Subjective health has the benefits of capturing the extent to which health issues are problematic for an individual and is more nuanced than a binary chronic versus no chronic issues (Albrecht, 1996). This operationalisation is not without issues however as due to the subjective and fairly technical nature of health, comparison between individuals becomes more difficult, as they can perceive different levels of health differently (Ilmakunnas & Ilmakunnas, 2018). Furthermore, there have been instances of reporting bias as individuals who want to exit the labour market can perceive their health as poorer than it is, as a type of justification for an exit (Gupta & Larsen, 2010).

To control that the effect is not purely driven by bias or reporting mistakes, an objective measure of health is also included through the question hXXY018 "Do you suffer from any kind of long-standing disease, affliction or handicap, or do you suffer from the consequences of an accident?". The objective health variable takes a binary shape with the value of 1 if true and 0 if not.

Wealth is the socio-economic characteristic utilised in the heterogeneity analysis. Drawing from the literature on early retirement behaviour there does not seem to be an accepted standard way of conceptualising wealth, with some including authors fixed assets such as housing and loans, whilst others only incorporate liquid wealth (Kuhn, Grabka, & Suter, 2021). Primarily driven by a lack of data, this research conceptualises wealth as private pension wealth, which only includes wealth accrued within occupational and private pension schemes (OECD, 2013).

The weakness of such a restricted measure of wealth is that it neglects other types of wealth (housing, equity) which have also been found to have an effect on both employment and early retirement (Cribb, Carl, & Tetlow, 2016; Kuhn, Grabka, & Suter, 2021).

Wealth is operationalised as the self-reported pension benefit accrued within any non-public pension fund. It is measured through the question(s) "What will be your gross pension benefit per year from the old-age pension age onwards, according to your overview." These questions ask respondents to report all pensions accrued in all separate private or occupational funds. Because there are no premade categories, it was decided to recode this variable into a dummy variable of 1 if the total accrued private pension is larger than €12,000 annually and 0 if not. Although seemingly arbitrary, €12.000 is approximately what an individual can receive annually through an AOW pension, not accounting for differences caused by inflation, marriage, or other related benefits (Sociale Verzekeringsbank, n.d.).

The final included socio-economic characteristic is occupation and it is operationalised using the variable cwXXY404 which asks the question "What is your current profession? / What profession did you exercise in your last job?". In this categorical variable, an individual self-categorises themselves into one of nine categories based on their occupation. The occupational categories are largely organised under high-skilled white-collar jobs (1-2), medium-skilled white-collar jobs (3-4), low-skilled white-collar work (5), and manual work of different skill levels (6-9). These categories do not perfectly align with the idea of occupational strain, nevertheless, there is a clear distinction between manual and non-manual jobs which indicates a degree of difference in strain between the groups. Furthermore, because of the diminished skill levels within the white-collar groups, it is also possible to separate white-collar workers with straining jobs (family carer) from more comfortable white-collar jobs (physician) (Maxwell, 2007).

This variable was therefore recoded into three groups where responses 1-2 became "skilled mental labour" 3-4 "intermediate mental labour" and 5-9 "manual labour". The choice of grouping low-skilled white-collar workers with manual labour is debatable since it is distinct from both higher-skilled white-collar work and manual blue-collar work according to the ISCO-08 classification (International Labour Organization, 2012). Nevertheless, for the purpose of this research, low-skilled white-collar work is more in line with manual labour based on the work characteristics, which involves physical activity to a much greater extent than their more skilled white-collar counterparts (Maxwell, 2007).

6. Empirical Strategy

6.1 Main Analysis

To isolate the effect of the AOW eligibility reform age on individuals' labour market participation, this thesis will adopt a difference-in-differences design (DID) inspired by Ardito (2021), where the 2012 AOW reform will function as a quasi-experiment between assumed similar groups.

With this design, the idea is that it will compare the change in the proportion of retired and employed individuals between treated and control cohorts across ages where they differ in terms of eligibility for AOW. Thus, if the proportion of retired and employment starts to differ between the groups after the age of 65, and before 67, since they are assumed to be otherwise similar, this difference can be attributed to the effect of the reform.

Simultaneously, because the implementation time and treatment length differ between treated birth cohorts, the empirical strategy is also designed to account for this difference. This is done by giving each treated birth cohort its own treatment length and start, rather than all treated birth cohorts having the same. As a consequence, treated birth cohorts with a smaller eligibility increase will transition into the control group faster (since the treatment is switched off at an earlier age) to which treated birth cohorts with a higher eligibility age are compared to. This allows for an accurate comparison at every age as only the treated birth cohorts who are actually still ineligible are viewed as treated.

The benefit of such a design is that can observe the effect of the reform across all eligibility increases at the same time, resulting in a model estimating the average effect of AOW reform, rather than each individual eligibility increase separately.

In simple terms, the analysis observes the outcome of all eligibility increases simultaneously which when combined results in the average effect of the reform. In formalised terms, it results in a model that looks the following way:

$$Y_{it} = b_0 + \delta_c + \gamma_a + \tau_t + \beta_1 [a < AOW]_t + \epsilon_{it} \quad (1)$$

Y_{it} refers to the two outcomes of either being employed or being retired, for every individual (i) at every time period (t), which in this situation is monthly. These outcomes are exclusive and binary with an individual reporting 1 if they are in either of the said states and 0 if they are not. The treatment effect of interest is denoted as $\beta_1[a < AOW]_t$, a dummy variable which is

1 for individuals who have not reached their AOW eligibility age and 0 for individuals that have, at any time period (*t*).

Because there is a strong reason to believe that an individual's retirement behaviour is affected by age and to control for any differences caused by having a different birth period, δ_c and γ_a denotes the fixed effects of age (γ) for every observed age between 62-67 (*a*), and the fixed effects of birth cohorts (δ), for every observed cohort between 1946 and 31-08-1954 (*c*).

As individuals from different birth cohorts are the same age during different time periods it is also necessary to control for the macro-economic context at every time period. This is because there is a risk that a difference in the economy could impact individuals' retirement decisions, meaning that any observed difference could be attributed to changes in the economy, rather than the effect of the reform (Rabaté & Rochut, 2019). This difference is controlled for by including the time period as a fixed effect with τ denominating the time period effects at any month between January 2008 and December 2021 (*t*).

A common issue for DID regressions is perfect collinearity between fixed effects (Rabaté & Rochut, 2019). However, as in this research age is measured in years, the time period is measured in months, and birth cohorts are based on a mix of the two, it is possible to include all three fixed effects at the same time.

ϵ_{it} means error for every individual (*i*) and every time period (*t*). Because individuals tend to retire around their SRA age (Ardito, 2021), and an individual can respond several times, independence of observations cannot be assumed. The errors are therefore clustered at a birth-cohort level as this can account for the non-independence both within and between individuals from the same birth cohort. Finally, the model is estimated using random effects rather than fixed effects, as it is more efficient (Baltagi, 2010), and there is no reason to believe that the random effects assumptions are violated in Model 1.

6.2 Heterogeneity Analysis

The second part of the analysis focus on synthesising research on general retirement behaviour with the average effect of increasing the AOW eligibility age (main analysis). Although only three out of many potentially influential variables, wealth, health, and occupation are included since there is strong theoretical and empirical evidence of these socio-economic characteristics being influential in determining individuals' labour market participation.

Borrowing again from the research design of Ardito (2021) this is done by taking Model 1 from the main analysis and interacting it with the socio-economic characteristics variables. However, unlike Ardito (2021) this analysis also includes these socio-economic characteristics as standalone main variables as it grants the model more explanatory power.

The second model should thus allow for heterogeneous outcomes dependent on socio-economic characteristics where one group is left as the reference category to which all other groups for each variable are relative to. Incorporating these new variables and interactions results in the following model:

$$Y_{it} = b_0 + \delta_c + \gamma_a + \tau_t + \beta_1[a < AOW]t + X_i + \beta_2\left[[a < AOW] \times (X_i)\right]_t + \epsilon_{it} \qquad (2)$$

Model 2 builds upon Model 1 which is used during the main analysis with the same fixed effects, time periods, main treatment variable and outcomes. The difference is that Model 2 further includes X which is the effects of every socio-economic characteristic for every individual (*i*). The model also includes $\beta_2\left[[a < AOW] \times (X_i)\right]_t$ which is the interaction variable of interest. It takes the shape of a dummy variable that equals 1 if the individual (*i*) is ineligible for AOW $[a < AOW]$ at a certain time period (*t*) and belongs to *X* group based on a socio-economic characteristic, and 0 otherwise. Important to note is that to prevent reverse causality, the socio-economic variables are measured at the ages of 62-64 and set as fixed for an individual throughout the observed period. The outcome is thus not the effect of those variables as observed during the same time period but rather of an earlier age.

Two main limitations of Model 2 make the internal validity of its findings weaker in comparison to model 1. First, when incorporating additional variables into the model the risk for omitted variable bias increases. Although a parallel trends test allows for a check of no omitted variables within model 1, when the socio-economic characteristics are included in model 2, it is no longer possible. There is therefore a risk that omitted variables could correlate with the newly incorporated variables, the new interaction effect, and the outcome, biasing the results (Angrist & Pischke, 2015).

A second limitation is that a key assumption of a random effect model is that the errors between individuals should not systematically differ from the errors within individuals. If this assumption is not met, then the coefficients will be inconsistent and biased. When conducting the heterogeneity analysis because these socio-economic characteristics are fixed within individuals and they risk introducing some omitted variable bias, it is questionable whether this

assumption underlying the random effects model is truly valid (Baltagi, 2010). To test this a Hausman test will is conducted and reported later in the result section.

7. Descriptive Statistics

Before any analysis is conducted it is necessary to briefly overview some descriptive statistics and assess their implications for the analyses. First, the size of the birth cohorts is assessed to control that no cohort is disproportionally small. Following that is a visual assessment of the outcome trends per birth cohort to test the parallel trends assumption. Finally, the socio-economic characteristics per individual will be tabulated between control and treated birth cohorts to ensure that they do not systematically differ.

Size of individual birth cohorts

As displayed in Table 3, the overall balance of observations is somewhat balanced between the birth cohorts. Although there is spread with certain cohorts having both more respondents and individual observations, no birth cohort is an outlier with vastly fewer or more observations. The smallest birth cohort is cohort "31-08-1953 to 01-09-1954" which with only 7,334 observations is almost half the size of the largest birth cohort which contains 13,994. However, 7,334 observations are still a large number of observations and there is no reason to believe that this birth cohort is systematically different from the others.

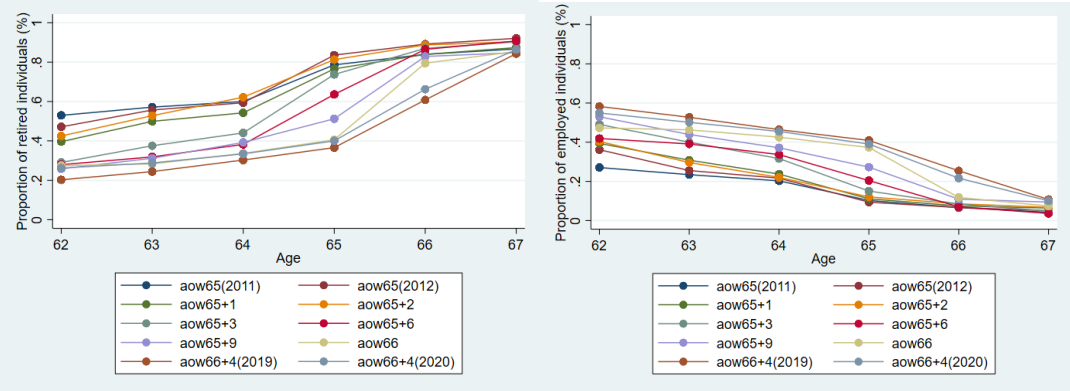
Table 3. Individuals and observations per birth cohort

Birth cohorts	**AOW eligibility age**	***N* individuals**	***N* observations**
1946	65	309	13,994
1947	65	272	12,749
01-01-1948 to 30-11-1948	65+1	197	10,291
01-12-1948 to 31-10-1949	65+2	260	12,364
31-10-1949 to 01-10-1950	65+3	176	9,590
30-09-1950 to 01-07-1951	65+6	160	7,911
30-06-1951 to 01-04-1952	65+9	166	9,630
31-04-1952 to 01-01-1953	66	185	8,928
31-08-1953 to 01-09-1954	66+4	130	7,334
31-08-1954 to 01-09-1955	66+4	215	11,549

Parallel trends assumption

To ensure that there is no systematic difference between the birth cohorts other than the treatment, Figure 1 maps the proportion of employed and retired individuals for each cohort across all observed ages. If the parallel trends assumption is true, it would expect that the trends of these outcomes should be similar for all cohorts between the ages of 62-64 and only begin differing at the age of 65.

Figure 1. The proportion of employed and retired individuals across birth cohorts and age



Note: The number in the brackets refers to the year of reaching eligibility to separate birth cohorts with the same eligibility age.

Reviewing Figure 1 several conclusions can be drawn. From ages 62 to 64, across all cohorts, the proportion of employed individuals remains fairly stable but decreases slightly every year. Similarly, but reversed, the proportion of retired individuals increases slightly every year. This is expected as during ages 62-64 the treatment effect is present for all birth cohorts, and no one was eligible for an AOW pension. Because of the increase in age, the number of employed and retired individuals does change but the trends are similar for all birth cohorts.

During the ages 65-66 there is a small increase in the spread between cohorts, which is explainable by the fact that treatment across the cohorts begins to differ. A visual assessment shows that at the age of 65, birth cohorts with an AOW age on the lower bound of 65 decreases more and cluster with a lower proportion of members still employed and a higher proportion being retired. Birth cohorts with an eligibility age in the upper range of 65 display a similar effect albeit not as large whilst cohorts with an AOW eligibility age of 66 display no change in the trend from earlier years.

At the age of 66, the remaining cohorts with an eligibility age of 66-66+4 months also start to differ from earlier years, with a substantially larger proportion of retired individuals and a small

proportion still employed. Finally, at the age of 67, all cohorts coalesce which is to be expected as at this age all cohorts have reached their AOW eligibility age. Based on the Figure, the parallel trends assumption does not seem to be violated, making a DID regression a valid design to answer hypothesis 1.

The cohorts all largely behave as expected with similar outcomes during ages where the treatment is the same for all groups (62-64, 67), and different outcomes during ages where treatment differs between groups (65-66). The shape of the trends supports the notion that hypotheses H1a & H1b are true as it seems that birth cohorts with a higher eligibility age tend to contain both a higher proportion of employed and non-retired individuals at older ages.

However, across ages 62-64, older birth cohorts do seemingly already showcase a higher proportion of retired and a lower proportion of employed individuals. Therefore, the risk exists that something occurred before the cohorts were to be observed which potentially affected the retirement and employment rate of older birth cohorts. If this change in older cohorts is not random, it raises the question of if these cohorts are fully comparable. Although data restrictions prevent the research from observing individuals at an even earlier age, a potential explanation for why they differ between already at the age of 62 could be because they face different retirement and employment conditions at an earlier age. Parallel to the AOW reform the Dutch welfare state has also developed which could have affected the possibilities for work and retirement for different birth cohorts differently.

Two examples of this already mentioned in the institutional background section are the decrease in UI claiming length and the dismantlement of the life course saving scheme. These changes in the Dutch welfare state have both potential to alter the employment conditions during observed years for older cohorts, and the potential to increase early retirement before the cohorts were to be observed.

Socio-economic characteristics

Table 4 tabulates the socio-economic characteristics as used during the heterogeneity analysis between the control and treated cohorts. When comparing the treated and control birth cohorts the groups show surprisingly similar outcomes for all socio-economic characteristics. Only for occupation do they differ slightly, as the treated birth cohorts contain a slightly higher proportion of skilled mental labour and a lower proportion of manual labour at the ages 62-64. Thus, there does not seem to be any systematic difference between the two groups, making a comparison possible.

One weakness which Table 4 showcases is that there is a large imbalance between the treatment and control group sizes, with the treatment group always having almost four times the number of observations. Although DID regressions do not require balanced groups, some of these groups are comparatively small with for example only 174 individuals from the control cohorts reporting their private pension wealth. Consequently, the results of heterogeneity analysis should be interpreted with a degree of caution, as with smaller groups, the outcome could be significantly affected by random error.

Table 4. Socio-economic characteristics per treated and untreated cohorts at the ages 62-64

Socio-economic characteristics	*N* individuals: Treated birth cohorts	*N* individuals: Control birth cohorts
Subjective health		
Very good	158 (17%)	43 (14%)
Good	560 (61%)	201 (65%)
Moderate-poor	195 (22%)	67 (21%)
N	913	311
Objective health		
No chronical issue(s)	522 (57%)	176 (57%)
Has chronical issue(s)	391 (43%)	135 (43%)
N	913	311
Occupation		
Skilled mental labour	155 (17%)	35 (11%)
Intermediate mental labour	326 (35%)	109 (34%)
Manual labour	452 (48%)	177 (55%)
N	933	321
Private pension wealth		
Large private pension	262 (44%)	86 (49%)
Small private pension	294 (53%)	88 (51%)
N	556	174

8. Results

The result section of this paper is organised in the following way. First, regressions R1 and R2 are conducted based on model 1, with the aim of finding the average treatment effect. This main model is used to answer hypotheses H1a & H1b and the question of what the average effect of increasing the AOW eligibility age is on retirement and employment across all affected individuals.

Regressions R3a-R3e and R4a-R4e are based on model 2 which uses model 1 as its baseline and then interacts the main treatment variable with a series of socio-economic characteristics

measured at the age of 62-64. The purpose of these regressions is to answer hypotheses H2a & 2b by analysing if the effects on retirement and employment of the reform are heterogeneous between individuals with different socio-economic backgrounds. For both groups of regressions, each socio-economic characteristic is first interacted with the main treatment variable separately. However, because of the likely possibility that health wealth, and occupation, and are correlated (Ardito, 2021), the final regressions (R3e, R4e) are fully saturated where all characteristics interacted with the main treatment effect simultaneously.

For all regressions (R1-R4e), the same reference categories apply for age, time period, and birth cohort. For the age variable, it is the age "62". For the time period variable, it is the period "200801" and for the birth cohort variable it is the birth cohort "1946". For the socio-economic characteristics, the reference categories are "very good health", "no chronic issues", "small private pensions", and "skilled mental labour".

8.1 Main Analysis Results

The results as seen in Tables 5 and 6, show the estimated average DID effect of the treatment variable (age<AOW) on the probability of being retired and employed, with its related p-value, z-score, level of statistical significance, robust standard error, and confidence interval at a 95% level.

The result of the regression can be interpreted as the probability difference of being retired or being employed for individuals ineligible for AOW in comparison to individuals eligible for AOW at every age. Because the coefficient is the average effect of several eligibility increases of different lengths (1-16 months) it is important not to treat this as a homogenous effect that applies equally to all birth cohorts. Rather, it is likely that the effects differ between the birth cohort which only had its AOW pension delayed by 1 month versus the birth cohort which had it delayed by 16 months.

Table 5: The average effect of increasing the AOW eligibility age on retirement

R1	Retirement	Robust Str. Err.	z-value	p-value	[95% Conf	Interval]	Sig
Age<AOW	-0. 231	0. 019	12.12	0.001	-0. 269	-0. 194	***
Overall r-squared		0. 219	Number of obs			104,340	
R-squared within		0. 351	R-squared between			0. 185	

*Notes: Includes fixed effects for age, time period, and birth cohort. Str. Err clustered at birth cohort level Estimated using random effects. p-values reported: *** p<0.01, ** p<0.05, * p<0.1*

As seen in Table 5, regression R1 finds that increasing the AOW eligibility age does have a substantive average effect, decreasing the probability of an individual who is now ineligible for AOW to be retired. Being ineligible for AOW (treated) results in a coefficient of -0.231 which can be interpreted as a negative a -23.1 percentage point difference in the probability of being retired relative to individuals who are eligible for AOW. This effect is statistically significant at the 0.01 level meaning that the null hypothesis of no effect can be rejected.

This result is in line with what was expected by hypothesis H1a since it does show that the AOW reform did induce individuals to delay retirement. When compared to similar studies the effect size is average and within reason for what could be expected. Although the difference between the previous studies is quite large, ranging from -0.115 to -0.478 (Ardito, 2021; Cribb, Carl, & Tetlow, 2016; Rabaté & Rochut, 2019; Staubli & Zweimüller, 2013) However, one must keep in mind that these results are not fully comparable with previous studies, as this analysis analyses the effect on self-reported retirement as a labour market state, and the studies used for comparisons analyses the effects on pension claiming.

Table 6: The average effect of increasing the AOW eligibility age on employment

R2	Employment	Robust Str. Err.	z-value	p-value	[95% Conf	Interval]	Sig
Age<AOW	0.123	0.015	8.19	0.001	0. 093	0.152	***
Overall r-squared		0.136	Number of obs			104,340	
R-squared within		0.227	R-squared between			0.119	

*Notes: Includes fixed effects for age, time period, and birth cohort. Str. Err clustered at birth cohort level Estimated using random effects. p-values reported: *** p<0.01, ** p<0.05, * p<0.1*

Regression R2 as seen in Table 6 showcases the result of the same regression but with the state of being employed as the outcome. The result of this regression finds that being ineligible for AOW (treated) results in a decrease in the probability of being employed compared to someone eligible for AOW pension benefits at the same age. The effect size is 0.123 (12.3 percentage points) and it is statistically significant at the 0.01 level. The result is in line with what was expected by hypothesis H1b since the increase in the probability of being employed is quite a bit smaller than the decreased probability of being retired. The effect size is on the larger size in companions to similar studies although still within the bounds of previous findings (Ardito, 2021; Cribb, Carl, & Tetlow, 2016; Rabaté & Rochut, 2019; Staubli & Zweimüller, 2013; Soosaar, Puur, & Leppik, 2021).

The above two results indicate that there is some evidence that increasing the AOW eligibility age cause individuals to delay their retirement in line with hypothesis H1a. Furthermore, it finds that the decrease in retirement is not matched 1:1 by an increase in employment as that increase is much smaller of about half the size. This was expected and is in line with hypothesis H1b as because of the substitution effect, not everybody prolonging their labour market participation was expected to do so through work.

8.2 Heterogeneity Analysis Results

To analyse if the effect of increasing the AOW eligibility age differs among subgroups within society, a series of regressions are run where the main treatment effect (age<AOW) is interacted with a series of socio-economic characteristics. Thus, not only do the regressions in Table 8 control for the same fixed effects as the main model, but also the effects of health, wealth, and occupation measured at the age of 62-64. As the number of regressions is quite high, Table 8 and Table 9 only report the coefficients, the standard errors in parathesis, and the statistical significance levels.

With the inclusion of interaction effects, the interpretation of the results is also slightly different. The effect of the main treatment variable can in model 2 be viewed as the treatment effect for the reference categories, whilst the treatment effect for the displayed groups is the main treatment effect and the effect of the interaction variable. Because the main treatment variable is the same for all groups, the degree of heterogeneity is then directly observable through the interaction variables coefficients.

Table 7: Hausman specification tests

Panel A: Regression R3e (retirement)	
Chi-square test value	124.654
P-value	0.01
Panel B: Regression R4e (employment)	
Chi-square test value	116.791
P-value	0.01

Finally, as discussed in the empirical strategy sections, because of the inclusion of more variables into the regression, the risk for omitted variable bias increases. This in turn risk violating a key assumption of the random effects model, indicating that perhaps a fixed effects model should be used instead. To discover which effects model is preferable, a Hausman specification test is conducted on the two saturated regressions (R3e, R4e). As seen in Table 7 panels A and B, the results of the Hausman specification test do not find the coefficients in

random effects models to be inconsistent and biased. Therefore, according to Baltagi (2010), since a random effect model is both more efficient and allows for the inclusion of time-invariant variables, it will be reported in the result section. The results of the regressions estimated using fixed effects model results can be found in Appendix A.

Table 8: The heterogeneous effect of increasing the AOW eligibility age on retirement

Variables	R3a	R3b	R3c	R3d	R3e
Main treatment effect					
Age<AOW	-0. 222***	-0.232***	-0.289***	-0.254***	-0.201***
	(0.023)	(0.022)	(0.030)	(0.027)	(0.067)
Health (self-assessed)					
Good health	-0.031				0.007
	(0.026)				(0.028)
Moderate-poor health	-0.072				0.021
	(0.034)				(0.038)
Age<AOW X Good health	-0.018				-0.027
	(0.031)				(0.034)
Age<AOW X Moderate-poor health	-0.112***				-0.128***
	(0.031)				(0.032)
Health (objective)					
Has chronic issues		0.018			
		(0.024)			
Age<AOW X Has chronic issues		-0.059**			
		(0.027)			
Private pension wealth					
Large private pensions			-0.002		0.025
			(0.021)		(0.025
Age<AOW X Large private pensions			0.014		0.013
			(0.035)		(0.033)
Occupational type					
Intermediate mental labour				0.086**	0.113*
				(0.041)	(0.059)
Manual labour				0.080***	0.119***
				(0.031)	(0.038)
Age<AOW X Intermediate mental labour				-0.032	-0.061
				(0.038)	(0.059)

Age<AOW X Manual labour				0.016 (0.035)	-0.027 (0.056)
Observations	77,481	77,481	46,079	78,381	46,079

*Notes: Includes fixed effects for age, time period, and birth cohort. Reference categories are individuals with very good health, small private pensions, and skilled mental labour. Str. Err clustered at birth cohort level Estimated using random effects. p-values reported: *** p<0.01, ** p<0.05, * p<0.1*

Table 8, regression R3a shows that there is a significant difference in terms of the retirement effect based on health. Although there is no difference between individuals of "Very good health" and "Good health", individuals reporting "Moderate-poor health" do display a larger negative effect size of -0.112 compared to the group with "Very good health". This effect is significant at the 0.01 level. The larger negative effect for poorer health individuals is seemingly robust as it stays significant in regression R3b when the subjective health variable is replaced by an objective measure and in regression R3e when all socio-economic characteristics are included simultaneously. The substantive outcome does however decrease quite sizably depending on if one looks at subjective or objective health as the coefficient for objective health interaction variables is only half the size (-0.059) and only significant at a 0.05 level.

Surprisingly, regression R3c-R3e shows that neither large private pensions nor having a more straining occupation results in a statistically significant heterogeneous effect. This lack of significant heterogeneity stays consistent both when the socio-economic characteristics are interacted separately and in the saturated model (R3e).

Across all regressions in Table 8, the main treatment effect stays statistically significant at a 0.01 level. The coefficient does shift a bit depending on the regression although it stays within a reasonable bound between -0.201 and -0.289. Finally, across regression R3a-R3e only occupation was found to have an effect on retirement as an independent variable. Individuals belonging to the groups "Intermediate mental labour" and "Manual labour" report ceteris paribus a higher probability of being retired which was expected.

The results in Table 8 are not in line with the expectations of hypothesis H2a. Not only do the regressions not find any statistically significant difference based on two of the three socioeconomic characteristics, but when they do, the effect is opposite (lower retirement delay probability) of what was expected (higher retirement delay probability).

Table 9: The heterogeneous effect of increasing the AOW eligibility age on employment

Variables	R4a	R4b	R4c	R4d	R4e
Main treatment effect					
Age<AOW	0. 173***	0.167***	0.140***	0.178***	0.146***
	(0 022)	(0.021)	(0.022)	(0.019)	(0.045)
Health (self-assessed)					
Good health	0.013				-0.001
	(0.024)				(0.025)
Moderate-poor health	-0.048				-0.039
	(0.035)				(0.035)
Age<AOW X Good health	-0.025				-0.003
	(0.024)				(0.026)
Age<AOW X Moderate-poor health	-0.127***				-0.101***
	(0.035)				(0.040)
Health (objective)					
Has chronic issues		-0.022			
		(0.024)			
Age<AOW X Has chronic issues		-0.084**			
		(0.035)			
Private pension wealth					
Large private pensions			0.006		-0.023
			(0.024)		(0.025)
Age<AOW X Large private pensions			0.034*		0.028
			(0.0178)		(0.019)
Occupational type					
Intermediate mental labour				-0.083**	-0.102**
				(0.041)	(0.050)
Manual labour				-0.11***	-0.122***
				(0.032)	(0.042)
Age<AOW X Intermediate mental labour				-0.019	0.042
				(0.031)	(0.044)
Age<AOW X Manual				-0.079***	-0.003

labour				(0.021)	(0.039)
Observations	77,481	77,481	46,079	78,381	46,079

*Notes: Includes fixed effects for age, time period, and birth cohort. Reference categories are individuals with very good health, small private pensions, and skilled mental labour. Str. Err clustered at birth cohort level Estimated using random effects. p-values reported: *** p<0.01, ** p<0.05, * p<0.1*

Reviewing the regressions R4a-R4d in Table 9 the results show that there is a statistically significant degree of heterogeneity in the employment response to the reform. Regression R4a shows that having "Moderate-poor health" is associated with a smaller effect on employment of the reform (-0.127) in comparison to individuals of "very good health", significant at the 0.01 level. These findings are further supported by both regression R4b and R4e which show that the smaller effect remains robust even when objective health is assessed (-0.084), and when all socio-economic characteristics are included at the same time (-0.101), albeit with a lower effect size which is still significant at the 0.01 level.

Regression R4b shows that individuals with "Large private pensions" could have a heterogeneous employment response to the AOW reform, responding with a larger positive effect on employment (0.034) than individuals with lower private pensions. It should be noted however that substantially this effect is quite small. This result is also of questionable validity as not only is it very weakly statistically significant (0.1 level), but the difference also becomes statistically nonsignificant in R4e once all other socio-economic characteristics are accounted for.

Finally, regression R4d shows that occupation could also potentially matter as individuals in the group "Manual labour" report a lower effect on employment (-0.079) than their reference category of "Skilled mental labour". Although this result is both substantially larger than the result for the private pension wealth and statistically significant at a 0.01 level, in regression R3e once all socio-economic characteristics are included, this effect also becomes statistically nonsignificant.

Throughout regression R4a-R4e the main treatment variable remains statistically significant at a 0.01 level. The effect size varies slightly (0.140-0.178) depending on which other variables are included. Among the socio-economic characteristics as independent variables only those belonging to the group "Intermediate mental labour", or "Manual labour" were found to have a negative effect on employment regardless of treatment.

The results of regressions R4a-R4e only very partially conform to the expectations of hypothesis H2b. Alike regressions R3a-R3e no heterogeneity was found based on either private

pension wealth or occupation. The results do however indicate that individuals with poorer health do have a smaller positive employment response than their healthier counterparts as expected by hypothesis H2b.

9. Discussion

Summarising the results of the analysis section, they are mixed in relation to what was hypothesised. Drawing from regressions 1 and 2 the hypotheses H1a *"The increase in the AOW eligibility age will lead to an overall delay in retirement among individuals affected by the AOW reform"*, and H1b*: "The increase in the AOW eligibility age will lead to a smaller overall increase in employment among individuals affected by the AOW reform"* can based on the above results be considered correct. The results do show that being ineligible for an AOW pension caused individuals to delay retirement and to a lesser extent for them to be employed for longer in comparison to someone of the same age but who is eligible for AOW.

The shape of the findings lends some credence to the argument that an SRA reform results in both a wealth, liquidity, and substitution effect. The reform did induce some delayed retirement and increased employment, indicating that the wealth and liquidity effects are present. Because these changes are not 1:1, a degree of substitution seems to be present, with some individuals delaying retirement but not replacing said delay with further employment. These individuals could potentially have switched to UI or DI. However, without an analysis of the effect on the claiming rate of other social benefits, the findings of this thesis are limited and cannot say anything about the shape of this substitution effect, and whether people actually claim other benefits or simply sustain themselves privately.

Furthermore, the results say nothing about the extent to which individuals continue to work. The research only looks at self-reported labour market status as employed or not employed. The findings do not indicate how much an individual is working nor if it is limited to part-time or full-time. It is possible that although the reform caused individuals to work for longer, part of the effect is offset by an adjustment in working hours. There are already reasons to believe that this could be the case considering that so-called "phased retirement" where individuals slowly reduce work hours in old age is already a common occurrence in the Netherlands (Bloemen, Hochguertel, & Zweerink, 2016).

Regarding the size of the findings, they are average for retirement and larger for employment compared to similar studies in different national contexts (Ardito, 2021; Cribb, Carl, & Tetlow,

2016; Rabaté & Rochut, 2019; Soosaar, Puur, & Leppik, 2021; Staubli & Zweimüller, 2013 Soosaar, Puur, & Leppik, 2021). However, here it is important to distinguish between ERA and SRA reform as the positive effect on employment found by this research, is larger than similar SRA reforms, but smaller than the effects of ERA reforms.

A potential factor explaining why the effect on retirement delay was not larger could relate to the fact that the AOW reform raised the eligibility age from the already high age of 65. It stands to reason then that the AOW reform retirement delay effects should be somewhat limited since as argued by Bellaby (2006) eligibility age increases for older individuals should induce a smaller effect than on younger individuals. One must also remember that the results are not fully comparable since this research used self-reported retirement as a conceptualisation for retirement whilst similar studies utilise pension claiming.

The effect on employment is larger in comparison to other SRA reform studies. Theorising why this is, there are two potentials reason tied to both the reform itself and the Dutch pension system in general. First, there was a very short period between the announcement of the AOW reform and its implementation. That, combined with the relatively rapid increase could mean that the wealth shock was severe in the Dutch case, and that individuals did not have time to smooth consumption by means (savings, reduced consumption) other than continuing to work (Mastrobuoni, 2009). The government's choice to pause the increase in AOW eligibility age in 2019 because individuals were struggling to adapt to longer working is an indication that individuals did consider the rise in eligibility age to be a shock (Irwin, 2019). However, such rapid and sudden change also occurred during the Estonian (Soosaar, Puur, & Leppik, 2021) and Italian (Ardito, 2021) SRA reforms, both with vastly lower effects on employment. It is therefore questionable if the shock level is sufficient to explain the large effect alone.

The second reason relates to the design of the Dutch pension system. The AOW grants a flat benefit from the day an individual becomes eligible. However, unlike many other public pension systems, it does not contain an ERA, preventing individuals from retiring early with a lower benefit level (OECD, 2017). This has implications for the strength of the liquidity effect since individuals are unable to trade part of their overall public pension income for a lower overall income, spread out over a longer time. Therefore, when faced with a wealth shock, unless they can privately fund their own retirement or get access to other social benefits, Dutch individuals, have limited options other than to work until they reach their later eligible age (Kahn, 1988). The lack of an ERA is somewhat rare but present in the Dutch system and could

explain why the positive effects on employment were higher in this context than what was found during the Italian (Ardito, 2021) and Estonian reforms (Soosaar, Puur, & Leppik, 2021), as both of those pension systems utilise an ERA.

The results from the heterogeneity analysis are unlike the results from the main analysis not especially convincing meaning that the hypotheses H2a *"The retirement delay effect will be smaller for wealthier individuals, poor health individuals, and individuals with straining occupations"* and H2b *"The positive effect on employment will be smaller for wealthier individuals, poor health individuals, and individuals with straining occupations"* are only very partially supported

The only significant and substantial heterogeneous effect found in the analysis was based on the health characteristic, between individuals reporting poor health or suffering from a chronic issue and individuals with very good health and no chronic issues. Although the shape of the effect was in line with the expectations for employment, contrary to the hypothesis, individuals with poorer health report a larger retirement delay.

One potential explanation for why this occurred could be the prevalence of so-called passive substitution. As argued by Rabaté and Rochut (2019), most of the substitution towards other social benefits is not a consequence of individuals who, once affected by an increased eligibility age, switch to social benefits, but rather of individuals already claiming social benefits simply claiming them for a longer. It could therefore be those individuals reporting poorer health have a higher chance of already claiming other social benefits since they are more likely to qualify for DI. If that is the case, then the contrasting results between higher retirement delay and limited further employment could be because poorer health individuals have both a disincentive to retire early (to claim DI for longer) and to be employed (access to benefits).

Having higher private pension savings than an AOW pension was not found to be statistically significant either as an independent effect or as interacted with the main treatment effect. Although this outcome is surprising there are two potential answers to why private pension savings did not result in a heterogeneous outcome. The first is that while in theory it would be expected that individuals who are less reliant on an AOW pension should not be as liquidity constrained, this does not account for the fact that individuals with higher wealth could have a higher level of optimal life-time consumption than individuals with lower wealth (Castro, 2006). It might well be that individuals with high wealth planned to retire once they could maintain a level of consumption where an AOW pension was nevertheless counted upon.

Therefore, when AOW benefits were postponed, an individual could despite having high private pension wealth be equally constrained as someone reliant on the AOW pension but has a lower desired consumption level.

An alternative explanation is that the opportunity cost of retiring could be relatively higher for high-wealth individuals. Blundell, French, and Tetlow (2016) argue that individuals with high private pensions tend to have higher incomes as well. This has the potential to also change the behaviour of individuals since a higher income increases the relative price of leisure (retirement), which in turn disincentivises individuals to retire before reaching their AOW eligibility age. However, had this been the complete explanation it would have been expected that individuals with high private pensions should have had a larger positive employment response, which was not the case.

Finally, also contrary to expectations, having a more straining occupation was also not found to result in a smaller heterogeneous response to the reform. Ardito (2021) argues that this occurred since, despite their more disadvantaged labour position, liquidity constraints prevent these individuals from both retiring and leaving work before the AOW eligibility age, despite the extra cost stemming from a decreased long-term health or disutility of work. However, if this explanation is to be fully valid, and manual labourer are more credit constrained, the analysis should have similar to Ardito (2021), found a larger retirement delay and positive effect on employment for these individuals, which is not the case.

10. Conclusion

This thesis has sought to broaden our understanding of the effects of increasing the statutory retirement age by answering the question **"How has the AOW reform affected the labour market participation of old-age individuals?"** The research was through a DID analysis, comparing birth cohorts facing different AOW eligibility ages, to see if the proportions of employed and retired individuals develop differently during ages where eligibility differs.

The expectation was that the AOW reform would lead to affected individuals delaying their retirement, and to a smaller extent increasing their labour supply until they reached their new increased AOW eligibility age. It was also expected that the severity of this effect would be heterogeneous across different socio-economic groups, as they face differing incentives and costs, which should cause them to adjust differently.

From the analyses conducted these expectations were only partially found to be true. It was found that increasing the AOW eligibility age does succeed in delaying the retirement of individuals and to a smaller extent increase their labour supply. The effect of the reform was also found to be partially heterogeneous with poorer health individuals seeing both a larger retirement delay and smaller positive effect on employment when compared to their healthier counterparts.

Based on these results the answer to the research question is that increasing the AOW eligibility age does lead to a delay in retirement for affected individuals. Simultaneously increasing the AOW eligibility also results in a smaller positive effect on employment for affected individuals. Therefore, whilst the AOW reform did succeed in increasing the labour market participation of older aged individuals, not all individuals participate through further employment. This participation change is also heterogeneous as poor health individuals participate to a larger extent but to a smaller extent specifically as employed.

Before concluding some limitations of this research needs to be briefly addressed. First, although the research identifies a gap in the retirement reduction and increase in employment, the research does not explore specifically to what extent this is the result of individuals substituting delayed pensions for other social benefits such as UI or DI. This makes it impossible to make any assertions regarding the concrete effect on the claiming rate on other social benefits because of the AOW reform. this is regrettable, considering the fact that the degree to which the reform causes individuals to spill over into other social benefits is of both high theoretical and practical significance. Additionally, the research also only looks at employment as a binary state, meaning that the findings say nothing about the type or extent to which individuals continue to work in actual working hours.

Another limitation relating to the validity of the findings is that it is not fully certain that all included birth cohorts are completely comparable. There is a 9-year difference between when the first birth cohort reached their AOW eligibility age and when the last one did. The welfare state is constantly changing, meaning that it is unlikely that all cohorts faced the exact same retirement conditions. This somewhat reduces the validity of the conclusions since it risks undermining a central assumption underpinning the analysis.

Specifically for the heterogeneity analysis, the used model is not a perfect model, and the author is aware that because of its simplicity there is a substantial risk for omitted variable bias. However, to maintain ease of interpretability, as well as due to limited knowledge of the

statistics field, the author did not want to stray too far away from the established research design by Ardito (2021), despite the fact that it does reduce the validity of the results.

Despite limitations, this thesis still generates some academic implications and opens further avenues for research. The research does find that the implementation of the AOW reform did in fact cause individuals to delay retirement and work for longer. Future research should aim to build on these findings by analysing the effect of increasing the AOW on a more diverse range of labour market states. Most important would be to analyse the effects of the reform social benefit claiming the size of the substitution towards other social benefits, although the effect on other states such as inactivity is also relevant. Another way further research could build upon these findings is by analysing the effects of the AOW eligibility reform on different types of employment. Literature on the rise of old-age part-time work already exists, but research on how increasing the SRA eligibility age could affect the prevalence of old-age part-time work leaves much room for exploration.

Finally, the long-term effect of increasing the AOW eligibility age is also something that warrants further research. As argued by Mulders (2018) and Vermeer (2016) the AOW eligibility age is not just a legal distinction but also a normative "normal retirement age", which sets the social standard for the acceptable retirement age. Thus, whilst the reform is still in progress and was tweaked as late as 2019, it would be interesting to analyse the effects at a time when the reform has matured, and the "normal" retirement age has shifted away from the traditional 65.

Within a practical context, the findings of this research lend credence to the overall rationale and justification for implementing the AOW reform. As seen by the results of this research, increasing the SRA does cause individuals to delay retirement which by extension reduces the pressure faced by the Dutch public pension system. It also increases old-age employment which should lead to more income for the state through taxes. Increasing the eligibility age does therefore seem to be a valid policy solution for at least partially increasing the sustainability of the public pension system.

However as argued by Bellaby (2006) such as solution does have its limitation, as after a certain age individuals might be unable to work any longer, possibly diminishing the effects of further increases in the eligibility age. Policymakers need to also be aware that not all individuals do delay their retirement and continued to work, especially individuals with poorer health. There is thus a need to weigh the potential budget savings with the implied social costs, as individuals

who are unwilling or unable to continue working are unlikely to be economically or socially better off as a consequence of the reform.

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Appendix A. Results of the fixed effects regressions

Table B1: The heterogeneous effect of increasing the AOW eligibility age on retirement with fixed effects

Main treatment effect	
Age<AOW	**-0.212*** **
	(0.011)
Age<AOW X good health	**-0.027*** **
	(0.007)
Age<AOW X Moderate-poor health	**-0.128*** **
	(0.009)
Age<AOW X AOW<private pensions	**0.015*** **
	(0.005)
Age<AOW X Intermediate mental Labour	**-0.061*** **
	(0.08)
Age<AOW X Manual Labour	**-0.026*** **
	(0.008)
Observations: 46,079	

*Notes: Includes fixed effects for age, time period. Estimated using fixed effects. p-values reported: *** p<0.01, ** p<0.05, * p<0.1*

Table B2: The heterogeneous effect of increasing the AOW eligibility age on employment with fixed effects

Main treatment effect	
Age<AOW	**0.142*** **
	(0.011)
Age<AOW X good health	**-0.002**
	(0.007)
Age<AOW X Moderate-poor health	**-0.100*** **
	(0.008)
Age<AOW X AOW<private pensions	**0.032*** **
	(0.006)
Age<AOW X Intermediate mental Labour	**0.043*** **
	(0.008)
Age<AOW X Manual Labour	**-0.001**
	(0.008)
Observations: 46,079	

*Notes: Includes fixed effects for age, time period. Estimated using fixed effects. p-values reported: *** p<0.01, ** p<0.05, * p<0.1*