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The Power of Announcements: Exploring the Announcement Effect on Consumption and Saving Patterns in The Netherlands

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The Power of Announcements: Exploring the Announcement Effect on Consumption and Saving Patterns in The Netherlands

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Abstract

An aging population has consequences for pension systems. To maintain sustainability, pension reforms are needed. Previous research focused on the causal effects of pension reforms on consumption and saving behavior instead of the announcement effect. Therefore, this research examines the announcement effect of Dutch pension system reforms on household heads' consumption and savings behavior. As the Life Cycle Theory predicts, consumption and saving patterns change at different points in life. Therefore, data on household heads between the age of 60 and the statutory retirement age is used to examine if they change their behavior in response to an announcement. A quantitative analysis of the announcement effect is made using data from the LISS panel between 2009 and 2022 and income statistics from the Central Bureau of Statistics. The empirical models indicate that announcements can change behavior differently between households with an income above or below the low-income limit. The regression discontinuity estimates indicate that the 2012 announcement positively affected consumption and savings while the announcements in 2015 and 2019 negatively affected consumption and savings. Furthermore, the 2012 and 2015 models indicated that households under the low-income limit change their consumption behavior significantly less. The negative effect on savings shows that the government should encourage people to save more for retirement, especially with the shift from defined-benefits to defined-contributions. The differences between income groups indicate that policymakers should consider supportive measures for low-income groups when designing pension policies.

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1. Introduction

1.1 Background

According to the World Health Organization, the number of people over 60 will almost double between 2015 and 2050 (WHO, 2022). An aging population also comes with consequences for the working-age population. A larger share of the elderly compared to the working-age population puts pressure on the contributions. To ensure that the elderly receive sufficient income for their old age and to guarantee that the working-age also receives retirement benefits in the future, pension reforms are needed.

The Pension at Glance report by the OECD provides insight into the pension reforms of OECD countries (OECD, 2021). One of the main solutions to the problem of the aging population is to increase the retirement age. There are still many differences between countries. Where the Netherlands starts to link the retirement age to life expectancy, the Slovak Republic reaches a retirement age of 64 in 2030 (OECD, 2021). Another solution is the cuts in benefits. An example of this is the abolition of the state pension partner supplement in the Netherlands (Tyros et al., 2022).

There has also been an increasing trend in the number of elderly people in the Netherlands. As of January 1st, 2022, there are over 3.5 million inhabitants over the age of 65. This is about 20 percent of the total amount of inhabitants, compared to 12.8 percent in 1990 (CBS, n.d.). Not only the number of elderly people has increased over the years, but the pressure on the labour force has also increased. In 2022, there are three people in the labour force age (20-65) for every person above age 65, compared to five people per 65-plus inhabitant in 1980 (CBS, n.d.). According to CBS (n.d.), this will even increase to almost two people in the working age for one 65-plus in 2040. When someone reaches the statutory retirement age, they can receive benefits from the Dutch state pension system (AOW). This is a basic pension that protects citizens from getting into poverty after the retirement age. Next to the general old age pension, the Dutch pension system consists of a supplementary pension and a third pillar for individual insurance. Through the increase of elderly people and the pressure on the labour force, reforms in the pension systems are needed to ensure the funding ratio in the state pension system and occupational pensions.

A few examples of these pension system reforms are as follows. In September 2008, the annual budget statement (Miljoenennota) for 2009 was released, with the introduction of the Deferred Pension Bonus (DFB) (*Kamerstukken I* 2008/9, 31700, nr. 2, p. 9.). In short, this reform of the second pillar is a tax credit for individuals who are still working from a minimum age of 61 (Jongen, 2016). Following this, a reform of the state pension was announced in July

2012. The First Chamber agreed on a new law to gradually increase the AOW age per the first of January 2013 (Hoppers, 2012).

1.2 Relevance

This research on pension system reforms differs from other research, in the way that previous research focuses on the causal effect of retirement on consumption patterns (Been & Goudswaard, 2021; Battistin et al., 2008). In this paper, the focus lies on the effect of announcements of multiple pension reforms on consumption and saving patterns. The expectation is that reforms can negatively impact the timing of consumption, as an individual can smooth their consumption before retirement if they expect a negative financial impact from the reforms. The announcement is used as a discontinuity, to examine the effects on consumption for someone close to retirement. This relevance leaves out the crucial part of effects on the society as a whole.

This research on the effect of announcements of reforms on consumption and saving patterns has social relevance in multiple ways. For example, the announcement of an increase in the statutory retirement age can result in a decrease in consumption when an individual is still working. Their share of retirement compared to their life expectancy suddenly decreases. The downfall of this is the possible lack of financial literacy and not taking net replacement rates at retirement into account. When results show that savings do not increase government intervention might be needed to nudge people in the direction to save more.

Moreover, pension system reforms can lead to political debates about the income levels of retired people, contributions to pension schemes, solidarity, and sustainability of pension funds (Natali, 2020). When analyzing the announcement effect, the patterns of consumption and savings can be brought to light and potentially shape the political debates.

Finally, the aging population brings complications with it for future reforms to maintain the sustainability of pension funds. This research contributes to helping policymakers make an informed decision in their trade-off between policies.

1.3 Announcements

In the field of pensions, there is little research about the impact of announcements, whereas it has been more researched in other fields. In research about housing prices, Jud and Winkler (2006) found that the announcement of an airport expansion actually decreased the housing prices in the area before the actual expansion. In the field of climate policy, Smulders et al.

(2012) find that carbon tax increases emissions in the period between announcement and implementation. Using the evidence from research in other fields, the announcement of a pension system reform can affect the behavior of an individual concerning consumption and savings.

A paper by Olaffson and Pagel (2018) seeks to find evidence for the Retirement-Consumption puzzle. This puzzle consists of the decline in consumption patterns during the early periods of retirement (Olaffson & Pagel, 2018; Been & Goudswaard, 2021). They find that individuals increase liquid savings before retirement and reduce consumer debt (Olaffson & Pagel, 2018). This is in line with the Life Cycle theory, which suggests that individuals increase their savings when their income is higher and dissave when their income is lower, for example at retirement (Deaton, 2005). When combining this with the announcement of a pension system reform, this would imply that an individual increases their savings and decreases their consumption when a policy is announced that negatively affects future income. However, this may still depend on how close an individual is to retirement. In addition, healthcare spending increases with age due to a decrease in health and an increase in demand for health (Gu, 2020; National Academic Press (US), 2008). This possibly affects consumption patterns between the treatment and control groups. By choosing a treatment group of individuals close to the retirement age and a control group shortly after, the characteristics of these groups are similar. Therefore, this thesis asks: *What is the effect of announcements of pension system reforms on the consumption and saving patterns of household heads close to retirement in the Netherlands?*

In the following chapters, this research starts by focusing on the theory behind the phenomena of consumption smoothing and saving for retirement. One of the main theories here is the Life Cycle Theory by Modigliani, which was first introduced in the 1950s (Deaton, 2005). Another focus in the theoretical chapter is the effect of announcing a policy on an individual's behavior and the differences in income levels. After the theories, the hypotheses for this research follow. The following chapter, the research design, will contain the method being used for the analysis and an explanation of the data. The analysis will start by providing descriptive statistics. Following, the empirical models and the results of the analysis are provided. At last, the conclusion and discussion of this research are provided. There will be a critical discussion on the implications of the results on the literature and the limitations of the research and/or analysis.

2. Theoretical Framework

State intervention regarding pensions suggests that the market for pensions does not work when we would leave the market up to only the consumers and producers of pension products and plans. Why does this market not work and why do we need government intervention? Nicholas Barr (1998) describes that we either need government intervention when there are market failures or when we want redistribution. Market failures occur when there are, among other things, incomplete insurance or information problems, like financial literacy. We want insurance after retirement as we do not know how long we live and therefore maybe save too little (longevity risk). Barr (1998) describes four conditions that need to be met to achieve complete insurance, namely: independent probabilities, probabilities are less than one, known probabilities, and finally complete information. Looking at information specifically, there must not be any moral hazard or adverse selection.

When applying this framework to retirement pensions, we notice that there is incomplete insurance. To start, there might not be independent probabilities as there can be shocks in the longevity risk such as the invention of medicines to increase someone's life expectancy. Following, as life expectancy may change, we do not know the probability of needing insurance, which makes calculating a premium increasingly difficult (Barr, 1998). Another problem is that we cannot estimate future inflation and it thus is an uninsurable risk (Barr, 1998, p. 211). Dealing with information asymmetry can also be a problem in terms of adverse selection. This comes down to the fact that an individual is more likely to buy insurance if they know they will need it. Concerning financial literacy, an earlier study by Spruit (2018) finds evidence of a negative effect of pension awareness on pension concerns. Furthermore, the study finds that men and higher educated people are more financially literate (Spruit, 2018). These reasons all support the framework that we need government intervention when there are market failures.

Apart from market failures, we also need government intervention for redistribution reasons. There can be redistribution from young to old individuals, where the older generation receives benefits while the younger generation pays the premium (Barr, 1998). The pay-as-you-go (PAYG) system of AOW in the Netherlands is an example of this redistribution. Another redistribution within pensions is between rich and poor, which also occurs under a PAYG system where richer individuals contribute more, but there are fewer differences between the benefits received. Finally, Barr (1998) describes the redistribution between men and women, since women live longer and can thus receive more benefits. Further research on the

redistribution between men and women shows different results, as women in the Netherlands receive 40% less pensions than men (OECD, 2021; NOS, 2021).

2.1 The Dutch pension system

As described by the framework by Barr (1998), government intervention is needed for pensions. When looking at the content of the Dutch pension system, it contains three pillars (Bovenberg & Meijdam, 2001; De Kruijf & De Vries, 2018). With these three pillars, it is possible to distinguish the Dutch pension system as a cappuccino model as it also has three layers. The first, and largest, layer is the state pension, followed by the occupational pension and private pension (Knoef, 2022b).

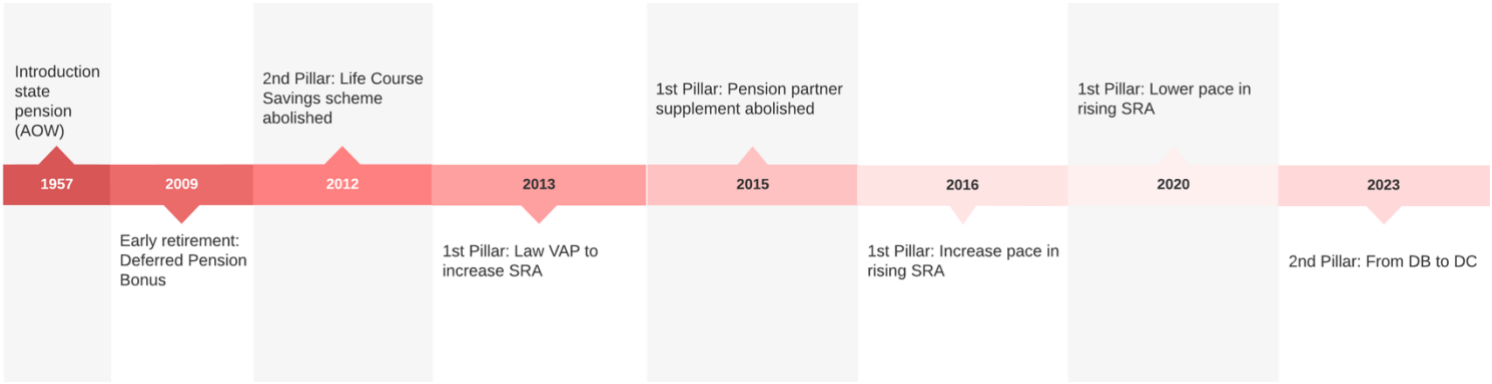
The state pension or basic pension (AOW) was introduced in the mid-1950s. One of the eligibility criteria for receiving the benefit is the number of years someone has lived in the Netherlands. To receive the full benefit, someone must have lived for 50 years in the Netherlands (Sociale Verzekeringsbank, n.d.). The financing is done through the pay-as-you-go system (omslagstelsel) where workers pay a premium to finance the state pension of the people who reached the statutory retirement age (SRA) (De Kruijf & De Vries, 2018). The contribution to this social insurance is mandatory for everyone who lives and earns income in the Netherlands (Belastingdienst, n.d.). The height of the benefit also depends on having a partner. The height of the AOW is 70% of the minimum wage if someone is single but is 50% of the minimum wage when someone is married or lives together (Ministry of General Affairs, n.d.). The major reform within this system, to maintain sustainability, is to gradually increase the SRA to match the life expectancy. The first agreement was made in 2012 with a law to let go of the SRA of 65 and gradually increase it with life expectancy (Wet VAP) (Eerste Kamer der Staten-Generaal, 2012). Afterwards, in 2015, a law was agreed upon to speed up the increase in SRA to maintain solidarity between workers and non-workers. This led to societal tension, where the Dutch parliament agreed in 2019 to lower the pace again, leading to a statutory retirement age of 67 in 2024 instead of 2021 and the attachment of life expectancy starting in 2025 (Eerste Kamer der Staten-Generaal, 2012). Other reforms regarding the state pension and the other pillars will be mentioned in the following section of this chapter, where a table with an overview of the reforms is provided.

Looking at the second pillar of the Dutch pension system, this supplements the benefits that an individual receives from the state pension. The benefits from the occupational pension are built up through an arrangement between the employer and employee. Both pay monthly premiums, where the height depends on the monthly wage and the arrangement that is provided

(Atav et al., 2019). In principle, occupational pension schemes are not mandatory. However, it can be made mandatory by the government for a profession or sector when an agreement is made between employers and employees (Tyros et al., 2022). This ultimately results in the fact that 90% of employees are enrolled in occupational pension schemes (Tyros et al., 2022). This does not take the self-employed into account. They carry their own responsibility to supplement their state pension. In June 2019, the Dutch government announced to reform its current pension system (Van Hekken et al., 2022; OECD, 2021). Due to increasing life expectancy and increases in the share of pensioners compared to workers, the sustainability of the system was in danger (Atav et al., 2019)**.** While the Dutch pension system is transitioning in the period between 2023 and 2027, obtaining insight into changes in the behavior of Dutch citizens is important to help optimize the policy reforms. The transition of the second pillar will consist of better communication with participants to increase their basic insight and help them make informed choices on their pension plans (Van Hekken et al., 2022).

The third pillar in the Dutch pension system consists of private pensions. This pillar is based on individual savings. Adding this third pillar to the state pension and occupational pension, results in an increase in the median replacement rate from 68 percent to 82 percent (Knoef et al., 2017). Compared to the mandatory first pillar and quasi-mandatory second pillar, the third pillar of the Dutch pension system is not mandatory. Though, it can be very useful for self-employed individuals or individuals who are not enrolled in occupational pension schemes (Pensioenfederatie, n.d.).

Figure 2.1: Timeline pension reforms



Based on the gross replacement rates, Knoef et al. (2017) find evidence for the size of the pension pillars. When taking the average for every income, the gross replacement rate for the state pension is close to 0.4 (Knoef et al., 2017). The occupational pension is slightly smaller with a replacement rate of over 0.3. Finally, private pensions and other pillars like housing and

human capital make up the remaining 0.15 with a total average gross replacement rate of about 0.85 (Knoef et al., 2017).

2.2 Pension reforms

Table 2.1 shows an overview of the recent pension reforms for the first and second pillars. Not only does it show what the reforms entail, but it also shows the difference in dates between the announcement of a reform and the actual implementation. To start with the oldest reform in the table, the Deferred Pension Bonus (doorwerkbonus) was introduced in 2009. This reform was announced on Prince's Day in 2008 when the government launches its plans for the following year. This bonus was meant for workers above the age of 61 to reduce early retirement (Jongen, 2016). Following the Deferred Pension Bonus, the Life Course Savings Scheme (levensloopregeling) was abolished in 2012. This scheme was introduced in 2006 to allow workers to save part of their income free of tax for early retirement (Jongen, 2016). This reform affected all workers and had a transition period until 2022 when it was finally abolished.

The pension agreement in 2010 introduced a plan to increase the statutory retirement age (Stichting van de Arbeid, 2010). In July 2012, the law VAP (law to increase the SRA) was agreed upon by the Senate to gradually increase the statutory retirement age from 65 to 67 in 2023 (Eerste Kamer der Staten-Generaal, 2012). The retirement age would gradually increase with life expectancy in the following years. The formula to calculate the new retirement age would be as followed.

$$V = (L - 18.26) - (P - 65)$$

Where V is the amount by which the SRA is increased. If V >= 0.25, the SRA is increased with 3 months. If in other cases V < 0.25, the SRA will not be increased (Eerste Kamer der Staten-Generaal, 2012). L is the average remaining life expectancy after the age of 65. The Central Bureau of Statistics found the average to be 20.10 years in 2019 and 19.50 years in 2020 (CBS, 2021b). The number 18.26 was the average remaining life expectancy after 65 in the reference period of 2000-2009 (Tweede Kamer der Staten-Generaal, 2012). Finally, P is the SRA of the year preceding the calendar year of the increase (Eerste Kamer der Staten-Generaal, 2012).

Table 2.1: Pension reforms with their announcements

Implementation:	Reform:	Affected group:	Announcement:
2009	Early retirement: Deferred Pension Bonus.	Workers aged 61 or higher	September 2008
2012 - Transition period until 2022	2nd pillar: Life Course Saving Scheme abolished.	Every employee	September 2011
2013	1st pillar: Law VAP (2012) to increase SRA. - Before 2013: 65 - 2013: 65 + 1 month - 66 in 2019 and 67 in 2023	> Born from January 1948	July 2012 (Earlier announcement already pension agreement in June 2010)
April 1st 2015	1st pillar: Pension partner supplement abolished.	Individual reaching SRA with younger partner having low income. > Born from January 1950	1996
2016	1st pillar: Increase pace in rising SRA. - 67 in 2021	> Born from June 1950	June 2015 (Also mentioned in coalition agreement October 2012)
2020	1st pillar: Lower pace in rising SRA. - 67 in 2024	> Born from 31 August 1953	June 2019
Planning: from July 2023	2nd pillar: From DB to DC and more flexible pension with the state of the economy.	Every employee	June 2019

Sources: Eerste Kamer der Staten-Generaal (2008), Stichting van de Arbeid (2010), Eerste Kamer der Staten-Generaal (2012), Eerste Kamer der Staten-Generaal (2015), Eerste Kamer der Staten-Generaal (2019), Rijksoverheid (2019)

The state pension partner supplement was abolished in 2015. This was already shortly touched upon in the introduction of this research, but the announcement of this first pillar reform was first made around 20 years before and then again in the coalition agreement in 2012 (Rutte

& Samson, 2012; Tyros et al., 2022). The pension partner supplement was a supplement that was given to couples where the oldest partner retired, while the younger partner had a low income. Abolishing this supplement changes the future income for couples where the younger partner had an income of about 1400 euros per month in 2015 (Tyros et al., 2022). The supplement was received automatically on top of the AOW for the older partner and did not need any application (Tyros et al., 2022). As the implementation started on April 1st, 2015, this reform affected individuals, with a younger partner with low income, reaching the statutory retirement age after that point.

In the coalition agreement in 2012, Rutte and Samson also mention another increase in the statutory retirement age. Where the increase in SRA started in 2013, Rutte and Samson already announce an increase in pace for the retirement age (Rutte & Samson, 2012). Though the first announcement was made years before, the law to increase the pace was not agreed upon until June 2015 (Eerste Kamer der Staten-Generaal, 2015). Starting from 2016, the SRA would gradually increase to 67 in 2021 instead of 67 in 2023. The cohort that is affected by this reform are the individuals that reach the SRA after the reform is implemented. Individuals who are born after June 1950 are affected, since the retirement age in January 2016 is 65 years and six months (Eerste Kamer der Staten-Generaal, 2015).

In June 2019, the Minister of Social Affairs and Employment informed the Parliament of the pension agreement between the Cabinet and employer and employee organizations (Ministry of Social Affairs and Employment, 2020). This new pension agreement has the goal to increase transparency and make the system more personal (Ministry of Social Affairs and Employment, 2020). The first major reform that was introduced is the decrease in the pace of the rising retirement age. As was mentioned before, the SRA would be 67 in 2021 but, with this change, the retirement age in 2021 will be 66 and four months. The retirement age of 67 will be reached in 2024 (Rijksoverheid, n.d.). On top of that, the retirement age will not anymore increase by one year for every year increase in life expectancy. Instead, the SRA increases by eight months for every year increase in life expectancy (Rijksoverheid, n.d.).

The final reform that this research will focus on is another reform that was introduced by the pension agreement in 2019. The second pillar reform aims to reform the system from defined benefits (DB) to defined contributions (DC). The majority of the second pillar pension schemes in the Netherlands are DB schemes (Lutjens, 2022). This entails that benefits depend on the years worked for the employer, wages earned, and contributions that are paid for the pension (Bodie et al., 1988; Van Hekken et al., 2022). The switch from defined benefit schemes towards defined contributions puts more responsibility on the shoulders of employees and

focuses more on the contributions that they make. Since the trust in pensions under the younger generation is low, making the system more transparent is important to ensure the younger generation that they will have pensions in the future (Knoef, 2022a). To maintain the sustainability of pensions, the Dutch government also introduced more flexible pensions (Rijksoverheid, n.d. b). A more flexible pension implies that during a lesser state of the economy or setbacks in the financial market, premiums can be raised, or benefits can be lowered (Knoef, 2022a).

2.3 Life Cycle Model

In the 1950s, Modigliani first introduced the Life Cycle Theory (LCT). This theory made predictions about spending choices at a later age in life since income would change over time and through retirement (Deaton, 2005). The role of saving plays a big role in the consumption and saving behavior of an individual. They must make choices on whether they prefer consumption now or consumption in the future. Not only plays it a role for the individual, but this behavior also influences policymaking for governments. Some examples of this influence are the effects of demographic change on national savings, changes from defined benefit plans to defined contribution plans on saving for retirement, and the role of saving in economic growth (Deaton, 2005). Browning and Crossley (2001) emphasized consumption smoothing within the life-cycle framework. Consumption smoothing is not about keeping a certain amount of consumption equal over time. Instead, it focuses on keeping the marginal utility of spending money equal during the life cycle (Browning & Crossley, 2001). Consumption smoothing can be done at different frequencies. Allocating consumption within a year can look at differences where income is relatively smooth while consumption changes. Browning and Crossley (2001) find evidence for this in the month of December. This shows that consumption smoothing is indeed about marginal utility and not keeping consumption equal. Since this research focuses on the announcement of policy reforms, a different frequency is more applicable than looking at consumption smoothing between months. A more applicable frequency is the year-to-year smoothing. This looks at changes in consumption patterns between years (Browning & Crossley, 2001). Cyclical changes like this can be the result of changes in future prospects for employees. Through this direction, pension system reforms can change the consumption and saving behaviors of individuals. Another frequency of consumption smoothing is applicable, namely during the working life. Since the reforms in Table 2.1 influence the individuals who have not reached the statutory retirement age yet, it is essential to take the frequency of consumption smoothing during the working life into account. The pattern of income and

consumption takes an inverted U-shape during the working life (Browning & Crossley, 2001). An explanation for this is that households are uncertain about future income and are thus cautious about spending in the present (Nagatani, 1972). Another explanation is the assumption that we cannot spend more than we earn during a lifetime. Households are thus liquidity-constrained (Browning & Crossley, 2001).

When looking at the optimal amount of consumption, we want to maximize our utility at a given time. For this, we need to know the time preferences of an individual. This contains whether they rather spend their income now or spend it in the future. This also depends on the interest rate for saving the consumption for a future moment (Knoef, 2022b). The formula to calculate the optimal consumption is shown as follows.

$$c_{t+1} = (1+ r) / (1 + \rho) \text{ x } c_t \quad (1)$$

In this equation, c_{t+1} is the amount of consumption at time + 1. The letter r is the interest rate, while ρ indicates the time preference of an individual. Following this, c_t indicates the amount of consumption in the current year (Knoef, 2022b). Since optimal consumption equally accounts for interest rates and time preferences, it is possible to keep optimal consumption equal during the life cycle. For this to occur, the interest rate and time preferences must be equal. Based on the optimal consumption in the current year, the savings during the working life and retirement can be calculated.

$$S_{t+1} = (1 + r)S_t + w - c_t \quad (2)$$

$$S_{t+1} = (1 + r)S_t + b - c_t \quad (3)$$

Equation 2 shows the optimal savings during the working life. Here, S_t indicates the savings for a certain point in time. S_{t+1} are the savings in the following year, w shows the yearly income for an individual (including subsidies, wages, etc.), and r and c_t are respectively the interest rates and consumption in a certain year (Knoef, 2022b). Based on equations (2) and (3), where w (yearly income) is replaced by b (yearly income including pension benefits, subsidies, etc.), it is possible to calculate the savings during the life cycle. This Life Cycle Model (LCM) is, however, based on the assumption that there is no uncertainty. Improvements in this model would correct for uncertainties like increasing income during the working life or the uncertainty in interest rates. Though, this model is only a starting point in understanding patterns in consumption and savings.

The application of the LCM in the U.S. shows that defined-benefit pension plans help people save for retirement (Thaler & Benartzi, 2004). Though, when the shift occurs from a defined benefit to a defined contribution plan, individuals will have more responsibility in joining and choosing a savings rate for their plan. Thaler and Benartzi (2004) indicate that because of this shift, individuals save less, or even too little for retirement. A problem that occurs is hyperbolic discounting, or time-inconsistent behavior, as people make different choices depending on the distance of time (Thaler & Benartzi, 2004). A result of this is procrastination because an individual prefers the present over the future. Another problem is self-control. A system of defined contributions requires an individual to take more action to save more for retirement (Thaler & Benartzi, 2004). To cope with these problems, the Save More Tomorrow plan was designed. Every time an employee that signed up for the program receives a pay rise, the contribution to the plan automatically rises to counter the loss aversion. On top of that, contribution rates automatically increase to a set maximum and employees can opt out of the plan at any time (Thaler & Benartzi, 2004). The conclusion that can be drawn from this program is that participants significantly increase their saving rates as a result of their inertia (Thaler & Benartzi, 2004).

When savings increase for pensions, the net replacement rates might also increase. Interesting research on gross and net replacement rates at retirement is done by Knoef et al. (2016). The OECD (2021) defines the net replacement rate as the ratio between the individual net pension entitlement and pre-retirement savings. This also takes taxes and contributions to social security into account. For the calculation of the net replacement rate in the Netherlands, Knoef et al. (2016) also include private savings and housing wealth. To summarize their results, they find a median net replacement rate at retirement of 101%, over all age- and socioeconomic groups (Knoef et al., 2016).

2.4 Announcement effect

Previous research focused on the behavioral effect of individuals on their consumption and savings patterns as a causal effect of the pension system reforms. The research by Tyros et al. (2022) and Been and Goudswaard (2021), however, do not look at possible changes in behavior when a pension reform is announced.

Coupling the Life-Cycle hypothesis with reform announcements, individuals change their consumption and saving behavior in anticipation of future income changes. Fedotenkov (2016) examines the announcement effect of a change from a PAYG system to a more funded scheme. The numerical model of the study reveals that agents decrease their consumption and

increase their savings following an announcement (Fedotenkov, 2016). Announcing lower pension benefits or an increasing retirement age leads to reduced consumption in the short- and medium-run as individuals compensate for their future losses (Nickel et al., 2008). More evidence of the announcement effect is based on public pension reforms in Italy. In 1992, the announcement of an increase in the eligibility age for retirement occurred (Santoro, 2006). This affected the decision to retire for the Italian working population. The announcement resulted in a significant drop in employment and an increase in pension expenditure (Santoro, 2006). Thus, the announcement of a reform can negatively impact behavior prior to the actual implementation. The German case of an increase in eligibility age suggests a change in labour supply (Engels et al., 2017). Even though unemployment did not change, a shift in unemployment occurred with a decrease under the age of 60 and an increase above (Engels et al., 2017). As the announcement had no effect on unemployment overall, but merely a shift in when the unemployment occurred, labour supply changes are not included in the analysis.

Bütler (1999) researched behavioral changes following expectations prior to a reform. The timing uncertainty of a reform plays a role in the loss of welfare under middle-aged and elderly groups (Bütler, 1999). Timing uncertainty relates to the lack of knowledge of the timing of a pension reform. This differs from no uncertainty (an announced reform) to complete uncertainty (surprise reform).

Recent research contradicts the findings of announcement effects and expectations of pension reforms. Using panel data on individuals over the age of 50 and across 12 European countries, Ciani et al. (2022) do not find an announcement effect on expectations for a pension reform. However, they do provide evidence that individuals raise their expectations in the year prior to the reform, which is further amplified by media attention (Ciani et al., 2022). Both Ciani et al. (2022) and Bütler (1999) underline the significance of information in behavioral changes. To explore this effect and targeted announcements, a literature review on financial literacy will be conducted after the reflection on differences in income levels.

2.5 Differences in income levels

When examining behavioral changes in changing consumption and saving patterns, an important variable that influences these decisions is income. When increasing the statutory retirement age, an individual cannot receive state pension from their previously expected age. They have the option to either keep working or take early retirement. As mentioned before, the Deferred Pension Bonus was introduced, and the Life Course Savings Scheme was abolished in respectively 2009 and 2012. These policy reforms made it financially less attractive to go on

early retirement. When someone chooses to keep working, they will increase their income and possibly change their consumption and saving patterns before retirement. One might increase their consumption as the relative price of consuming a good becomes lower and an individual can increase their utility. This phenomenon of increasing consumption is the income effect (McKenzie, 2022). Another effect that might occur with increasing the statutory retirement age is the substitution effect. In this case, an individual might not be willing to delay their retirement and thus substitute the old age pension for other social insurances (Atav et al., 2021). Looking at the evidence on changes in labor supply in the Netherlands, Atav et al. (2021) find that an increase in SRA decreased the share of retired individuals by 57 percentage points. The substitution effect is apparent in the conclusion that, from this 57 percentage points decrease, about one-third (20 percentage points) enrolled in social insurance, with mainly disability insurance (Atav et al., 2021).

Looking at the differences in income groups, responses to pension reforms change depending on if someone has a high or low income. Tyros et al. (2021) find that with the announcement of the abolition of the pension partner supplement, people with higher wealth tend to retire earlier. This is because they will have less incentive to work longer, and the reform relatively affects them less. While this effect is found on the abolition of a supplement that was aimed at partners where the younger partner had a lower income, more evidence is found regarding an increase in the normal retirement age for West German men. With an increase in the normal retirement age from 65 to 67, overall behavioral effects are moderate (Etgeton, 2018). Though there is evidence that poorer individuals suffer the most from this reform as they react less to this increase (Etgeton, 2018). Because they react less, these individuals will experience higher financial losses. The results of this research suggest that individuals who are more vulnerable to poverty do not change their consumption and saving patterns as much as richer individuals.

When comparing this case to an increase in the early retirement age for women in Germany, the results differ. Etgeton et al. (2023) find that the reform resulted in a decrease in saving rates for higher-educated women and homeowners. An important limitation is that they do not include the effects on the savings of their partners. Neither does it include the changes in labor supply for the partners as a result of the reform. Since the increase in early retirement age for women does not have a significant effect on the savings and consumption of single women, it is not possible to conclude that an increase in retirement age results in lower saving rates.

The effects of a major Dutch pension reform on private savings decisions are researched by Lindeboom and Montizaan (2020). In 2006, pension rights were reduced for individuals born after 1950, and the Life Course Savings Scheme was introduced (Lindeboom & Montizaan, 2020). This reform had a large impact on pension wealth since the gross replacement rate of retirement at the age of 62 decreased from 70% to 62% (Lindeboom & Montizaan, 2020). The behavioral response differed between higher and lower waged workers. The results show that lower-wage workers postpone retirement to increase their replacement rate, while higher-wage individuals are more often enrolled in the Life Course Savings Scheme as a response to the loss in wealth (Lindeboom & Montizaan, 2020). This shows that higher-wage workers tend to save more for retirement than lower wage when affected by a future loss in income.

For this research, an important distinction is the difference between lower and higher-income groups. Since the research by Etgeton (2018) mainly found significant effects for individuals who are vulnerable to poverty, and Lindeboom and Montizaan (2020) also found different effects for lower and higher wages, a definition for lower and higher wage groups needs to be established. The definition for low income in the Netherlands is defined by the Central Bureau of Statistics (CBS) as people who live in poverty or people who have the risk of poverty. This normative concept has different meanings between countries. The United Nations defines poverty as an income of less than 2 US dollars per day (UN, n.d.). A more relative definition of poverty is used by the European Union. The Dutch definition of the at-risk-of-poverty is in line with the EU definition which states that the poverty threshold is 60% of the national median equivalized disposable income after social transfers (Eurostat, 2023). When comparing affected individuals by the pension reforms to the unaffected, a distinction is made between households with incomes above and below the low-income limit. As indicated by the literature, poorer households respond differently to pension reforms than richer ones. Table 2.2 below indicates the net monthly income limit for households to be at risk of poverty. The low-income limit in 2021 is based on provisional figures, while the low-income limit for 2022 is self-calculated based on the inflation in 2022. In 2021 the inflation was 2.7 percent and the inflation in 2022 was a record high since 1975 at 10.2 percent (CBS, 2023). Applying the inflation to the low-income limit for 2021, the net monthly household income limit is 1250 euros for singles in 2022. After calculating the income limit for singles, the equivalence factor is used to measure the income limit for different types of households.

Table 2.2: Low-income limit for Dutch households

Year	Single	Couple without children	Couple with 1 child	Couple with 2 children	Couple with 3 children	Single parent 1 child	Single parent 2 children	Single parent 3 children
	Net monthly houshold income in euros							
2009	930	1270	1550	1750	1920	1240	1400	1640
2010	940	1290	1570	1770	1940	1250	1420	1660
2011	960	1320	1610	1810	1980	1280	1450	1690
2012	990	1350	1650	1850	2030	1310	1490	1740
2013	1010	1390	1690	1900	2080	1350	1530	1780
2014	1020	1400	1700	1920	2100	1360	1540	1800
2015	1030	1410	1710	1930	2120	1370	1550	1810
2016	1030	1410	1720	1940	2120	1370	1560	1810
2017	1040	1430	1740	1960	2150	1390	1580	1840
2018	1060	1490	1800	2030	2220	1400	1610	1840
2019	1090	1530	1840	2080	2280	1440	1660	1890
2020	1100	1550	1870	2110	2310	1460	1680	1910
2021*	1130	1590	1910	2170	2370	1500	1720	1960
2022**	1250	1750	2120	2390	2620	1650	1900	2170
Eq factor until 2018	1.00	1.37	1.67	1.88	2.06	1.33	1.51	1.76
Eq factor from 2018	1.00	1.40	1.69	1.91	2.09	1.32	1.52	1.73

* = based on provisional figures. ** = an expectation of the low-income limit based on inflation in 2022
Source: CBS (2023), CBS (2021), CBS (2019), CBS (2014), CBS (2010)

Where differences in income levels may affect the behavior to consume or save after the announcement of a pension system reform, it may arise that it also affects the retirement decision. The decision to retire is most affected by the generosity of the early pension benefits (Van Soest & Vonkova, 2014). The deferred pension bonus in 2009 was already aimed to delay the retirement decision. Damman et al. (2011) find that the retirement decision also depends on financial wealth. The wealthier someone is, the more likely they are to retire earlier. Though this effect is smaller than the effect health has on the retirement decision (Damman et al., 2011). Moreover, Kuhn et al. (2021) find a negative effect of labour income but a positive effect of

private wealth on the decision to retire. The negative effect on the decision to retire implies a substitution effect of the pre-retirement income. When a pension reform announcement negatively affects a wealthy household or a household with a high labour income, the decision to retire early also results in a drop in monthly household income. This drop in income could explain consumption smoothing for this group.

2.6 Financial literacy

Knowledge of financial situations influences the decision-making processes. For pensions, the saving patterns can be analyzed based on the financial literacy of an individual. To give the concept of financial literacy more clarification, the definition consists of multiple concepts. The main concept is the understanding of financial concepts (Remund, 2010). Following this, Remund (2010) recommends a definition that also includes planning and decision-making in a changing economy.

The role of financial literacy around retirement has been researched extensively. Though there is an overall optimistic view on financial well-being, there are still differences between groups. Mostly older people who are higher educated and healthier tend to have a better view of their own financial well-being (Xue et al., 2020). The effects of financial literacy on consumption are also considered. It helps individuals make more informed decisions on whether to smooth or modify their consumption patterns around retirement (Xue et al., 2020).

Looking at the effect of financial literacy on retirement planning, Van Rooij et al. (2012) offer useful insights. They focus on Dutch households and the association between savings and financial literacy. It helps to gain these insights as the saving patterns might differ for individuals who know the consequences of an announced reform, compared to individuals who are not aware of what the consequences will be for them. Van Rooij et al. (2012) find that financially literate individuals have higher savings as the costs for retirement planning are lower and the effort to process retirement reforms is less for these individuals. An important limitation is, however, that it is uncertain if the introduction of a financial education program increases financial literacy and consequently savings (Van Rooij et al., 2012).

2.7 Hypotheses

The Life Cycle theory suggests consumption smoothing and an increase in savings prior to retirement. However, the switch from defined benefits to defined contributions, as is happening in the Netherlands, may lead to individuals saving too little (Thaler & Benartzi, 2004). More evidence shows that individuals anticipate the expected reforms by smoothing their

consumption and increasing their savings in the short- and medium-run (Nickel et al., 2008; Fedotenkov, 2016).

The first hypothesis examines the impact of pension reform announcements on consumption. Based on a numerical model, Fedotenkov (2016) found an effect of pension announcements on consumption patterns. In addition, Etgeton (2018) shows that poorer households change their behavior less than richer households. On the other hand, early retirement may also affect consumption with the decisions varying based on household wealth, with wealthier households being more likely to retire early. Kuhn et al. (2021) find a negative relation between labour income and early retirement, indicating a substitution effect. Since those households delay retirement, the announcement affects them more. However, when wealthy households do decide to retire early, they experience a drop in income, which could potentially result in consumption-smoothing. Therefore, the following hypothesis applies to the consumption patterns.

H0: The announcement of Dutch pension system reforms does not affect consumer behavior for households.
H1: The announcement of Dutch pension system reforms negatively affects consumption for households above the low-income limit.

Thaler & Benartzi (2004) find that individuals save insufficiently for retirement when the pension system changes to defined contributions as is happening in the Netherlands since the announcement in 2019. However, Lindeboom & Montizaan (2020) find evidence from the Netherlands with an effect of higher savings by richer households. In line with the theoretical evidence, the following hypothesis applies to this research.

H0: The announcement of Dutch pension system reforms does not affect savings.
H1: The announcement of Dutch pension system reforms positively affects savings for households above the low-income limit.

3. Research Design

Since this research aims to find the effect of the announcement of pension system reforms on the consumption and saving behavior of households, a Large-N design fits best to untangle weak causal links. A common research strategy for causal inference is the time series design. The time series design looks at the differences within one unit over a period of time (Toshkov, 2016). One of the strengths of this research design is that it blocks the influences of factors that do not change over the selected time. In addition, when there are factors that change over time, they can be blocked out by the time series design by increasing the observations (Toshkov, 2016). Contrary to the time series design, the cross-sectional design compares multiple units over one period of time. The strength of this design is that it blocks influences of time factors while other factors can be controlled for (Toshkov, 2016). When combining the strengths of the time series design and the cross-sectional design, it results in a panel design for causal inference. A panel design focuses on observations across units and across periods of time. Within this design, it is possible to account for the trends between the treatment and control groups while at the same time accounting for the differences between the units of observation (Toshkov, 2016).

3.1 Regression Discontinuity

A way to eliminate selection bias in research is by using a Regression Discontinuity design. This design relies on a quasi-random selection of the treatment and control groups using observational data (Toshkov, 2016). One of the features of the Regression Discontinuity design is that the treatment and control groups are very similar around the cutoff point (Van Lent, 2022). The cutoff point indicates which group receives the treatment and which does not. Since it is a quasi-random selection, it is possible that there are eligibility criteria for an individual to be able to receive the treatment. Angrist and Pischke (2014) identify a sharp RD design and a fuzzy RD design. Within a sharp RD design, there is a clear cutoff point for whether someone receives the treatment or not. An example made by Angrist and Pischke (2014) is the effect of the legal drinking age on death rates in the US. They find that there is a jump in the trend of death rates when the legal drinking age of 21 is reached (Angrist & Pischke, 2014, p. 150). The formula corresponding to a sharp RD design is as follows.

$$Yi = \alpha + \beta Xi + \rho Di + \varepsilon i$$

Within this RD formula, Yi is either the outcome variable for a given individual i or the outcome variable at a given moment i. α is the intercept variable and holds the amount of the outcome variable when all other variables are equal to zero. The variable Xi is the running variable of the model. In the case illustrated by Angrist and Pischke (2014, p. 152) the running variable is the age in months until the cutoff point at age 21. This variable could also indicate the years when looking at a specific year of a policy change. β is the coefficient corresponding to this variable. The variable Di is the treatment dummy which indicates 1 for someone who has received the treatment and 0 for someone who has not, with ρ capturing the treatment effect of receiving the treatment. Finally, εi indicates the error term. As the RD looks at the treatment effect around the cutoff point, it can be considered a Local Average Treatment Effect (LATE). The effect is considered local, as it does not measure the causal effect of people who never take the treatment or people who always take the treatment (Angrist & Pischke, 2014). A regression discontinuity model illustrates the treatment effects in a graph with the outcome variable and the running variable. The trends before and after the cutoff are not always linear or flat lines, as the non-linearity can be mistaken as a discontinuity (Angrist & Pischke, 2014). Therefore, it is important to choose the optimal form of the line that fits the observations the best. One way to do this is by increasing the polynomials of the running variable. The fit of this line can be checked with the values of R-squared or the T-values. Another way to check for a discontinuity at the cutoff point is by changing the bandwidth of the data. When zooming in on the observations around the cutoff, the treatment and control groups can become more comparable. This does, however, come with a limitation. When zooming in on the data, there are fewer observations, so the effect becomes less precise (Van Lent, 2022). On the other hand, when the bandwidth is increased, results become more precise but at the cost of a less comparable treatment and control group.

With a fuzzy RD design, there is no concrete switch between the treatment and control group at the cutoff point. In this design, the cutoff point indicates an increase in the probability of someone receiving the treatment (Angrist & Pischke, 2014). This section will not dive more into the fuzzy RD design as it does not apply to this research.

A sharp RD design is applicable even though there is a gap between the moment of the announcement of a pension reform and its implementation. The clear cutoff point is when the announcements of the pension system reforms are made. The moment of the announcement defines whether someone is part of the treatment group or control group based on whether the reform affects them or not. The affected groups have already been indicated in Table 2.1, but a clear definition of the group follows in the operationalization.

3.2 Case selection and data collection

The case for this research is the pension system reforms in the Netherlands. Whether a household lives under the low-income limit is used to look at whether poorer households change their behavior differently than households that have more to spend.

The data for this research is collected by the LISS (Longitudinal Internet studies for the Social Sciences) panel. This consists of 5,000 households with around 7,500 individuals, which creates a representative sample of the Netherlands (CentERdata, n.d.). By using this data, this research aims to generalize the effects of the analysis to the Dutch population. Data on the background variables from the LISS panel is available for each month. The core studies that apply to this paper are the Work and Schooling, and Economic Situation: Assets. Furthermore, assembled studies on Time Use and Consumption and Support for Pension Reform are used to gather additional variables that apply to this research. Apart from the LISS panel, data on the low-income limit is gathered through the Central Bureau of Statistics Netherlands based on their yearly reports of poverty statistics.

3.3 Operationalization

The outcome variable or dependent variable of this research is the variable that captures what the analysis tries to predict. In this case, the outcome variables are the variables of consumption and savings. The consumption variable in this research is questioned in the LISS panel as the total amount of household expenditure per month in euros (De Bruijne, 2013). This is a ratio variable as the consumption cannot hold a negative value and the variable has a meaningful zero. Since the total amount of household consumption is used as the outcome variable, only the household heads are considered in the analysis as this reduces potential issues with the interaction within households (Been & Goudswaard, 2021). An issue that remains is that this variable is based on the recollection of the respondents. This induces potential recall bias. This, however, does not cause any problems in the analysis as the recall bias occurs for every individual for every year of the analysis (Been & Goudswaard, 2022). The variable of savings has also been captured by the LISS panel through the question of the total balance of someone's banking account, savings account, term deposit account, saving bonds, or savings certificates (Streefkerk, 2016). As this variable can hold a negative value, this is not considered a ratio variable but an interval variable. The savings are measured in whole euros and indicate the total savings as of the 31st of December in the previous year.

The main explanatory variables, or the independent variables are the cutoffs at the announcements of the pension system reforms. There are four different independent variables,

one for each announcement of the pension reform. These variables hold the value of the year of the announcement. A complete overview of the announcements and implementation of the Dutch pension system reforms can be found in Table 2.1 of the theoretical chapter. The first announcement is the abolition of the Life Course Savings Scheme in 2011. This cutoff is modeled as *cutoff1*. The second cutoff, *cutoff2*, is the year of the announcement of the Law VAP, which announced the increase in the statutory retirement age in 2012. The third announcement, *cutoff3*, is when the Dutch government announced that they will increase the pace of the rising SRA in 2015. The final cutoff, *cutoff4*, is the year that the Dutch government announced that they will lower the pace again of the rising SRA. In the same year, 2019, they also announced that the second pillar of the pension system will change from defined benefit plans to defined contributions.

When defining the treatment and control group for this research, an important part is that the treatment group consists of individuals who are affected by the treatment compared to a similar group of individuals who are not affected by the treatment. For this research, the treatment is the announcements of the pension system reforms. The treatment group thus consists of the individuals who have been affected by these announcements. Considering the variable of consumption looks at the total monthly consumption of households, only household heads will be included in the analysis. As was shown in Table 2.1, all workers who have not yet reached the statutory retirement age or will not reach the SRA between the announcement and the implementation are affected. Though, all people who are younger than the SRA are affected, only those with a minimum age of 60 will be included in the analysis. The group younger than this has more time to adjust to the future differences in income and is less likely to show effects on their consumption and savings behavior. Another reason might be inertia since their retirement age can seem far away and therefore, they do not account for their retirement replacement rate. Since the control group must consist of people who are not affected by the announcements, this group consists of household heads above the statutory retirement age. The control group is limited to people under the age of 70 since the characteristics of the treatment and control group must be similar. The smaller the difference in age between the treatment and control group, the more similar the characteristics will be. The summary statistics of the treatment and control group will be shown at the beginning of the analysis, in the next chapter.

The *lowincomelimit* variable is a dummy variable based on the low-income limit for households in the Netherlands. The values are calculated by the limit for singles and the corresponding equivalence factor for the household size, which can be found in Table 2.2. The

dummy variable holds the value 1 if a household has an income lower or equal to the low-income limit. Further variables, and their measurements, that are used for this research and the analysis can be found in Appendix A. Combining the variables mentioned in this section, the following regression discontinuity formula can be composed.

$$Yi = \alpha+\beta i +\rho Di + \delta lowincomelimiti + \varepsilon i \quad (1)$$

This formula is based on a linear model. When increasing polynomials of the running variable to fit the model, the part of the formula with the running variable i will change, resulting in $\beta_1 i + \beta_2 i^2$. The running variable captures the timing and the distance to the announcements. Therefore, the running variable runs between 2009 and 2022. Yi is the outcome variable, which is either the average monthly household consumption or the total balance of savings in a given year i. α is the intercept of the model, which represents the constant number of consumption and savings independent from the other variables. Di is the treatment dummy which indicates if someone is affected by the announcement of a pension system reform with ρ indicating the coefficient of the treatment dummy. Furthermore, literature shows that households with a risk of poverty react differently to a policy reform than richer households. The variable *lowincomelimiti* is a dummy variable that indicates a 1 if a household lives under the low-income limit in year i and 0 otherwise. Lastly, εi is the error term for the regression. To reduce the likelihood of an RD mistake, an interaction variable and polynomials can be added (Angrist & Pischke, 2014).

$$Yi = \alpha+\beta(i - i0) + \gamma [(i - i0)Di] +\rho Di + \delta lowincomelimiti + \varepsilon i \quad (2)$$

Formula (2) captures the interaction between the running variable i and the treatment dummy Di. In this formula, ρ is still the jump of the outcome around the cutoff. This model now looks at the shared effect of the cutoff and the running variable by centering the running variable and subtracting the cutoff (i – i0) (Angrist & Pischke, 2014). A negative coefficient for this interaction term implies a decrease in the outcome variable around the cutoff point. Another interaction term can be added for the treatment dummy and the low-income limit as shown in Formula (3). This captures the effect of the cutoff for households under the low-income limit in the treatment group.

$$Yi = \alpha+\beta(i - i0) + \gamma [(i - i0)Di] +\rho Di + \delta lowincomelimiti + \eta(lowincomelimiti*Di) + \varepsilon i \quad (3)$$

3.4 Validity

This research looks at the target population of a group of Dutch household heads around the retirement age. The generalizability or external validity thus only applies to Dutch households with an age around the SRA. This means that a potential causal effect of the pension announcement is not further generalizable to all Dutch households.

Where the regression discontinuity design has a lower external validity, it compensates with the internal validity. Internal validity looks at the extent to which the observed effects are due to the main explanatory variable and not by other factors. As this quasi-experimental research design reduces the selection bias, the internal validity of this design is high. It reduces selection bias by comparing groups that are affected by the cutoff point. Research on the internal validity of the RD design further confirms that this method has high internal validity as the estimates of the RD bias are low (Chaplin et al., 2018).

4. Analysis

This chapter contains the descriptive statistics to compare the treatment and control groups. The empirical models follow after the descriptive statistics. Here, the effects will be visualized in multiple graphs to compare consumption and savings at different cutoff points. The analysis then showcases the estimation results of the regression discontinuity models. Separate models are used for each cutoff to ensure sufficient observations to estimate causal effects.

4.1 Descriptive statistics

The sample population of the LISS panel consists of around 5000 households with 7500 individuals (CentERdata, n.d.). Without further explanation, the descriptive statistics in Table 4.1 can indicate that the majority of the LISS panel population is used in this research. However, these statistics may be misleading. The number of observations in Table 4.1 is per household or household head per year. The number of unique observations is indicated by N* in the tables. The population for the treatment and control group in each year of the analysis can be found in Appendix B. The summary statistics below are provided for each period between the announcements of the pension reforms. Furthermore, the total means of the variables for the whole research period is provided. Here, it is apparent that the variable for additional pension information has very few observations. These observations stem from a cross-national survey that was executed in 2013. Since the means for the treatment and control group are similar, that close to ¾ of the observations received additional pension information, this variable will not be controlled for in the regression analysis. In addition, when the analysis would include this

variable, this would give the regression a smaller N since it only takes those individuals into account who participated in that survey.

Table 4.1 Summary statistics

Variable	Treatment						Control					
	N.	N*	Mean	Std. dev.	Min.	Max.	N.	N*	Mean	Std. dev.	Min.	Max.
Period 2009-2011												
Age	1,523	794	62.00	1.43	60	64	858	463	67.44	1.64	65	70
Education	1,428	745	3.56	1.56	1	6	807	439	3.40	1.51	1	6
Net hh. inc.	1,411	745	3336.72	11404.08	0	299660	817	443	2629.99	6328.12	0	285759
Low-income	1,523	794	.09	.29	0	1	858	463	.04	.20	0	1
Period 2012-2014												
Age	1,432	719	62.03	1.43	60	65	1,159	584	67.56	1.59	65	70
Education	1,363	685	3.76	1.49	1	6	1,107	557	3.53	1.50	1	6
Net hh. inc.	1,330	669	2846.96	6670.07	0	240000	1,104	553	3379.69	11477.53	450	266319
Low-income	1,432	719	.12	.33	0	1	1,159	584	.05	.22	0	1
Period 2015-2018												
Age	2,121	867	62.42	1.67	60	65	1,468	650	68.09	1.42	65	70
Education	2,041	838	3.78	1.48	1	6	1,415	624	3.71	1.47	1	6
Net hh. inc.	1,957	807	3226.55	6191.80	0	133537	1,376	614	2920.44	7270.71	0	184110
Low-income	2,121	867	.12	.33	0	1	1,468	650	.05	.23	0	1
Period 2019-2022												
Age	2,256	967	62.59	1.98	60	66	1,059	510	68.58	1.12	67	70
Education	2,170	934	3.93	1.41	1	6	1,023	493	3.79	1.45	1	6
Net hh. inc.	2,018	877	3530.75	7223.68	0	164714	994	482	3009.30	5757.31	0	178677
Low-income	2,256	967	.12	.32	0	1	1,059	510	.08	.27	0	1
Total												
Birth year	7,332	2,152	1953.09	4.03	1944	1962	4,544	1,366	1947.14	3.60	1938	1955
Gender	7,332	2,152	1.27	.44	1	2	4,544	1,366	1.28	.45	1	2
Education	7,002	2,060	3.78	1.48	1	6	4,352	1,308	3.63	1.45	1	6
Net hh. inc.	6,716	1,995	3265.93	7938.02	0	250270	4,291	1,299	3003.88	8134.37	0	184110
Low-income	7,332	2,152	.11	.32	0	1	4,544	1,366	.06	.23	0	1
Hh members	7,332	2,152	2.05	.99	1	8	4,544	1,366	1.72	.64	1	6
Additional pension info.	370	370	1.30	.46	1	2	339	339	1.27	.45	1	2

Note: N. is one observation per year per individual. N* are the unique observations during the period

The distribution of gender between the treatment and control groups is similar. In both cases, this variable indicates that approximately 72% of the household heads in this research are male. When looking at the education variable, which categorizes the highest-achieved education with a diploma, there are some differences between the groups. In total, the treatment group has on average a higher education of .15 on a scale from 1 to 6. The education level is between higher secondary education and intermediate vocational education. This variable is controlled for in the regression analysis to control for these differences. Another difference is the net household income. Where Knoef et al. (2016) find a net replacement rate at retirement of 101%, the descriptive statistics find that, on average, the control group has a net monthly household income of 250 euros less than the treatment group. Though this statistic does not take private wealth into account. To decrease bias and to increase the fit of the model, the net household income will also be included as a control variable. Where the treatment group

averages a higher monthly household income, more households are under the low-income limit. Of the 7,332 observations over the years, around 11 percent of the observations have a net monthly income under the low-income limit. The control group averages five percentage points lower. These numbers are supported by research from The Netherlands Institute of Social Research (SCP), which found that poverty is highest in single-parent families and for people under the age of 65 (Hoff & van Hulst, 2019). When receiving an old age pension, poverty decreases rapidly (Hoff & van Hulst, 2019). Additionally, the treatment group contains larger households, since it is more likely that they have at-home living children. To control for the differences in the share of households under the low-income limit and the number of household members, these variables will also be included in the regressions.

Table 4.2 Summary statistics outcome variables

Variable	Treatment						Control					
	N.	N*	Mean	Std. dev.	Min.	Max.	N.	N*	Mean	Std. dev.	Min.	Max
2009-2011												
Consumption	698	482	1469.63	1370.10	0	24779	500	354	1595.57	2337.93	0	47229
Savings	232	232	48562.64	117321.4	-33594	1500000	184	184	77918.27	561252.2	-26000	7612147
2012-2014												
Consumption	360	360	1568.5	1345.05	0	17820	358	358	1711.66	2391.36	0	41075
Savings	429	329	54441.86	95685.17	-100000	1220000	492	378	52573.15	215874.3	-21500	4107780
2015-2018												
Consumption	731	502	1743.77	1887.45	0	26395	701	509	1687.35	2275.80	0	32000
Savings	407	322	52912.84	161312.1	-100000	300000	388	305	54131.48	101089.8	-5600	900000
2019-2022												
Consumption	877	499	1862.24	1810.96	0	31300	572	367	1792.83	1758.83	0	20150
Savings	447	334	69204.80	198020	-3000	3800000	282	231	51544.33	66910.75	-20000	486000
Total												
Consumption	2,666	1,361	1687.39	1677.53	0	31300	2,131	1,152	1698.21	2185.25	0	47229
Savings	1,515	878	57486.58	152573.3	-100000	3800000	1,346	787	56271.52	252630.9	-26000	7612147

Note: N. is one observation per year per individual. N* are the unique observations during the period

Table 4.2 provides the summary statistics for the outcome variables. Total consumption and savings show similar results for the treatment and control groups, but the differences in periods between the announcements suggest a potential cutoff effect. Both groups contain significant outliers. Excluding the top and bottom one percent can eliminate potential measurement errors and improve robustness. Some observations were over 100 times larger than the previous percentile which skewed the data and were thus removed. This included groups that had very high positive and negative savings as well as groups with very high and no consumption at all. Table 4.3 illustrates the means after adjusting for the outliers, with a notable impact on the mean of the savings variable.

Table 4.3 Correcting outcome variables for outliers

Variable	Treatment			Control		
	N.	N*	Mean	N.	N*	Mean
2009-2011						
Consumption	600	431	1619.78	452	324	1595.87
Savings	228	228	40890.5	180	180	35210.08
2012-2014						
Consumption	333	333	1595.01	330	330	1661.52
Savings	418	321	48745.06	481	368	37788.14
2015-2018						
Consumption	679	475	1629.67	659	486	1563.38
Savings	398	316	44962.73	378	298	4529.06
2019-2022						
Consumption	828	485	1855.26	539	353	1706.16
Savings	438	329	53704.44	280	230	50248.22
Total						
Consumption	2,440	1,290	1699.06	1,980	1,093	1626.02
Savings	1,482	862	47986.63	1,319	777	42271.11

Note: N. is one observation per year per individual. N* are the unique observations during the period

Appendix C provides additional statistics to highlight the differences in variables between income levels of the treatment group. The table reveals that households above the low-income limit are more inclined to opt for early retirement, resulting in a lower household income. On the other hand, almost 30% of households under the low-income limit receive disability insurance. Additionally, the private wealth argument is supported, showing that people with higher savings were more inclined to opt for early retirement.

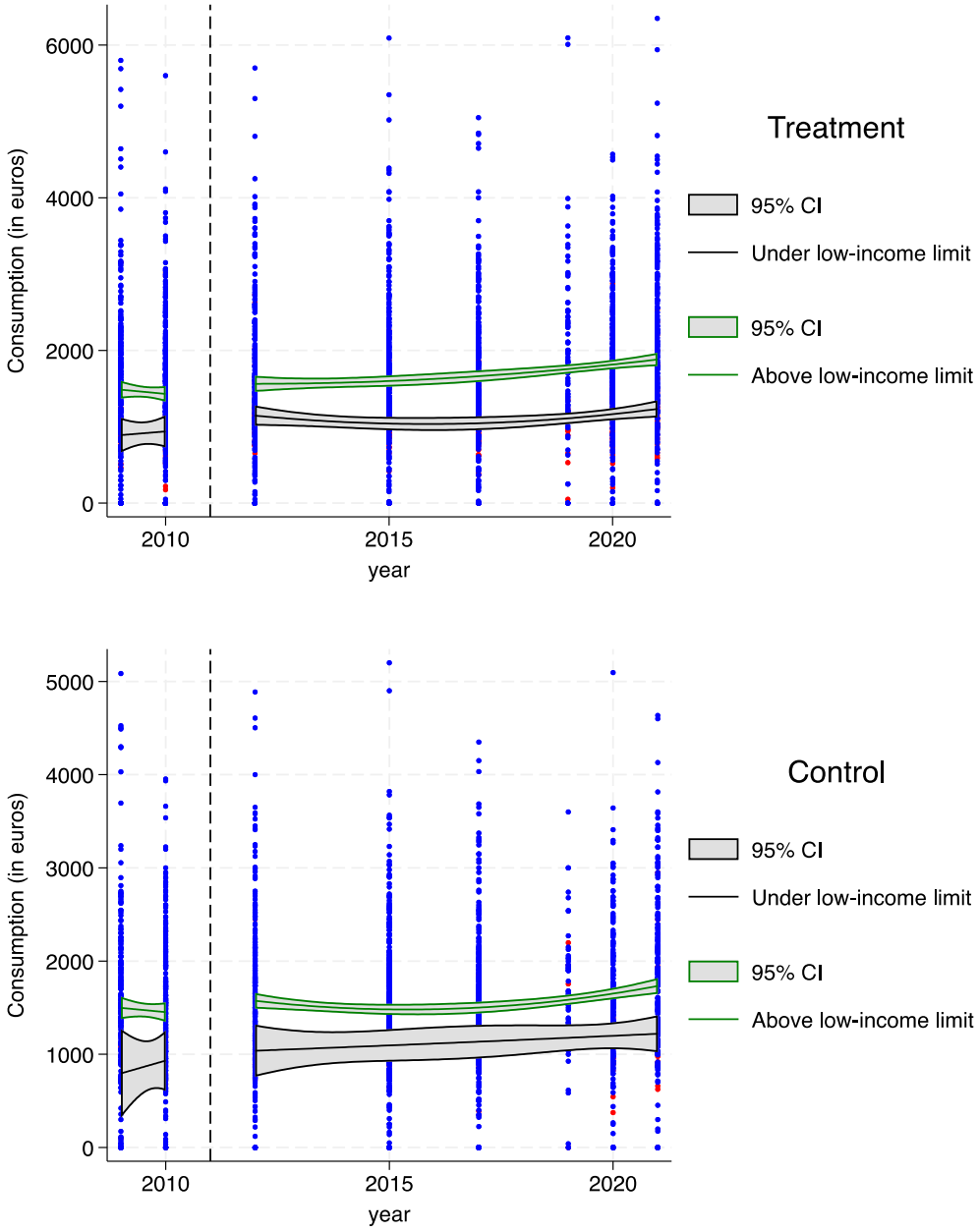
4.2 Empirical results

The empirical results contain the regression discontinuity graphs for the different announcements without adding control variables. Separate models are provided for the treatment and control groups to distinguish the effects. To observe an effect, the trend of the treatment group must differ from that of the control group. Within the graphs, there is a distinction between households below and above the low-income limit. As per the hypothesis, households above the low-income limit are expected to decrease their consumption and increase their savings, anticipating the pension reforms.

The first graphs look at the discontinuity of the announcement in 2011. Figure 4.1 shows the regression discontinuity for the consumption variable. In the top graph, the observations of the treatment group are shown, and in the bottom graph, the observations of the control group. The graphs in Figure 4.1 do not show any significant results. Though the scales of the two graphs are slightly different (due to outliers), the means of both graphs are similar. There is a slight decrease in consumption before the announcement for households above the low-income limit, however, this decrease may be due to there only being two years of observations. Overall,

there is a slight increase in consumption levels over the years. Both the treatment and control groups experienced a slight jump in consumption after the cutoff.

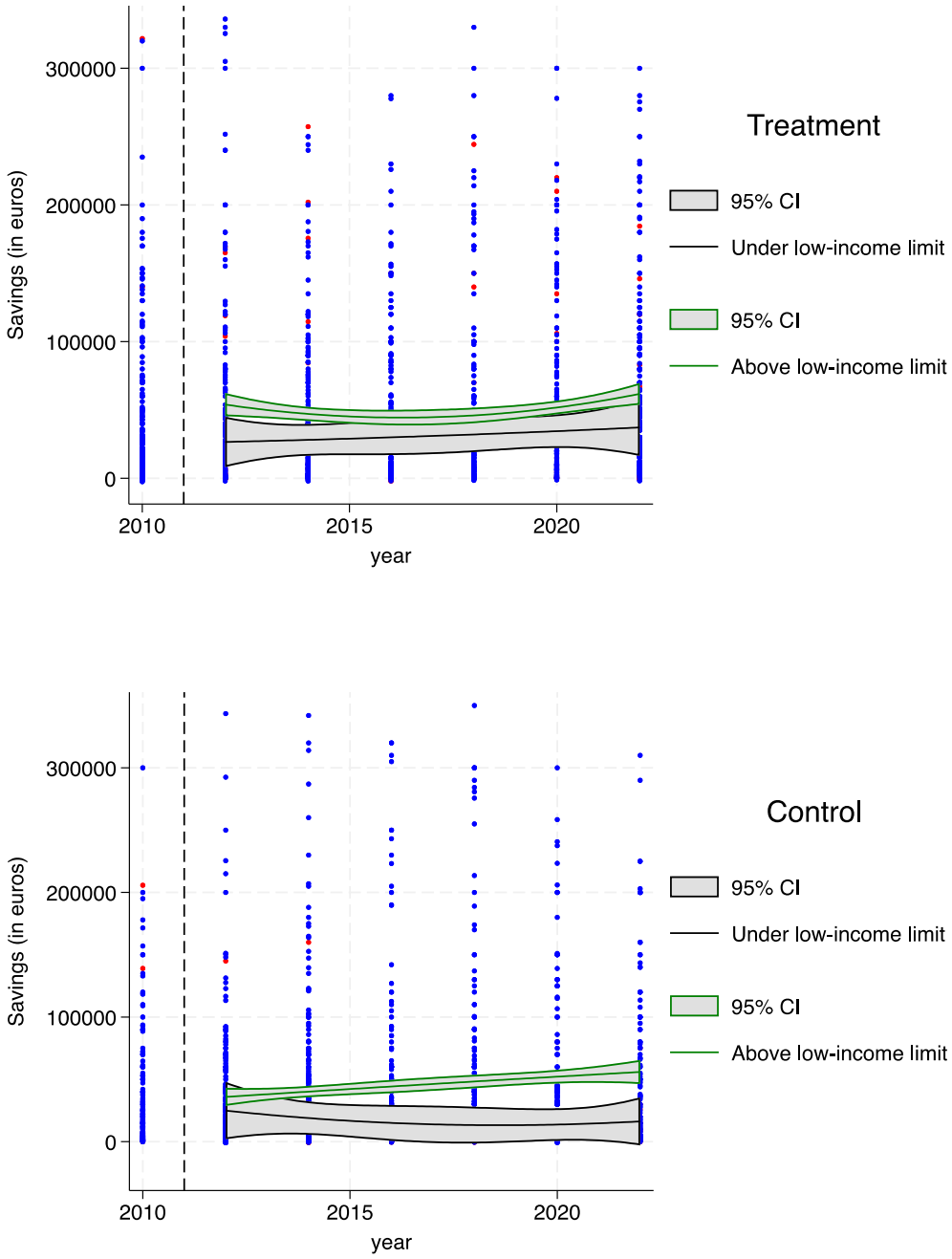
Figure 4.1 Regression Discontinuity on Consumption (2011)



Looking at Figure 4.2, there is no effect of the cutoff since there are not enough observations before the announcement to estimate a trend. The treatment group does have a rising trend in savings for the group under the low-income limit. For the control group, savings decrease slightly for these households, though the 95% interval is large in both cases. With the 95% interval, it is still possible that there has been no upward or downward trend for these households. Households above the low-income limit show a U-shaped trend for the treatment

group, while the control group shows an upwards trend in savings for households above the low-income limit.

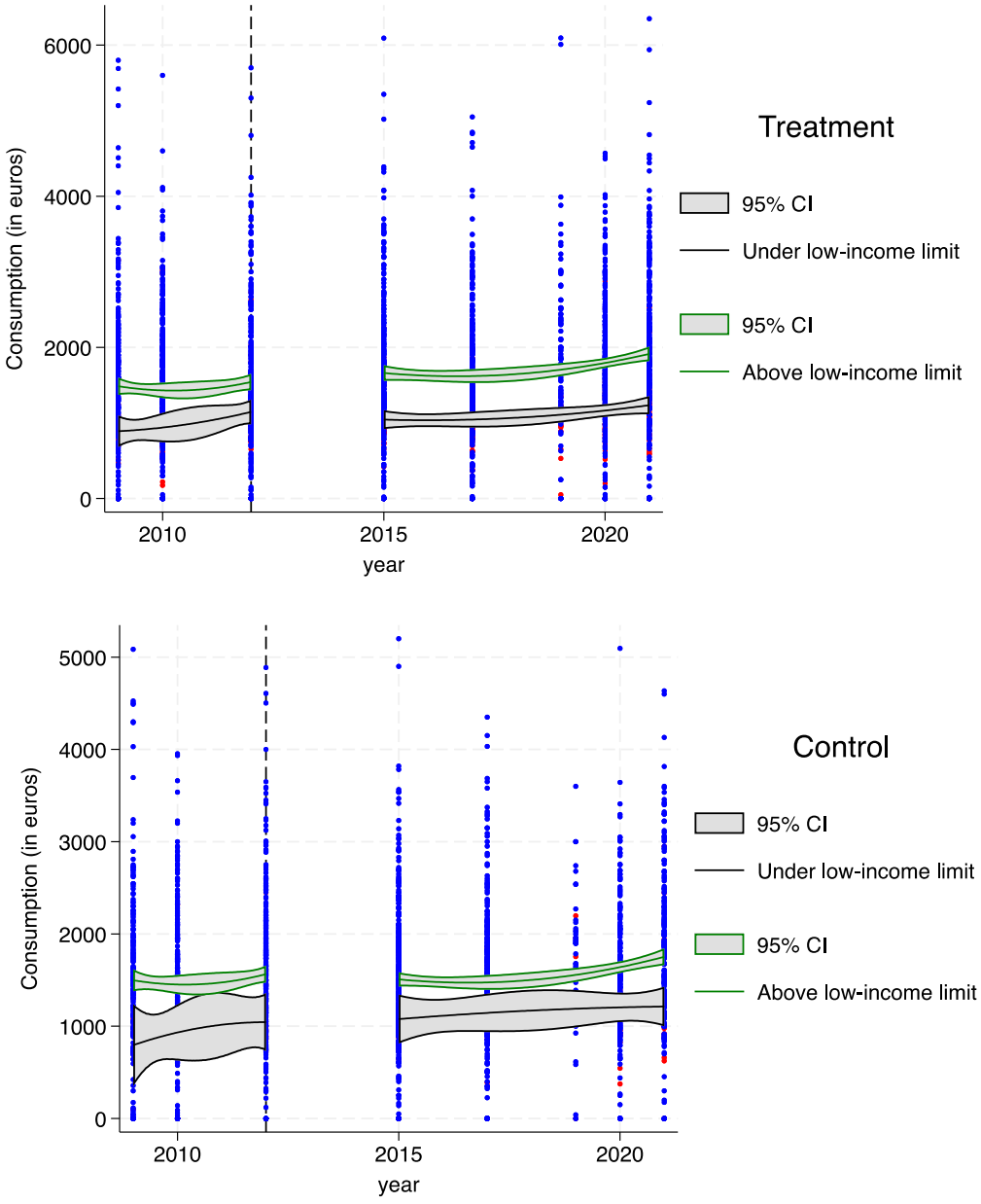
Figure 4.2 Regression Discontinuity on Savings (2011)



Moving on to Figure 4.3, there are significant results of the cutoff. The figure shows a decrease in consumption for households under the low-income limit and only a slight increase for households above the limit in the treatment group. The effects of the control group are different from the treatment group around the cutoff. For the control group, there is no effect for households under the low-income limit and a slight decrease in consumption for households

above the limit. Finally, the trend of these groups is the same before the cutoff. In the years after 2015, both groups follow the same upwards trend again.

Figure 4.3 Regression Discontinuity on Consumption (2012)



For households under the low-income limit, Figure 4.4 does not find any effect. The 95% interval is very large for this group, resulting in no clear effect of the cutoff. Though there is a slightly decreasing trend in savings for these households in the treatment and control groups. The figure does show an effect of the announcement for the treatment group above the low-income limit. There is a significant reduction in savings around the cutoff. A possible explanation is that the observations of the group above the low-income limit have higher

outliers in savings in the year 2012. Therefore, the line of the trend before the cutoff is steeper. The sudden drop around the cutoff could also explain the treatment effect of the announcement. This effect will be further explored in the estimation results. The control group does not show any effect around the cutoff and keeps an upwards trend in savings over the years.

Figure 4.4 Regression Discontinuity on Savings (2012)

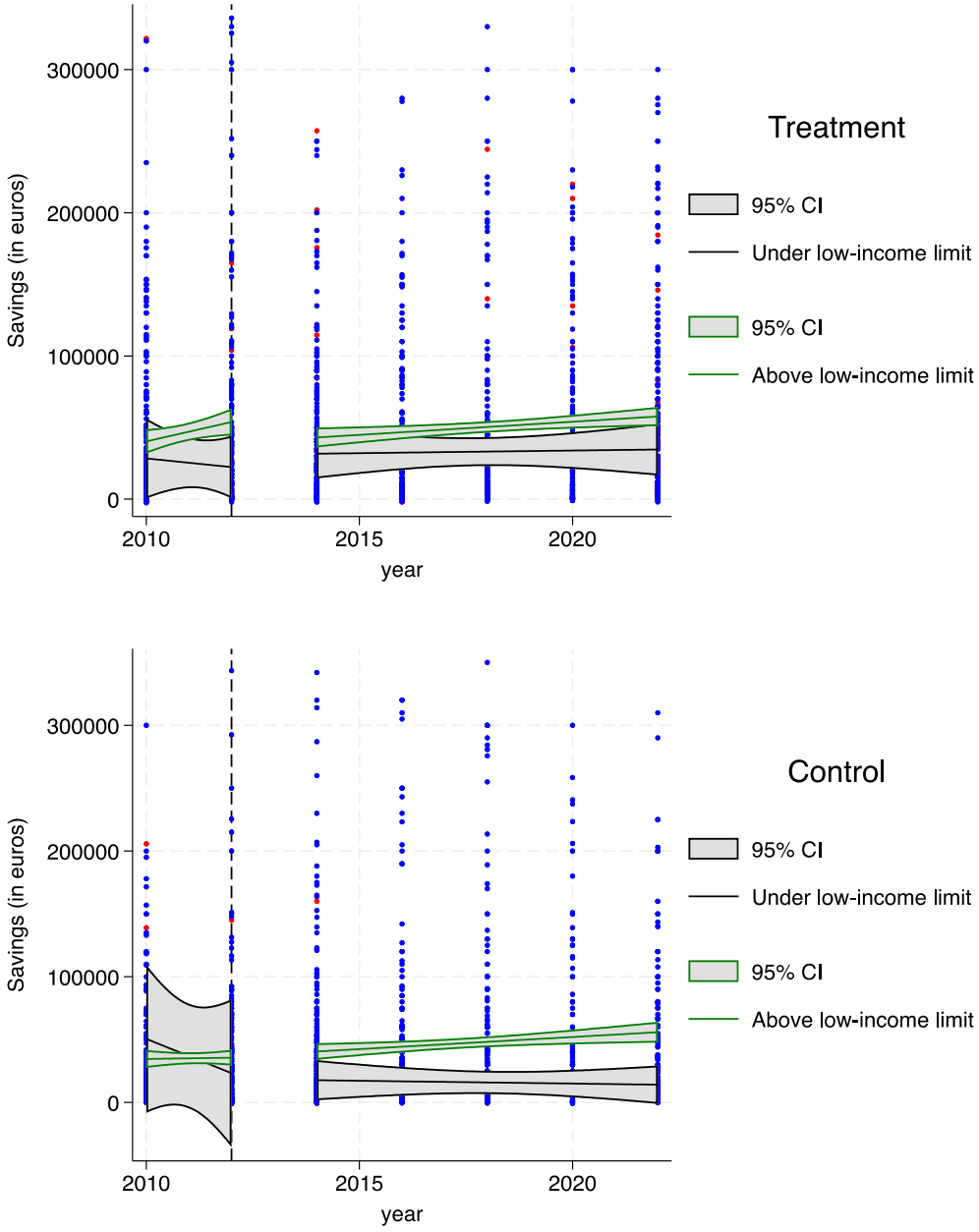


Figure 4.5 shows the regression model for consumption with the cutoff point in 2015. The model indicates a slight drop in consumption for the treatment group, however, this drop is indicated for households above and below the low-income limit. For the control group, there is no clear drop in consumption. The line for the group above the low-income limit shows a

slight drop in the control group, though this is not significant since the 95% interval contains the same values as the observation in 2015. A conclusion that can be drawn from this figure is that the announcement of a pension system reform in 2015 negatively affected consumption levels for the treatment group. Although the figure cannot confirm differences between incomes since the trend between households above the low-income limit and below the limit does not show any differences.

Figure 4.5 Regression Discontinuity on Consumption (2015)

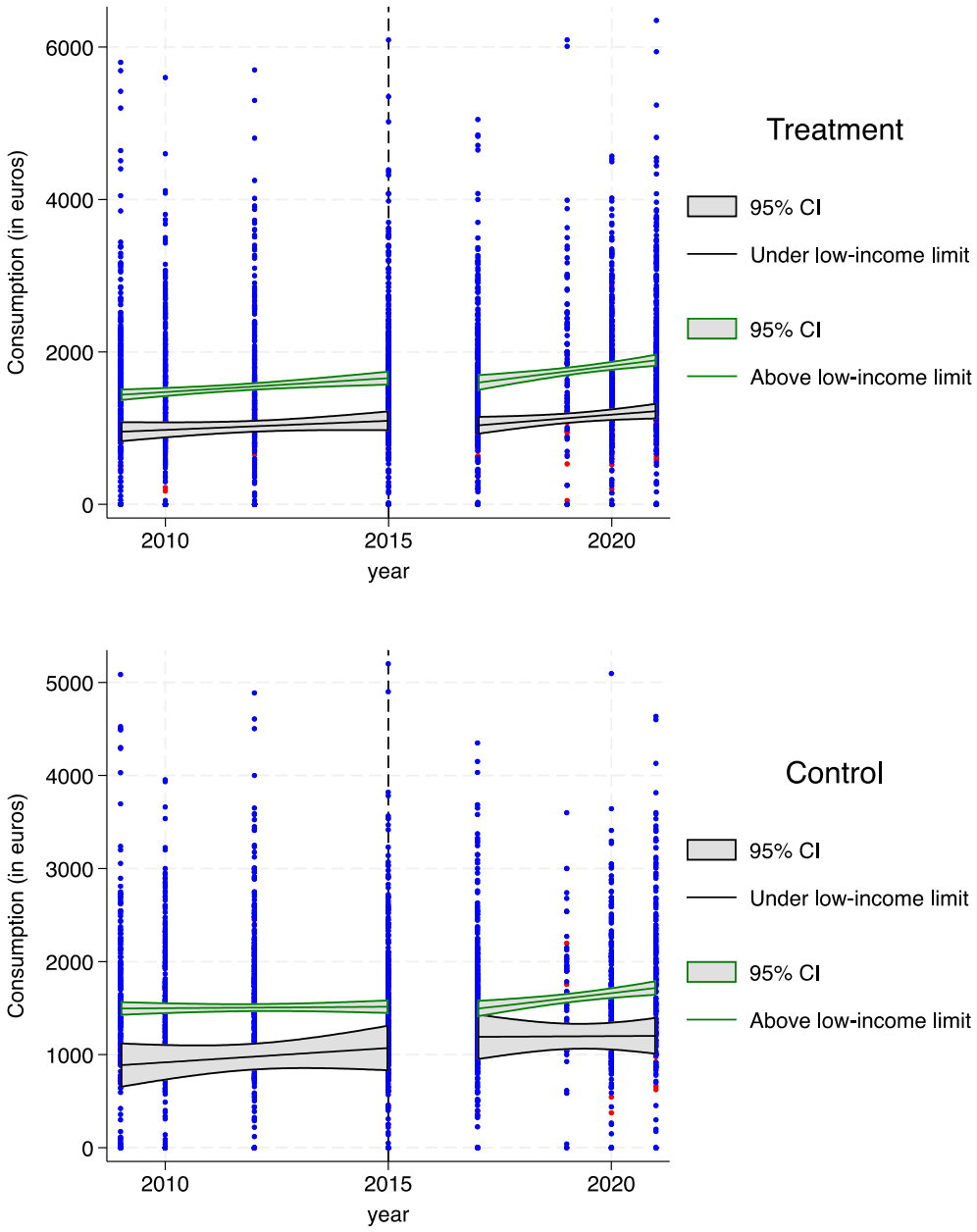
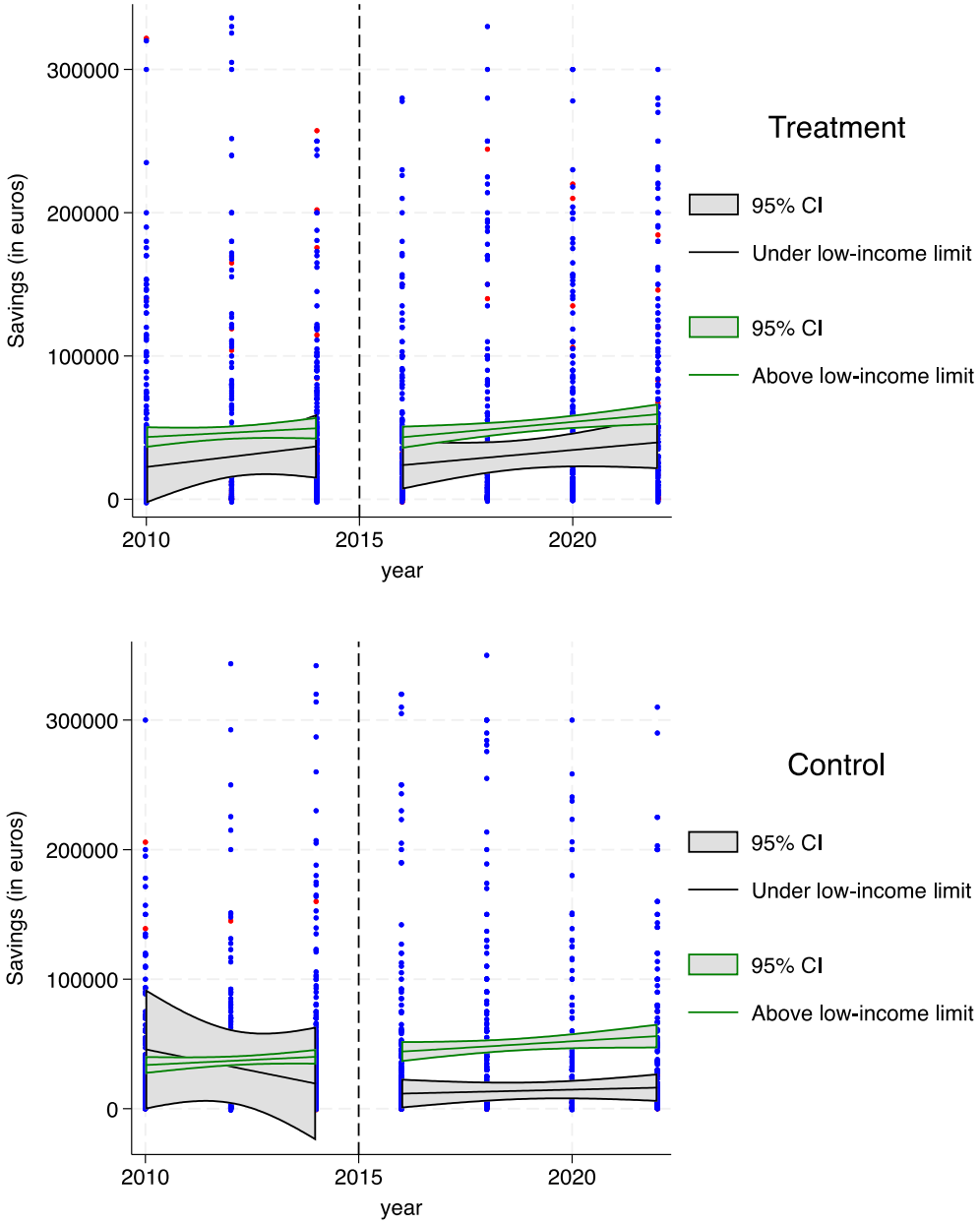


Figure 4.6 below shows the empirical results of the savings trend for the treatment and control group with a cutoff in 2015. This model indicates a slight decrease in saving levels for

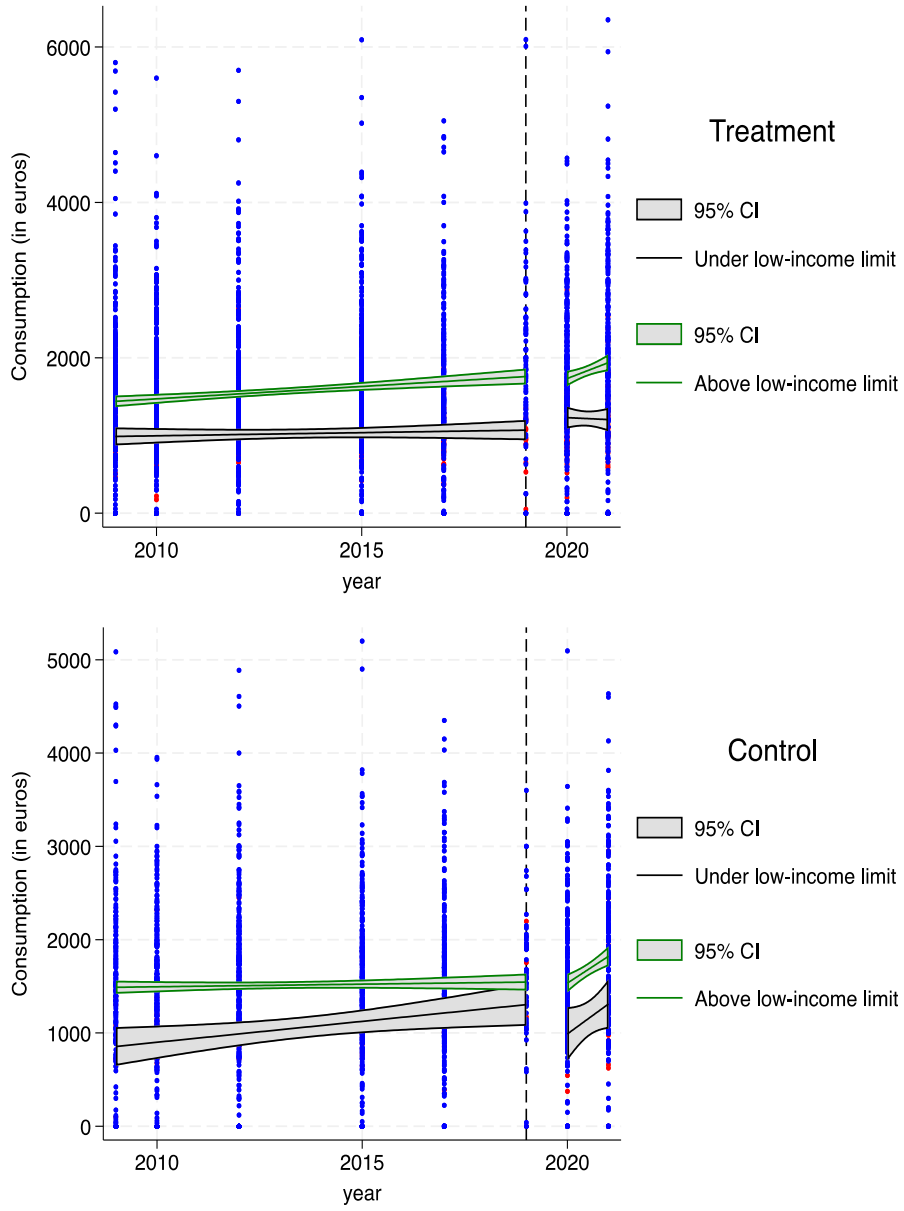
households above the low-income limit and in the treatment group. The estimates for the households under the low-income limit have a very wide 95% interval, so no clear effect of the cutoff can be estimated for this group. This trend also follows in the control group. Households above the limit in the control group follow an upwards trend in savings without a drop at the cutoff. This indicates that there has potentially been a treatment effect of the announcement in 2015. Contrary to the hypothesis, savings experience a decrease around the cutoff point. These effects will be further analysed in the estimation results, including control variables that potentially influence this effect.

Figure 4.6 Regression Discontinuity on Savings (2015)



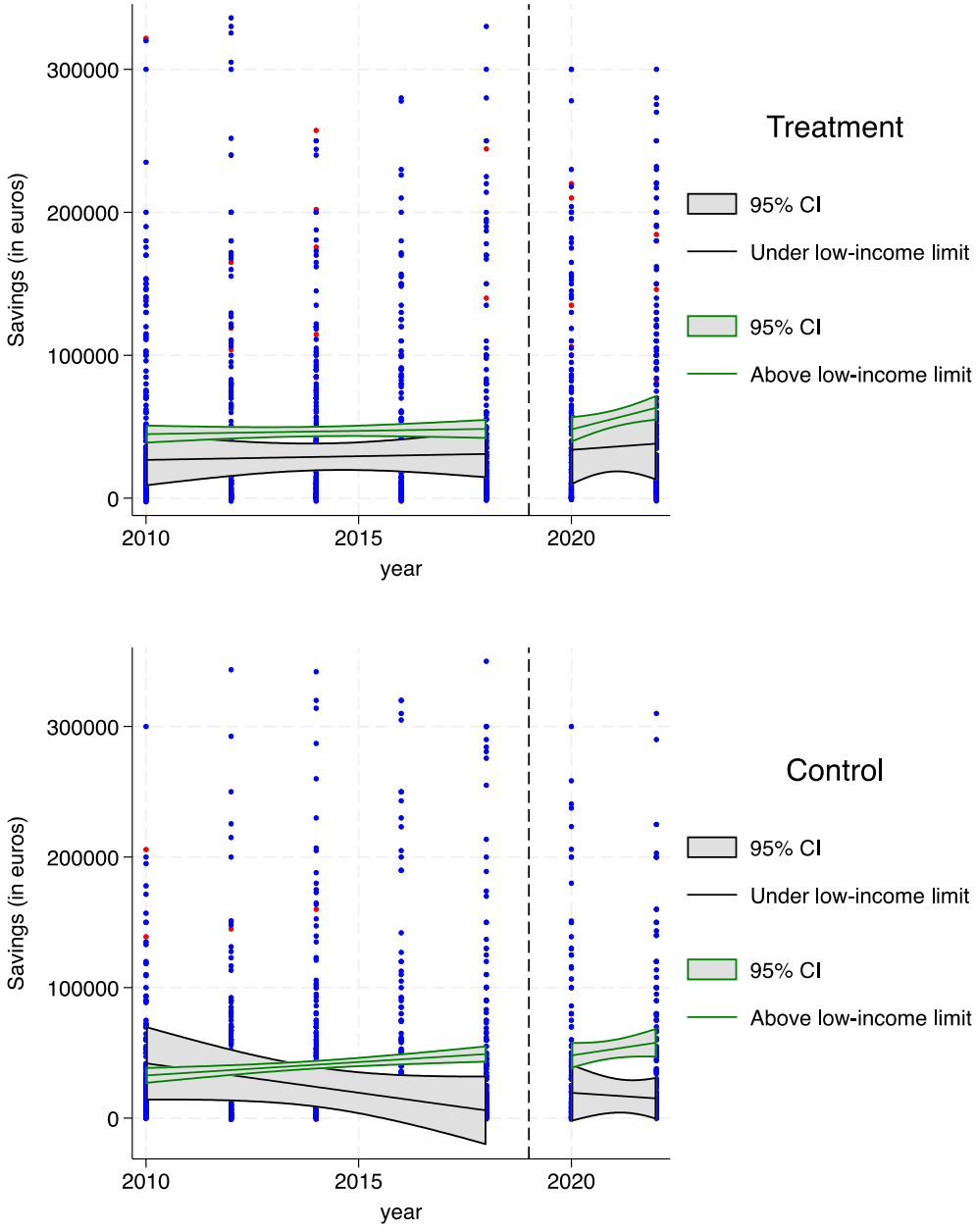
Examining the findings of Figure 4.7, some notable effects can be found. To start off, the cutoff suggests a small drop in consumption for households above the low-income limit, between 2019 and 2020. However, the 95% interval counters this effect since the 95% interval of the drop contains the same range of observations as before the cutoff. Households under the limit experience a slight increase in consumption in 2020, after which it slightly declines in 2021. Comparing this to the control group, there are some differences. For households above the low-income limit, there is no increase or decrease in consumption. The households under the limit do, however, experience a decrease in consumption around the cutoff. Both income groups from the control group experience the same increasing trend after the cutoff point as well as the group above the low-income limit in the treatment group.

Figure 4.7 Regression Discontinuity on Consumption (2019)



The final figure, Figure 4.8, does not output any effects of the cutoff for the treatment group. The trend for households under the low-income limit stays the same and the trend for households above the limit is that savings slightly increase. Though there is no drop or increase of savings around the cutoff point. Comparing this to the control group, the households with an income under the limit have again a wide range of the 95% interval. There is a decreasing trend over the years which does not significantly change around the cutoff point. Households above the limit in the control group do have an increasing trend in savings before the cutoff, compared to the treatment group. After the cutoff in 2019, this trend is equal for both groups and thus indicates that the announcement did not have any effect on the savings of the treatment group.

Figure 4.8 Regression Discontinuity on Savings (2019)



4.3 Estimation results

This section provides an overview of the estimation results. Compared to the empirical models, the estimation results include control variables to account for potential confounders and to reduce omitted variable bias. The regression results including the outliers will be provided first to look at whether including them is helpful for the estimation and empirical models. The regression results including the outliers are presented in Appendix D.

Looking at the results in Table D.1, the regression does not output many significant variables when including the outliers. In addition, the R-squared of models for each cutoff is very low. This means that each of these models barely explains any difference in the consumption variable. The different cutoffs in the models refer to the different years in which the announcements were made. Cutoff1 represents the announcement in 2011, Cutoff2 represents the announcement in 2012, Cutoff3 represents the announcement in 2015, and Cutoff4 refers to the announcement in 2019. *Year* is the running variable and indicates the year of the observations as was shown before in the empirical models. $Year^2$ is the squared running variable and is included in a model when this increases the fit of the observations. For the fourth cutoff, this is not included as this resulted in the running variable not being significant. Here, *Year* has a significant effect (at the 5% level) on consumption, resulting in an increase in consumption over the years. Following, the *Below_cutoff4* variable is significant (at the 5% level), which represents the effect of being below the cutoff on consumption. Here, being below the cutoff results in an increase in consumption by more than 900.000 euros. This substantial effect is mainly caused by the outliers before the cutoff point. Finally, the interaction between cutoff4 and the years has a significant effect (at the 5% level) on consumption. This suggests that the relation between the running variable and the outcome variable differs before and after the announcement. Since the coefficient is negative, the cutoff point/announcement has a negative effect on consumption patterns.

Table D.2 shows the regression estimates for the savings variable for each cutoff point. Where the regression on consumption did not output significant values for *education*, these models do. In each model, *education* has a significant effect at the 1% level, suggesting that higher education has a significant effect on how much someone saves. An increase in the *education* variable by one leads to an increase in savings by respectively 11,951 euros, 11,953 euros, 11,963 euros, and 11,945 euros for each of the cutoffs. The coefficients for the number of household members are slightly significant (at either 5 or 10% level) and positive, indicating an increase in savings when the household size increases. Again, the R-squared is low for each

model indicating that approximately one percent of the variation in the savings variable can be explained by the model.

Since the values of consumption and savings have been prone to large differences, the following estimation results exclude the top and bottom one percent of the outliers for the savings and consumption variable. By estimating the new models, this research aims to improve the fit of the models and obtain more robust estimates. On top of that, it excludes potential measurement errors as was mentioned in the descriptive statistics. These results will be presented in Table 4.4 and Table 4.5

When excluding the outliers in Table 4.4, more significant effects can be found. For the first cutoff, in 2011, $Year^2$ has a significant and positive effect in the model (at the 1% level), suggesting a quadratic relation between year and consumption. In addition, a negative and significant value of *Year* indicates a decrease in consumption over the years that diminishes due to the positive effect of $Year^2$. Control variables *education, household income,* and *household members* are positive and significant (at the 1% level) in all models, which indicates that an increase in household income, an increase in education, or an increase in household size leads to higher consumption. If the net monthly household income rises by one euro per month, their household consumption will rise by around .5 cents. The *low-income limit* variable is consistently negative and highly significant (at the 1% level) throughout all models, indicating that having an income below the limit results in lower consumption levels by respectively 392.1, 391.2, 388.4, and 450.2 euros per month for the different cutoffs. In line with Figure 4.1, the value for *Below_cutoff1* is insignificant, indicating no significant difference in consumption levels before and after the cutoff point. In addition, altering the bandwidth does not reveal an effect of the cutoff either.

The best fit for the second model is also quadratic since this increases the R-squared and significance of the cutoff point. The *Below_cutoff2* variable has a significant negative value of 340,050 (at the 5% level) indicating that households consume less before the announcement in 2012. In this model, the interaction between *Below_cutoff2* and *Year* is positive and statistically significant at 5%. The value of 168.9 shows that the announcement effect of this reform positively affects household consumption by around 170 euros per month. The R-squared of this model is 0.173 which shows that this model explains approximately 17% of the differences in household consumption. In the empirical results, when no control variables were included the effect of the cutoff was negative for households under the low-income limit and only slightly positive for households above. Including the controls contradicts the hypothesis that consumption would decrease.

Table 4.4 Regression results on consumption (excluding outliers)

Variables	(1) Cutoff1	(2) Cutoff2	(3) Cutoff3	(4) Cutoff4
Treat	31.85	32.81	41.38*	95.15***
	(24.28)	(24.28)	(25.12)	(30.47)
$Year^2$	7.238***	14.08***		
	(1.620)	(4.378)		
Year	-29,173***	-56,775***	55.51***	250.2***
	(6,534)	(17,671)	(11.12)	(46.51)
Low-income limit	-392.1***	-391.2***	-388.4***	-450.2***
	(31.54)	(31.48)	(32.19)	(33.71)
Net monthly hh inc.	0.00367***	0.00366***	0.00411***	0.00403**
	(0.000980)	(0.000982)	(0.00142)	(0.00198)
Education	141.1***	140.9***	134.7***	137.7***
	(8.453)	(8.450)	(8.684)	(10.74)
Hh members	226.7***	227.0***	228.6***	223.0***
	(17.45)	(17.43)	(18.30)	(20.27)
Below_cutoff1	-29,407			
	(114,843)			
Below_cutoff1 x Year	14.54			
	(57.13)			
Below_cutoff2		-340,050**		
		(131,973)		
Below_cutoff2 x Year		168.9**		
		(65.57)		
Below_cutoff3			116,431***	
			(27,908)	
Below_cutoff3 x Year			-57.71***	
			(13.84)	
Below_cutoff4				438,031***
				(98,817)
Below_cutoff4 x Year				-216.8***
				(48.92)
Constant	2.940e+07***	5.725e+07***	-111,264***	-504,662***
	(6.587e+06)	(1.782e+07)	(22,459)	(93,963)
Observations	4,010	4,010	3,601	2,456
R-squared	0.172	0.173	0.173	0.195

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

The third model analyses the results of the pension announcement in 2015. Households in the treatment group have a slightly significantly (at the 10% level) higher consumption of 41.38 euros per month than the control group. A linear relation best fits the model as increasing the polynomials decreases the R-squared. The running variable, *Year*, indicates a yearly increase in consumption levels. The positive and significant effect of *Below_cutoff3* indicates

that households consume more before the announcement of the pension reform. The interaction term is negative and statistically significant at the 1% level, indicating that the cutoff had a negative effect on consumption. The coefficient suggests a decrease of 57.71 euros per month. Therefore, the 2015 announcement is in line with the hypothesis and the empirical model in Figure 4.5, indicating a negative effect on consumption. By narrowing the bandwidth from 2009-2021 to 2010-2021, excluding the first wave of observations, the model fit improved. The R-squared of .173 indicates that the model explains 17.3% of the difference in household consumption.

The final model, the announcement in 2019, shows that the treatment group has on average a statistically significant (at the 1% level) and higher consumption of 95.15 euros per month. The running variable, Year, indicates a significant positive linear relationship with the outcome variable (at the 1% level). Compared to the cutoff in 2015, this cutoff has a greater effect on consumption. *Below_cutoff4* has a statistically significant and positive value, indicating that consumption is higher before the announcement in 2019. The interaction term *Below_cutoff4 x Year* is statistically significant at the 1% level and indicates that the announcement decreased household consumption by 216.8 euros per month. Where Figure 4.7 already indicated a slight decrease in consumption for households above the low-income limit, this model underlines these results more. These results show that we cannot reject the alternate hypothesis for consumption. For this model, the bandwidth is decreased to 2014-2021, resulting in fewer observations but a better model fit. Finally, the R-squared of .195 shows that this model explains 19.5% of the difference in the consumption variable.

Table 4.5 shows the regression results for the savings variable when excluding the top and bottom one percent of the outliers. The first observation is that there are no significant differences in the level of savings between the treatment group and the control group. Since the control group consists of pensioned individuals, these results do not indicate dissaving patterns in the first years after retirement. Furthermore, in the first model, implementing the squared running variable increased the R-squared of the model, meaning that a quadratic fit is the most applicable to this model. The slightly significant (at the 10% level) and negative coefficient for *Year* indicates that the total effect of the running variable on savings is negative. The slightly significant and positive coefficient for $Year^2$, on the other hand, indicates that the effect of the running variable diminishes over time. The cutoff variable is not significant in this model, which suggests that there is no effect of the cutoff on savings. The interaction term does not have any value since there is only one year of observations before the cutoff point.

Table 4.5 Regression results on savings (excluding outliers)

Variables	(1) Cutoff1	(2) Cutoff2	(3) Cutoff3	(4) Cutoff4
Treat	2,411	2,452	2,375	2,393
	(2,343)	(2,344)	(2,336)	(2,329)
$Year^2$	229.0*			
	(128.1)			
Year	-922,786*	1,325***	1,849***	4,720**
	(516,583)	(473.6)	(711.5)	(2,299)
Low-income limit	-10,692***	-10,759***	-10,583***	-10,695***
	(4,066)	(4,072)	(4,055)	(4,064)
Net monthly hh inc.	0.215	0.217	0.215	0.216
	(0.201)	(0.202)	(0.202)	(0.202)
Education	8,364***	8,355***	8,364***	8,359***
	(828.6)	(829.2)	(828.6)	(828.2)
Hh members	3,970***	3,947**	3,939**	3,945**
	(1,533)	(1,537)	(1,537)	(1,536)
Below_cutoff1	-8,236			
	(6,005)			
Below_cutoff1 x Year	-			
Below_cutoff2		-1.824e+06		
		(4.106e+06)		
Below_cutoff2 x Year		909.6		
		(2,042)		
Below_cutoff3			2.258e+06	
			(2.368e+06)	
Below_cutoff3 x Year			-1,118	
			(1,176)	
Below_cutoff4				8.352e+06*
				(4.738e+06)
Below_cutoff4 x Year				-4,134*
				(2,345)
Constant	9.297e+08*	-2.667e+06***	-3.726e+06***	-9.529e+06**
	(5.210e+08)	(955,373)	(1.436e+06)	(4.646e+06)
Observations	2,665	2,665	2,665	2,665
R-squared	0.061	0.060	0.060	0.061

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Low-income limit is negative and significant in each model, indicating that households under the low-income limit have on average 10,700 euros less savings than households above the low-income limit. As in Table 4.4, education has a positive and significant effect on savings (at the 1% level). The R-squared values are approximately the same for each model, indicating that the cutoffs explain 6.0% of the differences in the savings variable.

The difference of models two and three, compared to model one, is the linear fit of the models. The variable *Year* is positive and significant (at the 1% level) which suggests that savings increase over the years. For both models, the cutoffs do not significantly affect savings, contradicting the results from Figures 4.4 and 4.6 where a negative effect on savings was found.

Model 4, the announcement in 2019, also has a linear fit to the observations. However, this model has a slightly significant effect of the cutoff point and interaction term (at the 10% level). The positive coefficient of *Below_cutoff4* indicates that households have higher savings before the announcement than after the announcement. The negative interaction term of -4,134 indicates a drop of 4,134 euros in savings after the pension system reform was announced in 2019. The inclusion of controls in the regression model revealed a slightly significant effect of the cutoff, which was initially not detected in the empirical model.

4.4 Robustness checks

To check the sensitivity of the regression results, the robustness checks contain two approaches: limiting the bandwidth of the outcome variables and incorporating interaction terms to capture effects within different income groups. In the regression analyses, the top and bottom 1% were excluded. The robustness check excludes the top and bottom 5% of the consumption variable, resulting in a bandwidth of 5 – 3,317 euros per month. For savings, the top 5% and only the bottom 1% are excluded, due to a limited number of outliers at the bottom end, resulting in a bandwidth of -2000 to 200,000 euros. Notably, when excluding the outliers, the R-squared increased for the savings variable from approximately .060 to .072. The empirical models with the revised bandwidth are included in Appendix E. These models indicate a significant reduction in savings for households above the low-income limit following the 2015 announcement. Additionally, the revised bandwidth does not yield significant effects in the other empirical models.

The hypothesis proposed a positive effect of the announcements of pension system reforms on savings for households above the low-income limit. The interaction term *Below limit x After_cutoff* is introduced to examine this effect. This variable looks if the observation is below the low-income limit and after the announcement. The significance of this effect would indicate a distinct effect of the cutoff between income groups. Additionally, the interaction term *Low-income limit x Treat* is included to assess whether the treatment induces differences in the outcome variable between income groups.

Table 4.6 Robust regression results on savings

Variables	(1) Cutoff1	(2) Cutoff2	(3) Cutoff3	(4) Cutoff4
Treat	3,490*	3,499*	3,502*	3,443*
	(1,833)	(1,832)	(1,827)	(1,822)
$Year^2$	309.7***	459.9***		
	(94.61)	(156.2)		
Year	-1.249e+06***	-1.855e+06***	2,233***	4,833***
	(381,656)	(630,184)	(542.0)	(1,846)
Low-income limit	-10,174*	-10,911**	-11,493**	-12,194*
	(5,486)	(5,459)	(5,269)	(6,802)
Net monthly hh inc.	0.102	0.103	0.103	0.102
	(0.119)	(0.119)	(0.119)	(0.119)
Education	6,283***	6,281***	6,273***	6,275***
	(576.6)	(576.4)	(576.1)	(576.5)
Low-income limit x Treat	-2,075	-1,986	-2,158	-1,951
	(6,621)	(6,644)	(6,610)	(6,680)
Hh members	3,190***	3,186***	3,166***	3,170***
	(1,155)	(1,153)	(1,158)	(1,156)
Below_cutoff1	-8,190			
	(10,173)			
Below_cutoff1 x Year	-			
Below limit x After_cutoff1	496.5			
	(9,694)			
Below_cutoff2		-1.107e+07**		
		(5.286e+06)		
Below_cutoff2 x Year		5,502**		
		(2,626)		
Below limit x After_cutoff2		-2,546		
		(7,054)		
Below_cutoff3			4.126e+06**	
			(1.860e+06)	
Below_cutoff3 x Year			-2,043**	
			(923.5)	
Below limit x After_cutoff3			-3,593	
			(6,267)	
Below_cutoff4				1.013e+07***
				(3.797e+06)
Below_cutoff4 x Year				-5,013***
				(1,879)
Below limit x After_cutoff4				-2,611
				(6,853)
Constant	1.258e+09***	1.870e+09***	-4.501e+06***	-9.755e+06***
	(3.849e+08)	(6.359e+08)	(1.094e+06)	(3.731e+06)
Observations	2,569	2,569	2,569	2,569
R-squared	0.072	0.072	0.071	0.072

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

This robustness check finds that the treatment group possesses significantly higher savings by respectively 3,490 euros, 3,499 euros, 3,502 euros, and 3,443 euros (at the 10% level). In the first model, the squared running variable $Year^2$ and the *Year* variable are highly significant at the 1% level. The effect is still in the same direction, suggesting a diminishing effect of decreasing savings over the years. *Below_cutoff1* is slightly significant and negative, indicating an increase in savings after the announcement.

Limiting the criteria for the outcome variable has changed the fit of the observations in the second model. Like the first model, there is a significant negative effect of *Year*, with a significant positive effect of $Year^2$ (both at the 1% level), indicating a U-shaped effect of the running variable on savings. *Below_cutoff2* and *Below_cutoff2 x Year* are significant in this model (at the 5% level). These relations suggest that savings are lower before the announcement in 2012 and increase in the years after. The effect of the announcement is that savings increased by 5,502 euros which is in line with the hypothesis and contradicts the empirical results in Figure 4.4.

The third and fourth models capture a linear relation between *Year* and savings. These models find a positive and statistically significant effect of increasing savings over time. Model three, with an announcement in 2015, finds a statistically significant negative effect of the interaction term (at the 5% level), implying a decrease in consumption by the announcement. The effect of the announcement is that savings decreased by 2,043 euros. For model four, an effect in the same direction is found. This effect is more statistically significant at the 1% level. In this model, the announcement resulted in a decrease in savings of 5,013 euros. These results indicate that an effect of the announcements on savings can be found when the bandwidth of observations is reduced.

The interaction terms *Low-income limit x Treat* and *Below limit x After_Cutoff* are not significant in the four models. The insignificance of *Low-income limit x Treat* implies that the treatment effect on savings does not differ between the households above and below the low-income limit. Similarly, the insignificance of *Below limit x After_Cutoff* implies that the cutoff effect does not significantly differ between the income groups. The negative announcement effect on savings could potentially imply a shift from the working population to early retirement. As the interaction term is insignificant, this explanation is unlikely as it would also imply a shift for households below the low-income limit. These findings indicate that the research can reject the null hypothesis of the announcement not influencing savings. However, the announcement effect is not in line with the alternative hypothesis, since the effect does not differ between income groups.

Table 4.7 Robust regression results on consumption

Variables	(1) Cutoff1	(2) Cutoff2	(3) Cutoff3	(4) Cutoff4
Treat	43.87*	44.42*	53.99**	109.2***
	(25.63)	(25.63)	(26.57)	(32.97)
$Year^2$	7.213***	14.02***		
	(1.620)	(4.354)		
Year	-29,074***	-56,558***	55.06***	249.5***
	(6,534)	(17,570)	(11.11)	(46.54)
Low-income limit	-296.8***	-317.0***	-327.5***	-352.1***
	(64.41)	(65.33)	(70.43)	(74.30)
Net monthly hh inc.	0.00366***	0.00365***	0.00411***	0.00403**
	(0.000978)	(0.000978)	(0.00141)	(0.00198)
Education	141.3***	141.1***	134.9***	137.7***
	(8.454)	(8.450)	(8.685)	(10.74)
Low-income limit x Treat	-151.3**	-153.4**	-170.7**	-157.1**
	(77.03)	(77.34)	(80.08)	(72.25)
Hh members	225.5***	226.3***	227.5***	221.0***
	(17.49)	(17.47)	(18.35)	(20.32)
Below_cutoff1	-26,680			
	(114,601)			
Below_cutoff1 x Year	13.22			
	(57.02)			
Below limit x After_cutoff1	-84.65			
	(105.7)			
Below_cutoff2		-338,694***		
		(131,410)		
Below_cutoff2 x Year		168.3***		
		(65.28)		
Below limit x After_cutoff2		-119.8*		
		(72.60)		
Below_cutoff3			115,582***	
			(27,860)	
Below_cutoff3 x Year			-57.23***	
			(13.81)	
Below limit x After_cutoff3			-145.7**	
			(63.11)	
Below_cutoff4				437,756***
				(98,927)
Below_cutoff4 x Year				-216.6***
				(48.97)
Below limit x After_cutoff4				-27.88
				(64.49)
Constant	2.930e+07***	5.703e+07***	-110,352***	-503,280***
	(6.588e+06)	(1.774e+07)	(22,438)	(94,025)
Observations	4,010	4,010	3,601	2,456
R-squared	0.173	0.174	0.175	0.196

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Like the robustness of the savings variable, the empirical models for consumption are included in Appendix E. Control variables are not included in the empirical models, so a potential effect will be checked for in Table 4.7. Limiting the outcome variables does not change the results that were found in the previous empirical models. An exception is that the revised empirical model of 2015 does not find a decrease in consumption for households above the low-income limit.

The first cutoff, in 2011, does not produce a significant effect, meaning that the null hypothesis cannot be rejected for consumption. The treatment group does have a higher consumption of 43.87 euros per month (significant at the 10% level). Compared to the previous regression results, the effect of the *low-income limit* has decreased. Where households under the income limit previously averaged a lower consumption of 392 euros, they now average a lower consumption of 297 euros per month (both significant at the 1% level). The coefficients for the interaction term *Low-income limit x Treat* are negative and significant at 5% in any of the four models. Comparing the coefficients to the *Low-income limit* variable, the treatment effect diminishes the differences between the households above and below the low-income limit. This could mean that the group above the low-income limit experienced a larger decrease in consumption or the group below the limit experienced a larger increase in consumption. The effect of being below the low-income limit on household consumption is now respectively -151.3, -153.4, -170.7, and -157.1 euros per month for each cutoff. In addition, the running variable *Year* and $Year^2$ yield robust results across all four models, indicating values that are approximately the same as those observed in the previous regression estimates. Implementing the interaction terms barely increased the R-squared for the models. The models respectively explain 17.3%, 17.4%, 17.5%, and 19.6% of the differences in monthly household consumption.

As in Table 4.4, the robustness check also outputs a significant effect of the cutoff in 2012. The alternate bandwidth and the addition of the interaction terms increased the significance of the effect to the 1% level, indicating that the cutoff had an overall significant positive effect on consumption. The *Below limit x After_cutoff2* variable outputs a negative and slightly significant (at the 10% level) effect, indicating that being after the cutoff point results in a smaller effect on household consumption for households below the low-income limit. The coefficient of -119.8 indicates that the positive announcement effect is 119.8 euros per month lower for households below the low-income limit. Considering these results, the null hypothesis of the announcement having no effect on consumption can be rejected. The found effect,

however, contradicts the alternative hypothesis since the cutoff in 2012 has a positive effect on monthly household consumption.

The third model indicates a significant effect of being in the treatment group on consumption (at the 5% level). The treatment group averages 53.99 higher consumption per month. In addition, the positive and significant (at the 1% level) linear effect of *Year* in models 3 and 4 indicates an increase in consumption during the researched period. The negative effect of the cutoff in 2015 is robust with the effect in Table 4.4, indicating a significant and negative effect on consumption (at the 1% level). The negative effect of *Below limit x After_cutoff3* (significant at the 5% level) indicates that households below the low-income limit experience a smaller negative effect of the cutoff. Consequently, the alternative hypothesis cannot be rejected since this model found a negative effect on consumption which is larger for households above the low-income limit.

The final model indicates a larger effect of the treatment group on consumption. The treatment group now averages a higher consumption of 109.2 euros per month and is significant at the 1% level. Furthermore, the linear effect of *Year* and the cutoff effect of *Below_cutoff4* and *Below_cutoff4 x Year* have not altered compared to the regression in Table 4.4, indicating a robust negative effect of the cutoff in 2019 on monthly household consumption. The insignificance of *Below limit x After_cutoff4* indicates that the cutoff effect does not differ between households above and below the low-income limit. These effects result in the rejection of the null hypothesis. The research cannot reject the alternative hypothesis since the announcement negatively affected consumption for households above the low-income limit. However, it is important to note that there was no significant difference between income groups.

5. Conclusion

This chapter includes the concluding remarks of the previous analysis. The research question will be answered through the ability to reject the null or alternative hypothesis. After the concluding remarks, a discussion follows with the limitations of this research. Finally, recommendations for future research and several policy implications are provided.

5.1 Concluding remarks

This research aimed to find the effect of announcements of multiple pension system reforms on the consumption and savings patterns of household heads in the Netherlands. Previous research by Been & Goudswaard (2021) and Tyros et al. (2022) solely examined the causal effect of retirement. Based on the theory, this research expected a negative announcement effect on

consumption for households above the low-income limit and a positive announcement effect on savings for households above the low-income limit. To examine whether households anticipated the reforms, each of the used pension announcements is analyzed in a separate regression discontinuity model.

The first model of this research relates to the 2011 announcement of the abolishment of the Life Course Savings Scheme. Although this change primarily affects savings through the abolishment of a second-pillar pension scheme, neither the empirical models nor the regression estimates reveal a significant effect. This is mainly because there was only one year of data available on savings before this announcement. Consequently, for this announcement, the research cannot reject the null hypothesis of there being no effect of the announcements on savings. However, by excluding the outliers and implementing income interaction terms, the treatment group had a slightly significant (at the 10% level) positive effect of 3,490 euros of savings. Additionally, higher-educated household heads save more, and households below the low-income limit report an average of over 10,000 euros fewer savings. Finally, the robustness check shows that the amount of household members is also related to savings, as increasing the amount of household members by one, increases the savings for each model.

For the consumption variable, there were two years of observations to estimate the announcement effect. The empirical model, without any controls, in Figure 4.1 showed an increase in consumption for both the treatment and control groups. The robust empirical models, however, do not show an effect for the treatment group. When adding control variables and excluding the outliers, the cutoff of the announcement does not reveal a significant effect either. Consequently, the null hypothesis of there not being an effect of the announcement on consumption cannot be rejected for the 2011 announcement. In the robustness check, the treatment variable became slightly significant (at the 10% level) and positive, meaning that the individuals in the treatment group average a higher household consumption. Where the low-income limit negatively affects savings, it also negatively affects consumption though this effect decreases a bit when limiting the outliers further and adding income interactions. Since this effect also takes the observations from the control group into account, the interaction term *Low-income limit x Treat* was added. The significant (at the 5% level) negative effects of this variable show that the household consumption for households under the low-income limit in the treatment group is lower than for households above the low-income limit in the treatment group. Additionally, education, net monthly household income, and the number of household members significantly increase household consumption.

In 2012, the announcement was made that the statutory retirement age would increase passed age 65. The empirical model for 2012 showed a negative cutoff effect on savings, though this effect was not found in the robust empirical model. The estimation of the effect did not find significance in the first instance however, the robustness check for this model found that the cutoff effect was positive and increased savings by 5,502 euros. Though this effect did not differ between income groups as the income interactions are insignificant. These results show that the null hypothesis for savings can be rejected. The results indicate that the alternate hypothesis cannot be rejected though there is no difference between income groups. In the research by Etgeton (2018), a difference was found in the behavior between poorer and richer individuals as a response to an increase in the normal retirement age. In addition, Lindeboom & Montizaan (2020) found that richer individuals increase their savings more in response to a loss in wealth. For the 2012 reform, the results from the differences in behavior as Etgeton (2018) found and the larger increase in savings by Lindeboom & Montizaan (2020) are not in line with the results of this research. A potential cause is the usage of only two income groups, with one indicating a low income and the other category holding all other incomes.

In the empirical models, the announcement of an increase in retirement age had a negative effect on consumption for households below the low-income limit. The effect found by the estimation results contradicts this effect. In both the regression estimates and the robust regression estimates, a significant positive effect of the cutoff on consumption is found. In addition, the negative and slightly significant effect of *Below limit x After_cutoff2* indicated that the positive consumption effect is weaker for households with an income below the low-income limit. Most theories, including the Life Cycle Theory, the numerical model by Fedotenkov (2016), and the research by Nickel et al. (2008) contradict the positive effect on consumption by implying consumption smoothing as a reaction to future income loss. The results are, however, in line with the expectations of Etgeton (2018), since the group below the low-income limit react less to the announcement. Consequently, the null hypothesis for consumption can be rejected as the announcement does induce a positive effect on consumption. The alternate hypothesis can also be rejected as the direction of the effect differs.

The 2015 pension announcement included an increase in pace for the rising statutory retirement age. The empirical models, examining the trends in savings, found a negative effect of the cutoff for households above the low-income limit. This negative effect remains robust when considering a limited savings variable. However, the regression estimates did not initially indicate any effect of the cutoff, although this finding is not robust as a negative announcement effect arises when excluding additional outliers and incorporating income interactions.

Importantly, this significant effect does not differ between households above and below the low-income limit. The lack of significance of the *Below limit x After_cutoff3* interaction suggests that the potential shift from the working population to early retirement is unlikely. Another possibility is that an equal share of household heads under the low-income limit opt for disability assurance as the share of household heads above the low-income limit opt for early retirement. If enrollment in disability insurance increased because of the announcement, the findings are in line with the found substitution effect by Atav et al. (2021). The findings of the negative announcement effect contradict the findings by Lindeboom and Montizaan (2020), who found that savings increase for richer households in response to a decrease in future income prospects. Overall, given the negative announcement effect, the null hypothesis can be rejected, indicating that the 2015 announcement had a significant effect on savings behavior.

For monthly household consumption, the empirical models indicated a negative cutoff effect for both income groups. This result, however, is not robust as the revised empirical models only indicate a negative effect on consumption for households below the low-income limit. The regression estimates also found a negative cutoff effect on household consumption. This effect remained robust across different conditions. In addition, there is a significant difference between the treatment and control groups, where the treatment group has significantly higher consumption. Following, the negative and significant effect of *Below limit x After_cutoff3* indicated that there is a difference in the announcement effect between the income groups, where the group below the low-income limit experiences a smaller effect of the cutoff. This is again in line with the arguments made by Etgeton (2018). Furthermore, the negative effect of the announcement on household consumption underlines the theoretical arguments of the Life Cycle Theory (Browning & Crossley, 2001). The results also further confirm the findings by Nickel et al. (2008) indicating that individuals smooth their consumption in the short- and medium-run to compensate for their losses. Consequently, the alternate hypothesis cannot be rejected as there is a negative effect of the announcement on consumption. Additionally, this effect is larger for households above the low-income limit.

The final announcement, in 2019, contains the lowered pace in the rising statutory retirement age and the introduction of a switch from defined benefit plans to defined contribution plans with more flexibility in the pensions. For this announcement, the empirical models for savings showed no effect of the cutoff. At first, the estimation results indicated a slightly significant (at the 10% level) negative effect of the cutoff. When correcting for further outliers and implementing the additional interactions, the cutoff effect became highly significant and negative. The coefficient of the interaction *Below_cutoff4 x Year* decreased by

1,000 compared to the previous regression results. As the income interactions are insignificant, the conclusion can be drawn that the negative effect does not differ between households with an income above or below the low-income limit. The negative announcement effect of this pension system reform is in line with the findings by Thaler and Benartzi (2004). They found that the switch from DB to DC resulted in fewer savings, as procrastination and a lack of self-control played a negative part in the decision to save for retirement (Thaler & Benartzi, 2004). Based on these results, the null hypothesis can be rejected as we find a negative announcement effect on savings for households above the low-income limit. However, the effect does not differ for households under the low-income limit and is not in the same direction as the alternate hypothesis.

Where the empirical models did not show any effect on savings, they did for household consumption. The first models indicated a decrease in consumption for households above the low-income limit and a slight increase in consumption for households below the low-income limit. These results are not robust since the revised models do not indicate a drop in consumption for households above the low-income limit. The estimations results found a robust significant (at the 1% level) negative effect of the announcement on household consumption. In addition, the treatment has a highly (at the 1% level) significant positive effect on household consumption. Furthermore, this negative effect applies to both income groups with no difference in effect between them. Where the found effect is in line with the expectations, the lack of difference between income groups is not. The alternate hypothesis cannot be rejected since the research did find a negative announcement effect on household consumption for households above the low-income limit.

In summary, the impact of the announcements of pension system reforms on consumption and savings in the Netherlands varies depending on the reform. For the 2011 reform, no effect on household consumption and savings was found due to limited data availability prior to the announcement. In contrast, the 2012 announcement had a positive effect on both savings and monthly household consumption. However, the positive announcement effect on consumption was found to be relatively weaker for households below the low-income limit. Additionally, the 2015 announcement had a negative effect on both household consumption and savings. Similarly, households below the low-income limit experienced a weaker effect on consumption. Lastly, the 2019 announcement also negatively affected household consumption and savings. For this announcement, no significant difference is observed between income groups.

On top of the patterns in consumption and savings, other findings of this research contain the significance of the low-income limit, net monthly household income, and education. As previously mentioned in existing theories, there is a significant difference in consumption and saving levels between lower and higher-income groups (Etgeton, 2018; Lindeboom & Montizaan, 2020). For this research, the households below the low-income limit had lower consumption of around 300 euros per month and lower savings of above 10,000 euros. Contrary to the low-income limit, household income only has a significant positive effect on consumption. Additionally, an increase in education resulted in a significant increase in consumption and savings. Besides the found effects of the regressions, the finding of almost 30% of individuals receiving disability insurance in households below the low-income limit in the treatment group is in line with the research on the substitution effect by Atav et al. (2021).

5.2 Discussion

This research has some shortcomings regarding the data. To start off, it is hard to generalize the effect of the pension announcements to other countries since the sample is based on observations within the Netherlands and for Dutch pension reforms. In addition, it is difficult to generalize the effect within the working population of the Netherlands since the treatment group only consists of individuals between the age of 60 and the statutory retirement age. Where the total LISS panel consisted of around 7,500 individuals, limiting the range of age along with limited responses to the questions on consumption and saving resulted in fewer observations. This shows in the unique observations. Where the background statistics have around 2,000 unique observations for the treatment group, consumption and savings only have respectively 1,290 and 862 unique observations when correcting for outliers. The effects can thus not be generalized to the whole population. The generalizability can be improved by comparing the observations of the LISS panel to other databases and to other countries. Where this research has some shortcomings regarding external validity, it compensates with high internal validity. The usage of the regression discontinuity design increases the internal validity, as there is no selection bias in this quasi-experimental research design.

Another limitation of this research is the use of the consumption variable. The recall bias for this variable is not an issue since this is consistent across each year of observations. While the LISS panel includes multiple questions on household consumption across various categories, the analysis solely focuses on the total monthly household consumption. This approach fails to capture variations within the categories for households above and below the

low-income limit. Different categories such as food, transportation, and leisure may vary in their patterns as a response to the announcements.

A potential third shortcoming of this study is the possibility that the observed causal effects of pension reform announcements on consumption and savings patterns are the result of chance rather than a true causal relationship. It is possible that other policy interventions or other factors influenced the relation between the main explanatory variable and the outcome variables leading to effects that do not align with the initial hypothesis for each model. To address this shortcoming, further research is needed to examine various public policies and estimate their effects on consumption and savings patterns. Such an analysis would provide a more robust conclusion of the announcement effect which makes room for policy recommendations.

The reliability of this study is enhanced through the usage of the regression discontinuity models and the statistical analysis. They provide a robust framework for analyzing the announcement effect on consumption and saving behavior for household heads. The usage of publicly available data from the LISS panel and building on prior studies contributes to the overall reliability of the findings.

5.3 Recommendations

An interesting field of expansion for this research is the incorporation of financial literacy. The literature showed that financial literacy positively affects savings (Van Rooij et al., 2012). Due to a lack of data availability on financial literacy in the LISS panel, controlling for financial literacy within the regressions was not possible. A suggestion for future research is to distinguish the announcement effects between income groups and financial literacy. This way the relationship between the behavioral effects and financial literacy can be brought to light in the context of the announcement effect.

Based on additional research on financial literacy, alongside the results of this study, some policy recommendations can be provided. The results indicated a negative effect on both consumption and savings for the 2015 and 2019 pension announcements. As the Dutch pension system is transitioning to a more flexible system with defined contributions instead of defined benefits, the complexity of the new system along with a lack of knowledge may lead to individuals saving too little for retirement. To address this, the first policy recommendation is to give guidance regarding an individual's pension situation and help improve their financial situation after retirement. Another approach, similar to the Save More Tomorrow plan by Thaler and Benartzi (2004), is to nudge people in the right direction by introducing a plan where

individuals automatically increase contributions with every pay rise, while still retaining the option to opt out at any time.

Another policy recommendation that stems from this research is to design pension policies that consider the differences in income groups and provide support specifically for households under the low-income limit. This is based on the results that, for certain reforms, households under the low-income limit change their consumption less as a reaction to their future income loss. If they do respond to these changes, a drop in consumption or savings may not be socially desirable for this group. Therefore, when announcing pension system reforms, it is important to implement supportive measures for households under the low-income limit to protect their financial well-being. An example in line with this recommendation and financial literacy is to provide financial information regarding the consequences of the reforms. Another example is to extend transitional periods for low-income households or to expand eligibility criteria for financial assistance. Further research is required to examine the most effective way that low-income households can be supported.

Finally, time preferences are used extensively in the Life-Cycle models to indicate the optimal consumption and saving levels. If time preferences are incorporated in future research, the effect of an announcement can be measured between people who are more and less patient. In addition, Thaler and Benartzi (2004) explored time preferences for the switch from defined benefits (DB) to defined contributions (DC) where they found that the switch resulted in a higher value for the present. The time preferences of an individual can thus be a potential cause of the change in consumption and savings patterns. Including the time preferences can be an interesting opening to future research by checking if the negative announcement effect on savings holds for the switch from DB to DC in the Netherlands when controlling for time preferences.

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Appendix A. List of variables

Category	Variable	Description	Measurement
Background	Age (leeftijd)	Age of the respondent	Integer
	Year of birth (gebjaar)	Year of birth of the respondent	Integer
	Leeftijdjanuari	Age of the respondent in January	Integer
	Leeftijdjuni	Age of the respondent in June	Integer
	Leeftijdjuli	Age of the respondent in July	Integer
	Leeftijdseptember	Age of the respondent in September	Integer
	Gender (geslacht)	Gender of the respondent	1= male, 2 = female
	Position (positie)	Position in the household	1-7. 1 = household head
	Net household income (nettohh_f)	Net household income (in euros)	Integer
	Number of children (aantalki)	Number of at-home living children in the household	0-9.
	Education (oplmet)	Highest achieved education with a diploma.	1-6. 1 = primary school. 6 = University
Work and Schooling	Main occupation (cw525)	Primary occupation of the respondent	1-14. 9 = pensioner
Economic Situation: Assets	Savings (ca012)	Total balance of all banking and savings accounts + bonds and certificates (in euros). As of December 31st, of the previous year. (Can be negative)	Integer
Time Use and Consumption	Consumption (bf078)	Total amount of household consumption per month (in euros)	Integer

Support for pension reforms	Receive additional pension info (la001)	Did the respondent receive additional pension information?	1 = Additional info. 2 = No additional info.
Self-constructed	Low-income limit (lowincomelimit)	Whether the household has a net monthly household income under the low-income limit	0 = No 1 = Yes
	Year	Year of the questionnaire	2009-2022

Note: Descriptions are based on the questions from the LISS panel.

Appendix B. Population of the study

Year	Treatment	Control	Total
2009	517	248	765
2010	546	313	859
2011	460	297	757
2012	462	373	835
2013	468	359	827
2014	502	427	929
2015	484	424	908
2016	530	375	905
2017	528	325	853
2018	579	344	923
2019	596	288	884
2020	558	274	832
2021	501	253	754
2022	601	244	845
Total	7,332	4,544	11,876

Appendix C. Differences between income levels for the treatment group

Variables	Treatment group
Early retirement (in %)	
- Under income limit	4.16
- Above income limit	15.16
Disability Insurance (in %)	
- Under income limit	29.27
- Above income limit	9.70
Net household income (in euros)	
- With early retirement	2,782.21
- Without early retirement	3,319.89
Savings (in euros)	
- With early retirement	61,868.96
- Without early retirement	45,343.97
Low-income limit (in %)	
- With early retirement	4.01
- Without early retirement	12.17

Appendix D. Regression estimates including outliers

Table D.1 Regression results on consumption including outliers

Variables	(1) Cutoff1	(2) Cutoff2	(3) Cutoff3	(4) Cutoff4
Treat	363.1	353.6	354.6	406.1
	(438.3)	(428.5)	(431.2)	(479.2)
$Year^2$	3.782	71.54	196.8	
	(4.708)	(60.01)	(190.2)	
Year	-15,250	-288,702	-794,795	246.9**
	(18,481)	(241,462)	(768,003)	(117.3)
Low-income limit	3,189	3,208	3,194	3,191
	(3,529)	(3,549)	(3,535)	(3,538)
Net monthly hh inc.	0.00196	0.00312	0.00327	0.00400*
	(0.00390)	(0.00283)	(0.00292)	(0.00227)
Education	50.68	47.88	48.90	41.02
	(125.6)	(128.1)	(127.2)	(135.1)
Hh members	-154.5	-138.4	-142.3	-131.4
	(350.0)	(335.1)	(338.8)	(327.3)
Below_cutoff1	7.134e+06			
	(6.839e+06)			
Below_cutoff1 x Year	-3,550			
	(3,402)			
Below_cutoff2		-352,520		
		(522,746)		
Below_cutoff2 x Year		174.0		
		(252.1)		
Below_cutoff3			-4.602e+06	
			(4.438e+06)	
Below_cutoff3 x Year			2,283	
			(2,202)	
Below_cutoff4				908,389**
				(430,545)
Below_cutoff4 x Year				-450.1**
				(213.6)
Constant	1.538e+07	2.913e+08	8.023e+08	-497,541**
	(1.878e+07)	(2.435e+08)	(7.751e+08)	(237,196)
Observations	4,308	4,308	4,308	4,308
R-squared	0.004	0.003	0.003	0.002

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

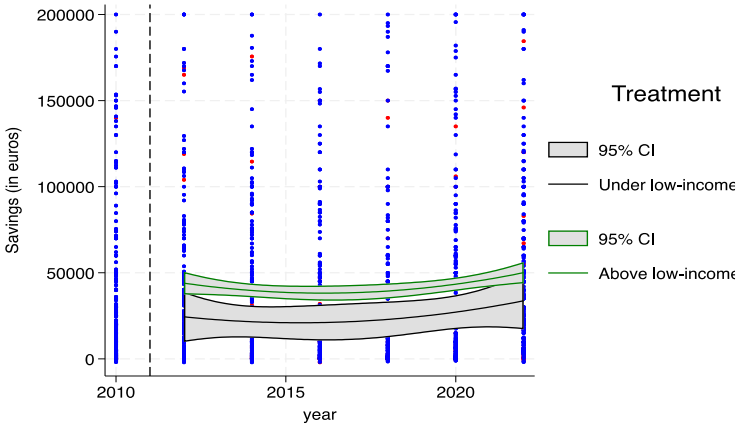
Table D.2 Regression results on savings including outliers

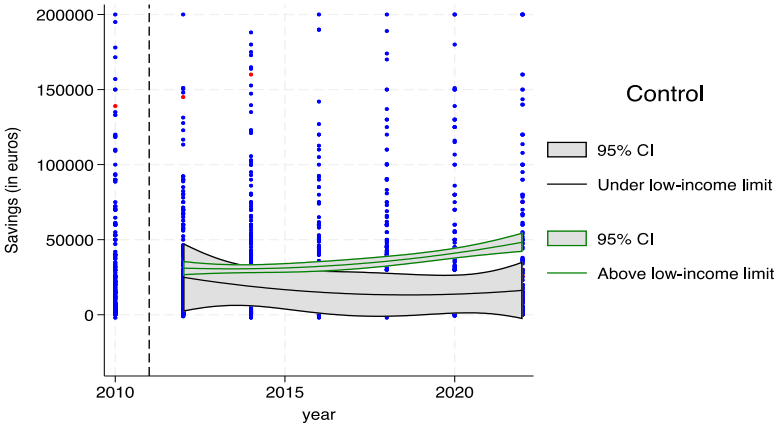
Variables	(1) Cutoff1	(2) Cutoff2	(3) Cutoff3	(4) Cutoff4
Treat	-1,152	-1,197	-1,192	-689.3
	(7,952)	(7,961)	(7,862)	(7,460)
$Year^2$			1,280	
			(936.7)	
Year	1,315*	1,485	-5.167e+06	6,540
	(783.6)	(1,192)	(3.781e+06)	(6,217)
Low-income limit	2,747	2,745	2,588	2,467
	(12,899)	(12,905)	(12,768)	(12,827)
Net monthly hh inc.	0.416	0.415	0.413	0.420
	(0.417)	(0.416)	(0.412)	(0.405)
Education	11,951***	11,953***	11,963***	11,945***
	(2,555)	(2,558)	(2,562)	(2,552)
Hh members	11,254*	11,274*	11,381**	11,411**
	(5,741)	(5,770)	(5,796)	(5,809)
Below_cutoff1	22,435			
	(21,531)			
Below_cutoff1 x Year	-			
Below_cutoff2		2.182e+07		
		(2.131e+07)		
Below_cutoff2 x Year		-10,846		
		(10,593)		
Below_cutoff3			-2.391e+07	
			(2.346e+07)	
Below_cutoff3 x Year			11,857	
			(11,630)	
Below_cutoff4				1.563e+07
				(1.351e+07)
Below_cutoff4 x Year				-7,742
				(6,687)
Constant	-2.666e+06*	-3.010e+06	5.215e+09	-1.323e+07
	(1.589e+06)	(2.414e+06)	(3.818e+09)	(1.257e+07)
Observations	2,716	2,716	2,716	2,716
R-squared	0.013	0.013	0.013	0.012

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

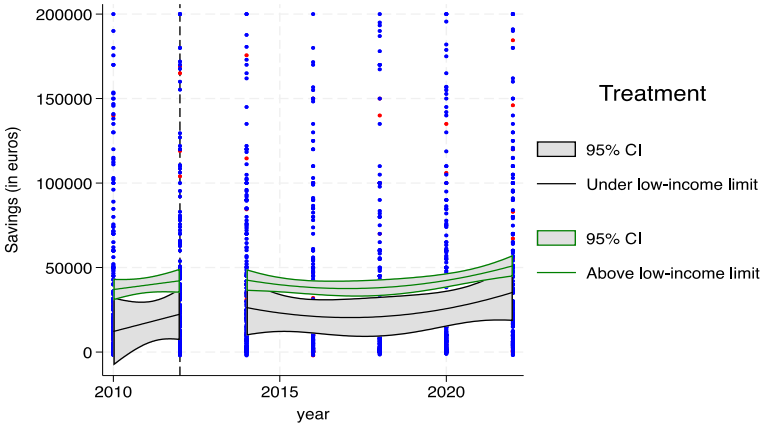
Appendix E. Robust empirical models
Regression Discontinuity models on Savings (excluding 5%)

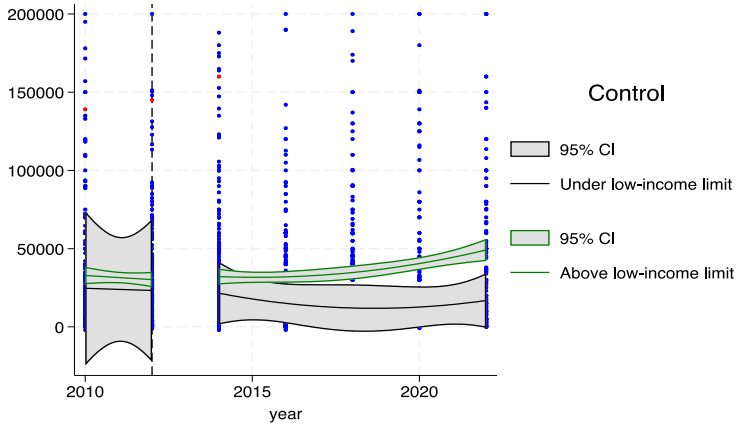
2011:



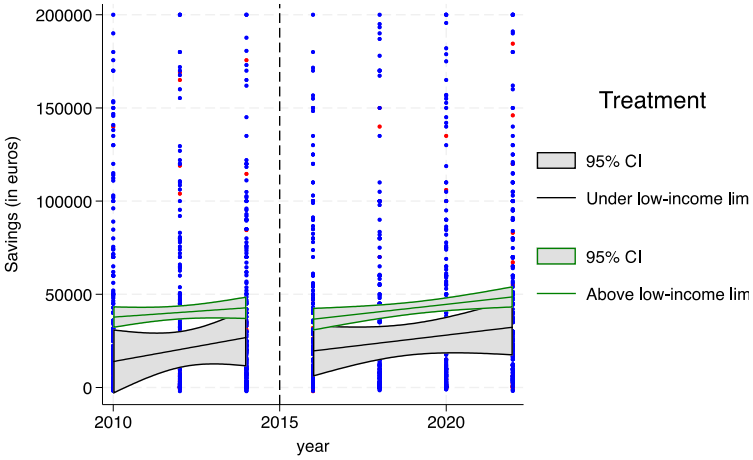


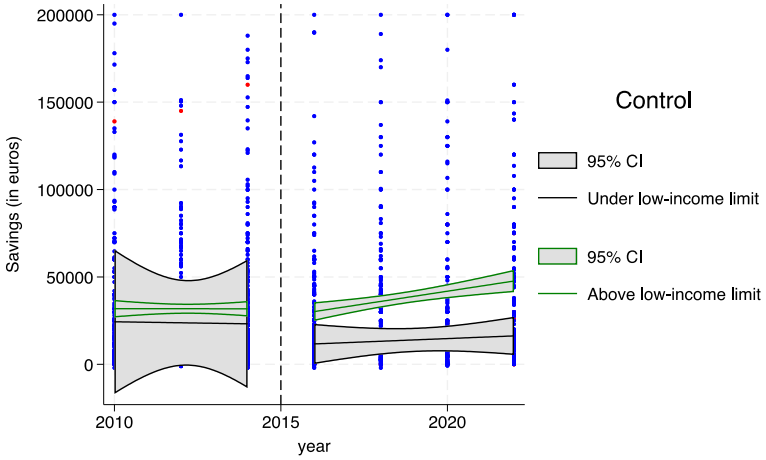
2012:



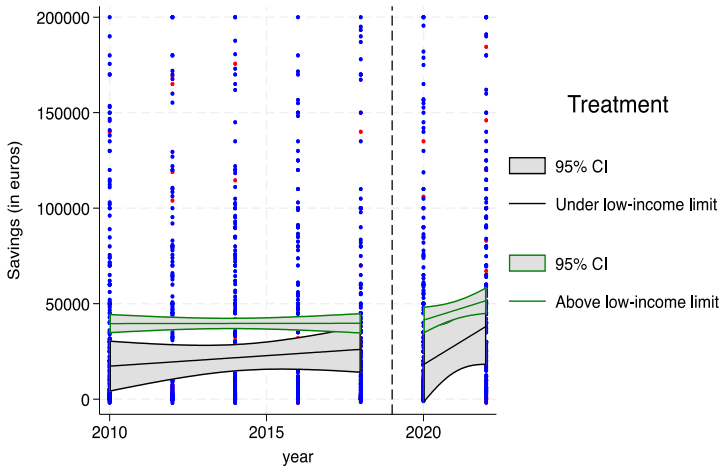


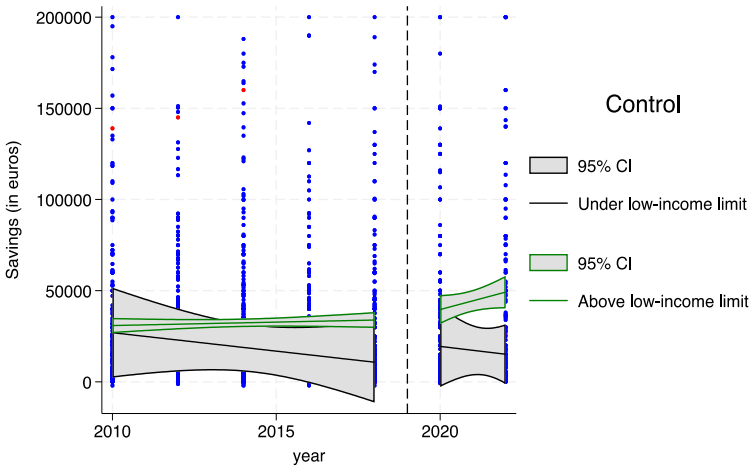
2015:





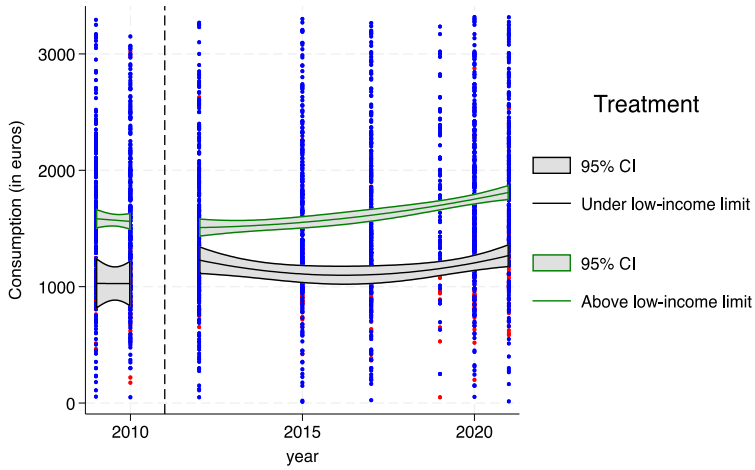
2019:

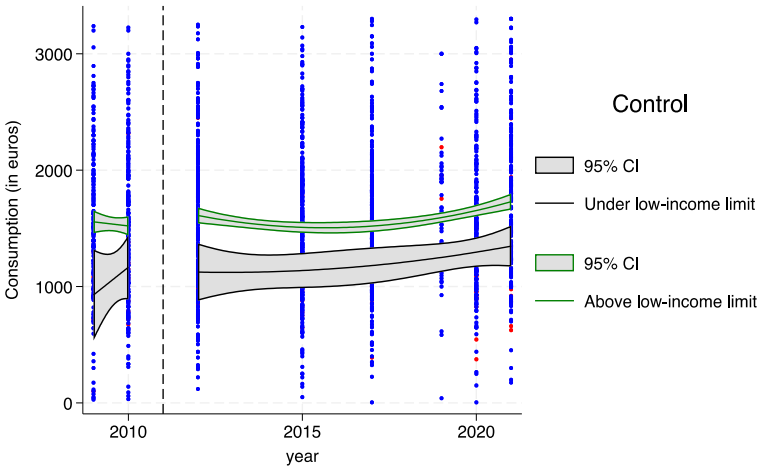




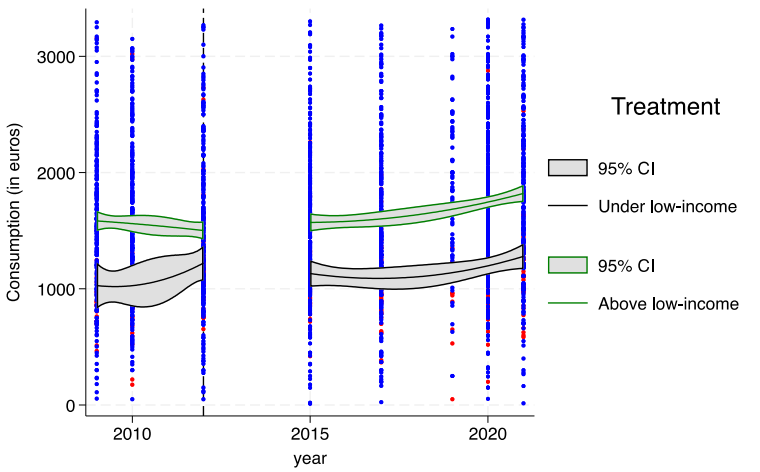
Regression Discontinuity models on Consumption (excluding 5%)

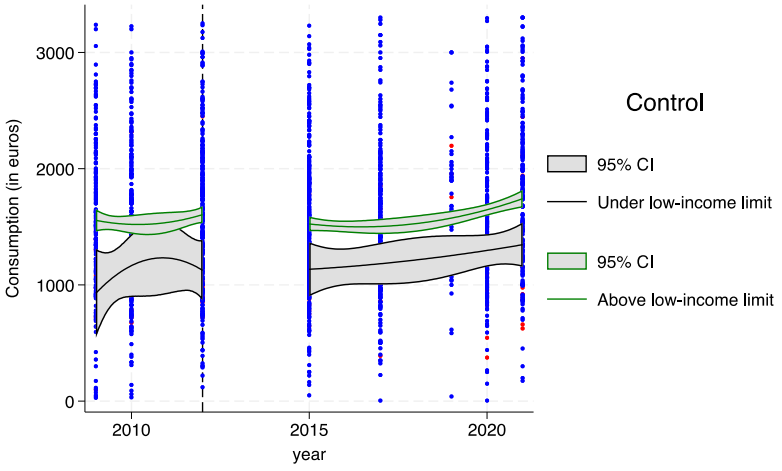
2011:



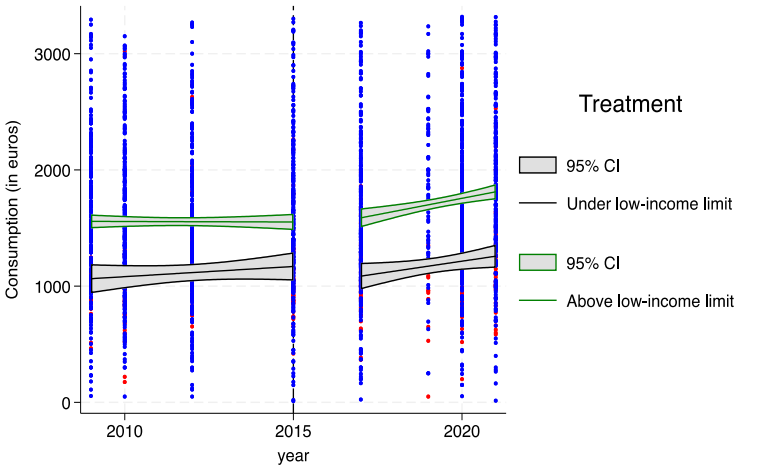


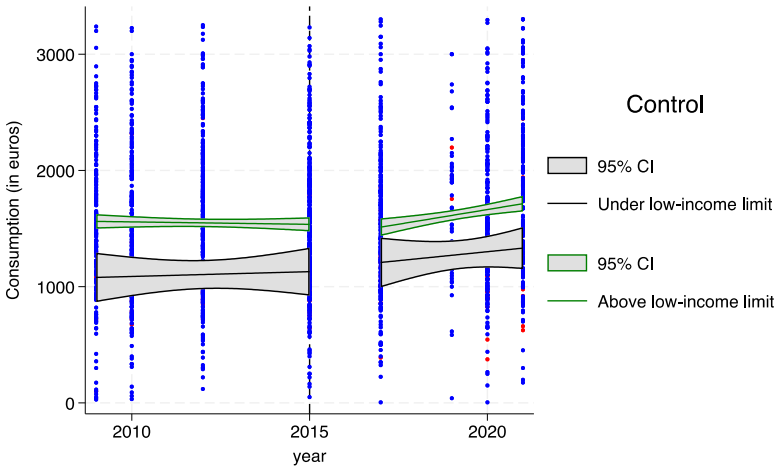
2012:



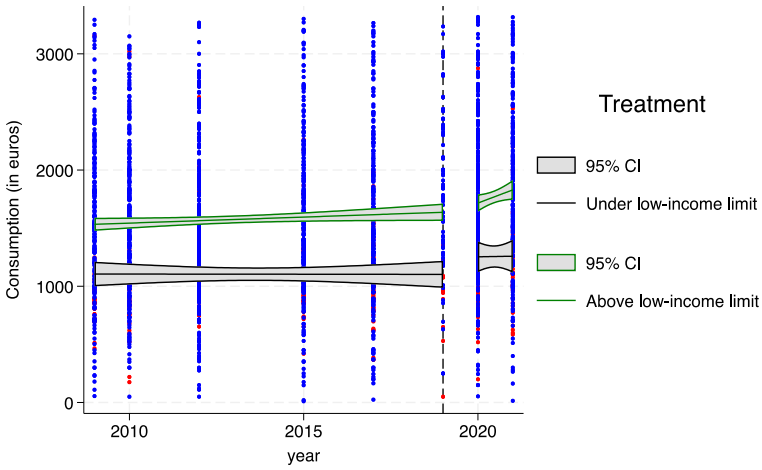


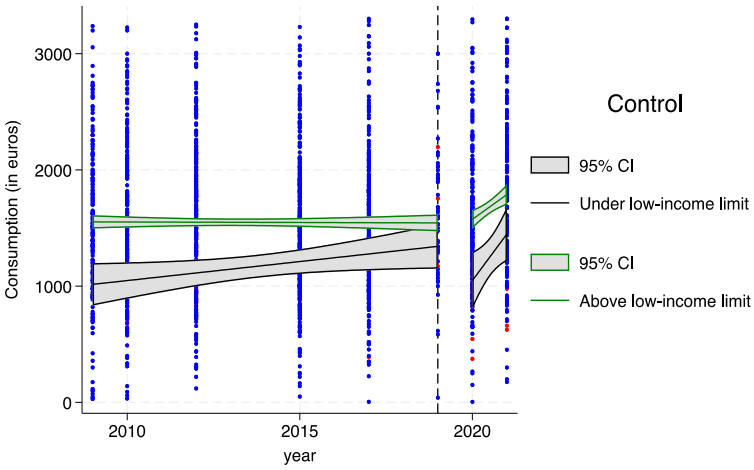
2015:


Consumption (in euros)
0
1000
2000
3000
2010
2015
2020
year
Treatment
95% CI
Under low-income limit
95% CI
Above low-income limit


Consumption (in euros)
0
1000
2000
3000
2010
2015
2020
year
Control
95% CI
Under low-income limit
95% CI
Above low-income limit

2019:


Consumption (in euros)
0
1000
2000
3000
2010
2015
2020
year
Treatment
95% CI
Under low-income limit
95% CI
Above low-income limit


Consumption (in euros)
0
1000
2000
3000
2010
2015
2020
year
Control
95% CI
Under low-income limit
95% CI
Above low-income limit