The effects of social insurance benefits on leaving employment at older ages in the Netherlands

Adriaan Kalwij (Utrecht University) and Arie Kapteyn (University of Southern California)

Abstract

In the Netherlands, from 1989 to 2013, in the age group 55-63 the annual exit rate from employment to receiving social insurance benefits in the following year decreased from around 17 percent to 7 percent for men, and from 14 percent to 5 percent for women. We found that less generous social insurance benefits have had small but significant negative effects on these exit rates: The annual exit rate to social insurance benefit receipt next year (at ages 56-64) would have been about 14 percent higher for both men and women in 2013 should social insurance benefits schemes of 1989 still have been in place. This increase amounts to staying, on average, three months longer in employment from age 55 onwards in 2013 than in 1989. These findings are driven to some extent by the reduction in the maximum duration of unemployment insurance benefits in 2007, but predominantly by making (early) retirement schemes actuarially fair from 2006 onwards. The increase in disability insurance's income replacement rate in 2006 has led to a slight increase in the exit rate from employment, conditional on eligibility. As the estimated effects of changes in the social insurance benefits from 1989 to 2013 on working beyond age 55 are relatively small, they suggest the importance of other factors such as changes in workers' skills, improved health (on which we provide some evidence), and social insurance's tighter eligibility criteria.

Keywords: Aging populations, social insurance programs, reforms, benefits, employment, older workers, The Netherlands

1. Introduction

Social insurance reforms since the mid-nineteen-nineties have reduced the financial incentives for leaving employment at older ages in the Netherlands for those eligible for benefits. This chapter investigates the claim made in our previous two chapters (Kalwij, Kapteyn & de Vos 2018; de Vos, Kapteyn & Kalwij 2018), that these reduced financial incentives during recent decades may have decreased the probability of leaving employment at older ages and, consequently, contributed to the rising employment rates at older ages since the mid-nineteen nineties. In particular, we quantify the contributions of the changes in the benefits schemes of various social insurance programs from 1989 to 2013, including early retirement schemes[1], to the decline in the probability of exiting employment and claiming social insurance benefits before the state pension age during this period.

The reforms of social insurance since the mid-nineteen-nineties have, in part, been triggered by an ageing Dutch population. A steady increase in life expectancy for over a century and sharply decreasing fertility during the nineteen-sixties with a below replacement level fertility since, are the main drivers of a forecasted doubling of the old-age dependency ratio in the coming decades (Figure 1). For every person over 65 there were four persons of working age (20-64) in 2010, while it is forecasted that in 2040 there will be two persons of working age for every person over 65. This ageing of the Dutch population burdens (future) public finances as it increases public expenditures on, for instance, health care and state pensions which are partly financed through taxation on earnings from a relatively shrinking workforce (OECD 2011; van Ewijk et al. 2006). This burden on public finances can be

---

[1] Early retirement and mandatory private (occupational) pension schemes are considered part of social insurance as these are facilitated through favorable taxation and regulated by public policymakers with pension laws.

alleviated by keeping people in work longer, as it will increase income tax revenues, and by increasing the state pension age to reduce public pension expenditures.

Over the last decades, therefore, social insurance in the Netherlands, as in many other OECD countries, has been redesigned to create stronger incentives for continued work at older ages (Gruber & Wise 2004; Wise 2012, 2016A). In particular, as employment rates among 55-64 years old men were notoriously low for several decades (Figures 2 & 3), with an all-time low of about 20 percent for men aged 60-64 in the mid-nineteen-nineties, a first batch of pension reforms from 2000 onwards aimed at keeping workers employed by making early retirement less attractive (de Vos, Kapteyn & Kalwij 2018). Previous studies suggested that these reforms are likely to have contributed to the increase in labor force participation of the 55–64 population from less than 30 percent in the mid-nineteen-nineties to 45 percent in 2007 (Euwals, de Mooij & van Vuuren 2009; Van Oorschot 2007). As the reforms of early retirement schemes mostly affected individuals born after 1949 (de Vos, Kapteyn & Kalwij 2018), its full impact can only be assessed with the data currently available. An assessment of the effects of early retirement benefit schemes on the exit probability from employment is one of the objectives of this chapter.

Mandatory private occupational pension schemes (from here onwards referred to as private pensions) in the Netherlands usually include early retirement options, i.e. receiving private pensions before the state pension age (SPA).[2] Apart from the consequences of population aging for public finances, decades of generous early retirement schemes, the dotcom crisis and the recent great recession with in its aftermath historically low interest rates, left their marks on the solvability of pension funds and necessitated further pension

---

[2] This paper does not analyze the role of voluntary private pensions or other financial products that might be used to finance (early) retirement.

reforms including a gradual increase in SPA from 65 to 69 from 2013 onwards.[3] An increased SPA will, by construction, reduce public pension expenditures and although it is likely to also delay the claiming of private pensions, the most important immediate measures to improve pension funds' solvability have been through a shift from benefits based on final earnings to benefits based on average earnings and a reduction in pension entitlements and benefits (Kalwij, Alessie, Gardner & Ali 2018). De Vos, Kapteyn & Kalwij (2018, Section 4.2) have shown that an increase in SPA keeps workers employed longer.

Next to pension reforms there have been reforms of the unemployment insurance (UI) and disability insurance (DI) programs. While the effectiveness of the UI reforms for older workers might have been mitigated by the introduction in 2007 of an income support program for workers aged 60-64, the DI reforms, and in particular stricter eligibility requirements, have significantly reduced the inflow into DI (de Jong, Lindeboom & Van der Klaauw 2011; Kalwij, de Vos & Kapteyn 2016; Koning & Lindeboom 2015). An objective of this chapter is to assess to what extent changes over time in UI and DI benefits, conditional on being eligible, have affected the probability of leaving employment and receiving these benefits.

The increased employment rates at older ages from the mid-nineteen nineties onwards after many years of declining rates for men and stagnating rates for women may suggest that the social insurance reforms have been effective (Figures 2 and 3). Figures 2 and 3 also show, however, that employment rates beyond SPA have more than doubled for men since 1995 and more than quadrupled for women, despite the fact that at those ages social insurance reforms are unlikely to have had much impact. As argued in Kalwij, Kapteyn, and de Vos (2018), this may suggest the importance of other factors for the rise in employment at older

---

[3] SPA is 66 and four months in 2019 and is expected to increase to 69 and three months in 2040 (de Vos, Kapteyn & Kalwij 2018).

ages, such as improved health, increased levels of education, and a better match of older workers' characteristics with labor demand. Or at least, such factors may have contributed to the success of the social insurance reforms in unlocking the unused work capacity of older workers that is documented in Kalwij, Kapteyn & de Vos (2017). While we do not observe these variables, we control for health on an aggregate level using life tables information as in particular the health of men has improved substantially during our observation period (see Figure 4). Furthermore, we control for individual income as a proxy for socioeconomic status and skills, which might be negatively related to the probability of leaving employment, as for instance low wage workers face higher unemployment risk than high wage workers. We control for household income and homeownership as proxies for household wealth, which might be positively related to the probability of leaving employment (Bloemen 2011).

The rest of the chapter is structured as follows. Section 2 discusses the social insurance reforms, which have been described in more detail in our previous chapter (de Vos, Kapteyn & Kalwij 2018). In our analysis we use only the most salient features of social insurance in terms of benefits and durations of benefits. That is, we do not take into account possible sector, firm or individual specific arrangements as we do not observe these, nor how household composition might affect an individual's state pension (SP) or social assistance (SA) benefits when no longer eligible for DI or UI benefits. An advantage of taking such a crude approach is that our measure of social insurance wealth (SIW), once conditioned on individual earnings and age, is unlikely to be endogenous to individual and firm characteristics that may also influence the employment decision. In other words, we may assume our measure of SIW is exogenous for the worker's decision to leave employment, and whether this is by receiving UI or DI benefits or by retiring early. It also means that there is,

for given age and earnings[4], no variation in SIW within a calendar year so we exploit mainly variation in SIW across time and age, or rather variation in the implicit tax rate (ITAX) calculated based on SIW, to identify the effects of social insurance benefits on the probability of exiting employment. Section 3 describes the data taken from the (Dutch) Income Panel Study. In our sample, employed individuals are followed from the age they entered the panel (55 or over) until they left employment or reached the age of 70 (whichever came first).[5] The data cover the period 1989-2014. Thus, we start observing workers before the implementation of most of the reforms aimed at keeping workers employed and stop observing workers just after SPA started to rise in 2013. Section 4 presents our empirical results and section 5 discusses the main findings.

---

[4] We also condition on homeownership. This variable is used to assess eligibility for SA, which is means tested. Furthermore, there are no gender differences in the social insurance rules.

[5] A worker may also have died, emigrated, or left the sample for other reasons (see Section 3).

Figure 1 **Dependency ratios 1970-2040.**
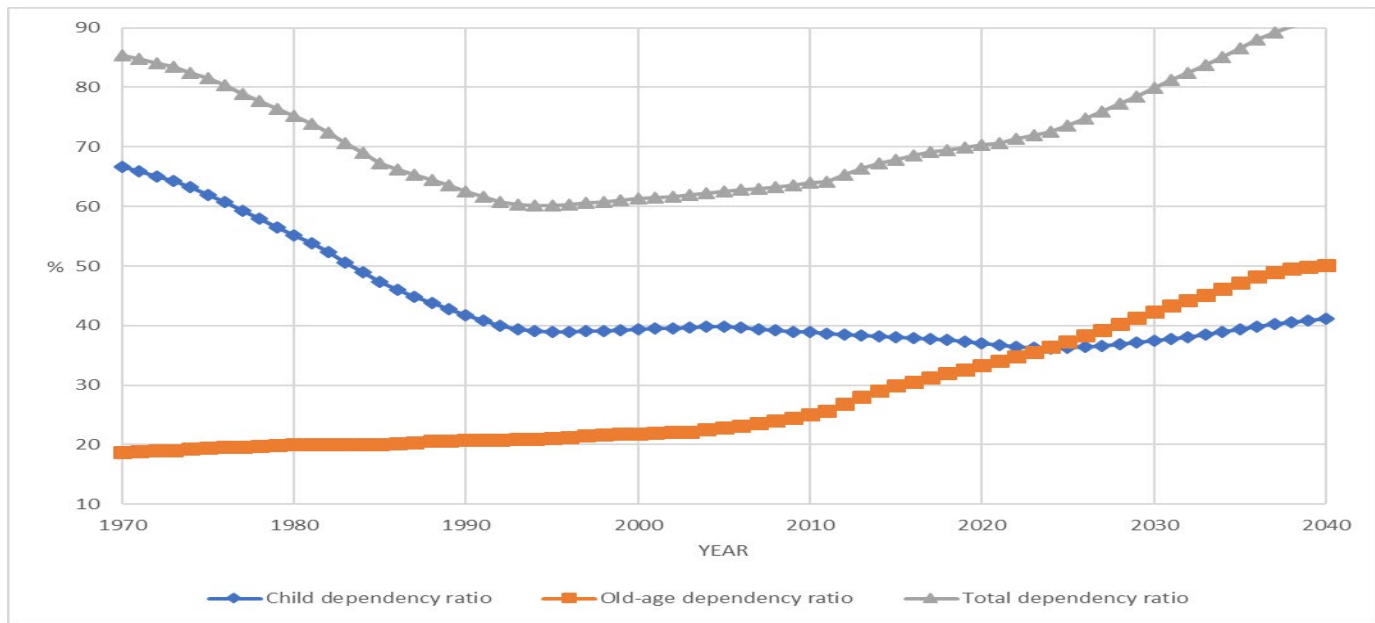
Source: Statistics Netherlands (data extracted on April 5, 2019; statline.cbs.nl**).**

Notes: The total dependency ratio is defined as the number of people under 20 or over 64 as a percentage of the number of people aged 20-64, the child dependency ratio as the number of people under 20 as a percentage of the number of people aged 20-64, and the old-age dependency ratio as the number of people over 64 as a percentage of the number of people aged 20-64.
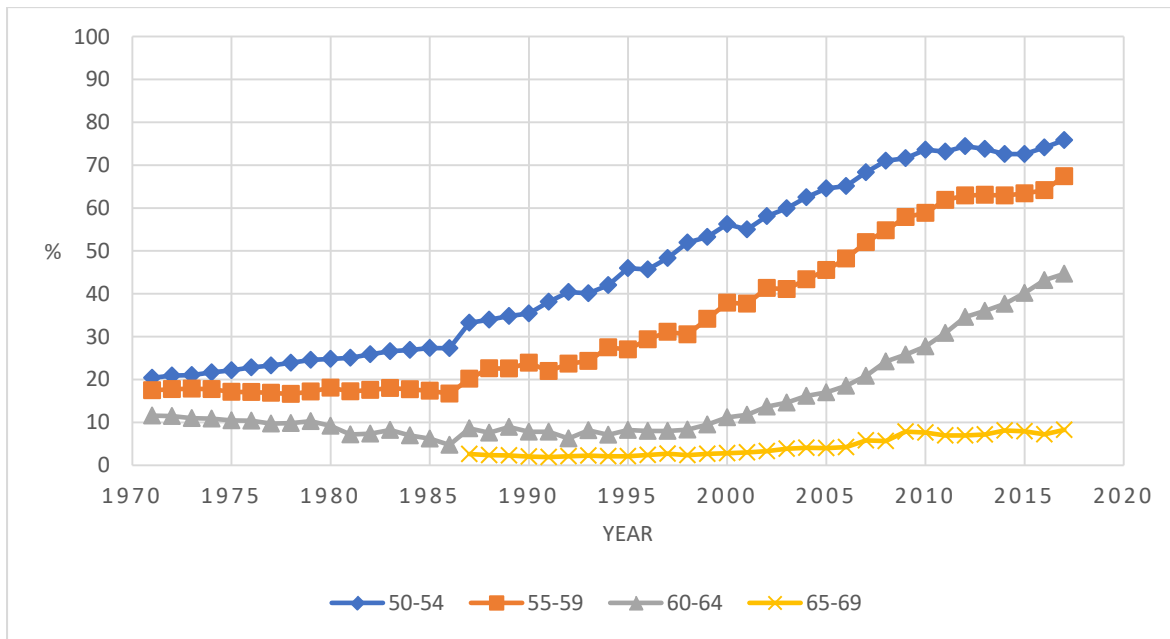
Figure 2 **Men's employment rate by age.**
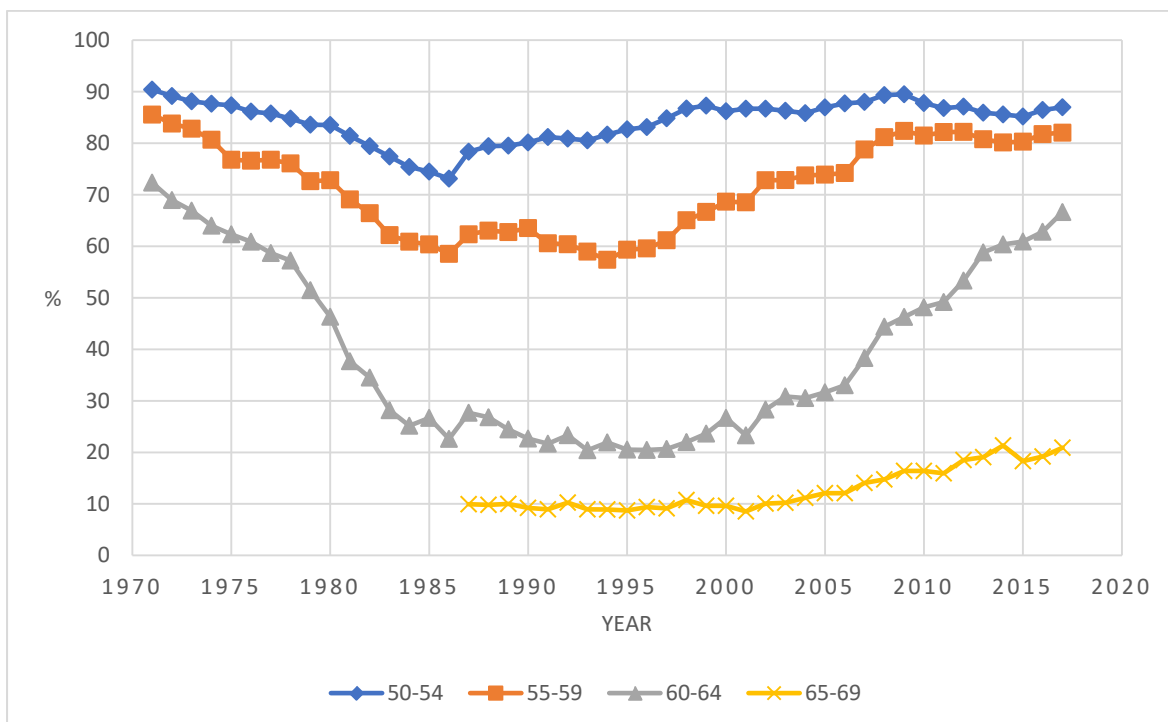
Source: OECD (Data extracted on April 5, 2019; stats.oecd.org).

Note: Only for this Figure, employment includes the self-employed.
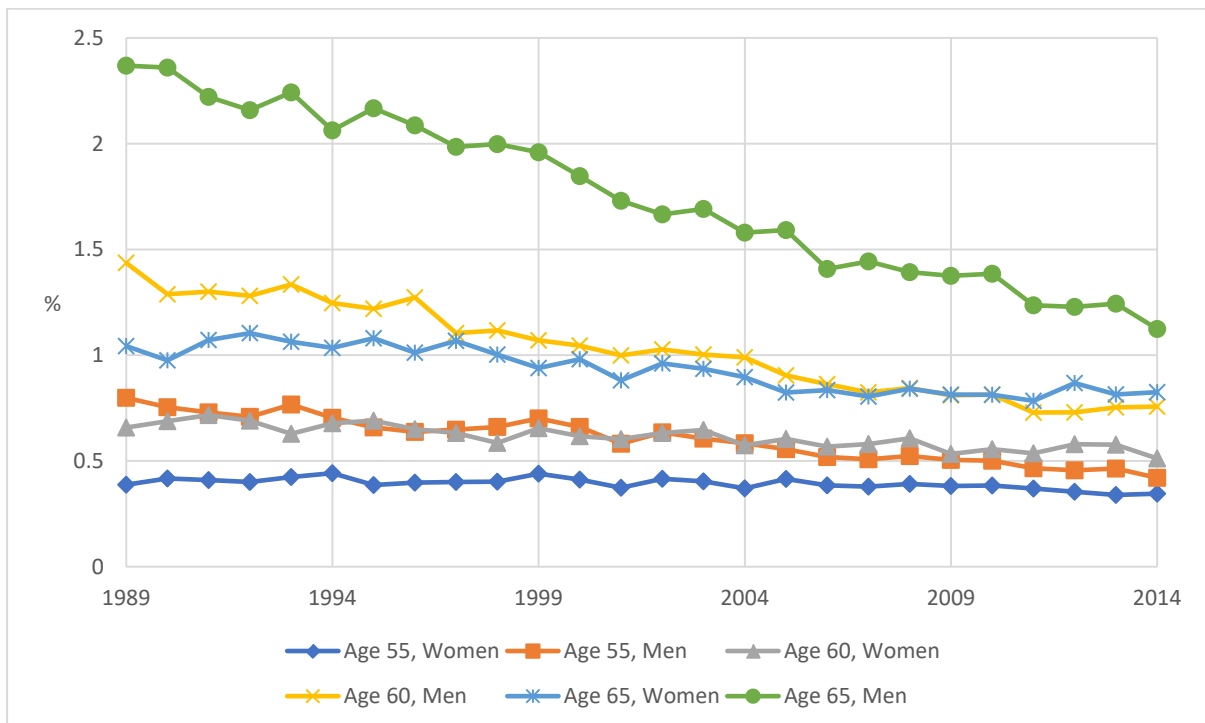
Figure 3   Women's employment rate by age.

Source: OECD (Data extracted on April 5, 2019; stats.oecd.org).

Note: Only for this Figure, employment includes the self-employed.

Figure 4   Men's and Women's annual mortality rates at selected ages by year.

Source: Human Mortality Database (Data extracted on May 2, 2019; mortality.org).

2. Social insurance reforms 1989-2015: The most salient features

Social insurance programs typically consist of eligibility criteria, income replacement rates and benefit durations. For the Netherlands, these are stipulated in social insurance laws (UWV 2013A, 2013B, 2013C, 2014A, 2014B) and pension laws (wetten.overheid.nl). All claims to unemployment and disability insurances cease at SPA and early retirement is defined as retiring before SPA. From that age onwards, all workers receive a state pension, most often supplemented with a private (occupational) pension.

The implementation of these laws, within the legal framework, may depend on collective bargaining between unions and firms (or groups of firms within a sector), with outcomes that may be individual specific. For instance, private pensions may have sector specific arrangements. Municipalities and other institutions may have their own income support programs for those in need, on top of the programs outlined below. Furthermore, for instance, in case of a plant closure, unions, firms and local governments may negotiate redundancy schemes, such as offering early retirement to older workers instead of UI. Finally, some programs such as Social Assistance and State Pension take into account individuals' household situation, which we ignore in this chapter. Hence, individuals may face social insurance provisions that are less or more generous than described below. As discussed in the introduction, we only consider the most salient features of social insurance benefits schemes and by doing so many nuances are missing in our discussions.

Our rather crude approach makes it possible, given our data (Section 3), to calculate social insurance wealth for all workers in our sample; a necessary input for our empirical analysis (Section 4). Table A1 presents the parameters for computing social insurance wealth for each worker based on the discussions in the remainder of this section.

2.1 Social assistance (SA)

Universal social assistance (SA) has been in place since the early nineteen-sixties. It is a means tested program with benefits equal to 70% of the minimum wage (Table A2). When claiming SA, one does not accrue private pension (PP) entitlements but one does accrue (public) state pension (SP) entitlements, simply by being a resident in the Netherlands (see Section 2.5).

UI and DI became less generous around 2005 (see Sections 2.2 and 2.3). To support older workers with arguably poor employment opportunities, an income support program was introduced in 2007 that guarantees individuals who entered UI or DI at the age of 60 or over and whose entitlements to UI or DI benefits have run out, non-means tested SA benefits until SPA.

2.2 Disability insurance (DI)

Between 1984 and 1992, DI benefits were based on a 70% replacement rate and lasted until SPA (if one remained eligible). Before 1984, the replacement rate was 80%. From 1993 onwards, the benefit duration was shortened to three years when receiving DI at ages 53-57, and to six years when receiving DI at ages 58-64. In response to these reforms, policymakers, unions and employers agreed on (supplementary) private disability insurance for workers, often at the sector or firm level with auto-enrollment, to guarantee work-disabled older workers a replacement income after the DI benefit has run out and until SPA. In 2006, major reforms to DI took place that mainly affected eligibility. Medical screening became stricter and the threshold for benefit eligibility was increased from 15 to 35 percent reduced work capacity. Workers were only entitled to full benefits if they were 80-100 percent disabled. In

addition, the replacement rate was raised to 75%. When DI benefits end, workers are entitled to SA. If they are over 60, benefits are not means tested. While on DI one keeps contributing to the private pension scheme of the last employer but at a lower accrual rate, as it is based on replacement DI benefits and not last earnings. Nevertheless, as was the case with the 1993 DI reform, after 2006 supplementary private disability insurances effectively nullified the effects of shorter DI benefit durations on DI uptake from the perspective of workers. Hence, conditional on being eligible for DI, the financial incentives to take up DI have hardly changed since the early nineteen-eighties.

2.3 Unemployment insurance (UI)

Eligibility for UI can be the result of job loss, for instance due to a firm closure or termination of a labor contract. The UI replacement rate is 70% since 1985 (80% before 1985). While on UI, one does not accrue private (occupational) pension benefit entitlements.

UI benefit duration depends on work experience. Before 2007, workers with at least 35 years of work experience were entitled to four years of benefits and workers with at least 40 years of work experience were entitled to five years of benefits. Work experience has however only been registered since the end of the nineteen-nineties, so it was assumed that workers started their first job at the age of 18. Therefore, before 2007, for workers just below the age of 57.5, UI benefit duration equaled four years and for workers aged 57.5 or over, the duration equaled five years. After UI benefits ran out, the unemployed were entitled to continuation benefits (SA level, not means tested). If a worker was below 57.5 when taking up UI, the duration of these continuation benefits was one year before 1995 and two years from 1995 onwards. If a worker started receiving UI at the age of 57.5 or later, this duration was 3.5 years. Summing up, before 2004, a worker aged 57.5 or over who was eligible for UI, could have UI and continuation benefits until SPA. A worker younger than 57.5 could

have UI benefits for four years and continuation benefits for one year (or two years after 1994), followed by a few years of means tested SA before SPA. Hence, the age of 57.5 is a pivotal age for the financial incentives of claiming UI at older ages.[6]

From 2004 onwards there are no more continuation benefits, but these have been replaced in 2007 by non-means tested SA benefits for workers aged 60 or over (see section 2.1). Also, before 2004 the unemployed aged 57.5 or over did not need to apply for jobs, while from 2004 onwards they have a job-search requirement. From October 2006 onwards the UI benefit duration is limited: one month for every year worked, with a maximum of 38 months.[7]

2.4 Early retirement (ER)[8]

An important eligibility criterium for ER is that one can only take up ER when employed. Workers enrolled in a private pension scheme have often the option to retire early, that is to start receiving pension benefits before SPA. While nowadays early retirement (ER) schemes are directly linked to the private pension (PP) schemes (see Section 2.6), most generous ER schemes that did not affect workers' PP entitlements were in place since the late 1970s and gradually covering almost all workers towards the end of the nineteen-eighties.

---

[6] For our analysis we set this age equal to 58 as we observe ages in full years (and at December 31 of each year).

[7] We assumed this shortening of UI benefits duration was effective from 2007 onwards (we only observe full years) and set the maximum duration equal to three years for all individuals aged 56 and over. From 2005 onwards, actual work experience has been used by caseworkers, but as there are no official administrative records before 1995, for older workers the rule of having worked from the age of 18 has been used by caseworkers (hence a maximum benefit duration entitlement at the age of 56).

[8] See also Euwals, De Mooij, & Van Vuuren 2009; Euwals &Trevisan 2011; Groot & Heyma 2004; Lindeboom 1996; Nelissen 2001.

These latter ER schemes were targeted for reform from the mid-nineteen-nineties onwards when it became apparent that these would not be financially sustainable as they were by and large unfunded (Jansweijer 1996). Until 1996, ER schemes were usually characterized by very high net replacement rates and with ER benefits that lasted until SPA. No actuarial adjustments of ER or PP benefits took place. In addition, during early retirement PP benefit accrual continued and the PP replacement rate remained 70% of gross earnings after 40 years of PP accrual. Typically, before 1996 ER was offered to workers around the ages 58 to 62.[9] When reaching SPA, workers who had been early retired received PP as if they had continued working until SPA. The main political argument for having such generous ER schemes was that workers who made use of it often worked in declining industries. While unhealthy workers could make use of DI, an equally generous option, the healthy ones could make use of ER (Jansweijer 1996; p.181/182). Another appealing argument in times of high youth unemployment was that ER schemes would create jobs for the young; an argument still often made but with little basis in fact (Kalwij, Kapteyn, & de Vos 2010). The generous system lasted until 1996 with only one minor reform, which reduced the replacement rate for the period 1993-1996 to 85% instead of the 90% before 1993.

Gradually, over the period 1997-2005, most ER schemes have been made more actuarially fair (before SPA) with a typical gross replacement rate of around 70% at age 62. This change was triggered by legislation that only allowed favorable tax treatment for actuarially fair ER schemes. The new ER schemes did not allow for PP entitlements accrual during early retirement. From 2006 onwards, workers born before 1950 faced slightly less generous ER schemes but the major ER reform affected those born after 1949. These latter

---

[9] For our analysis we assumed the age of 60.

younger cohorts have ER schemes that are directly linked to their PP schemes and when a worker retires early, actuarial adjustments of ER and PP take place.

2.5 State pension (SP)

The state pension age (SPA) is the age at which all residents in the Netherlands receive a state pension (SP). Since 1956, SPA has been equal to 65 for both men and women. As of 2013, SPA has been gradually increasing (de Vos, Kapteyn & Kalwij 2018).[10] SP equals 70 percent of the minimum wage from SPA until the end of life. The actual SP received may deviate from this norm as it depends on the number of years residing in The Netherland, while for couples it depends on the age of the spouse.[11]

2.6 Private (occupational) pensions (PP)

PP schemes are designed by firms, industries and unions and legislated by (national) pension laws. Such schemes are, therefore, most often industry specific. Almost all workers are mandatorily enrolled in their employers' PP schemes from the age of 25 onwards[12] until SPA. Before 2004 and for a typical PP scheme, PP amounted to 70% of final earnings at SPA if a worker had accrued entitlements for at least 40 years in that scheme. From 2004 onwards, PP is based on average lifetime earnings (not implemented retroactively), albeit often with

---

[10] This increase is not taken into account in our analysis. We set SPA equal to 65 in 2014 (our last year of observation) as the increase had only been two months and we observe ages in full years.

[11] We assumed that all workers lived in the Netherlands from the age of 15 onwards and are entitled to a full SP. We did not observe the years of residence, but should having lived abroad caused retirement income to drop below SA-level, there is income support to guarantee a minimum income at SA-level. Spousal characteristics are not taken into account in our analysis and we treat individuals as singles. See Mastrogiacomo, Alessie, and Lindeboom (2004) for a discussion on the importance of this.

[12] From 2007 onwards it is from age 21.

higher annual accrual rates so that for most older workers at the time of this reform the change made little difference.[13]

As noted in Section 2.4, ER did not affect PP until 1997. From that year onwards ER schemes gradually changed and by 2005 workers did no longer accrue PP entitlements while early retired.[14] For workers born after 1949, actuarially fair adjustments of PP take place when receiving PP before SPA.[15] Finally, it has been possible from 2004 onwards to start claiming PP after SPA, but only for about 17% of employees (SER 2006; SZW 2005). Moreover, these employees could only defer part of their PP benefits and most often with an age-limit of 67. Hence, very few workers postponed PP. In our empirical work, we therefore assume that all workers receive PP at SPA.

3. The data: Income Panel Study of The Netherlands (IPO)

For our empirical analysis we use the Income Panel Study of the Netherlands (IPO, Inkomens Panel Onderzoek; CBS 2009). IPO is an administrative database of individual incomes collected by Statistics Netherlands from official records such as tax records, the population registry, institutions that pay out social insurance benefits and the department of housing for rent subsidies. Data are available for the years 1981, 1985, 1989–2014. The 1981 and 1985 samples are not part of the income panel and are only used for descriptive statistics. We do not use the 1981 sample of women as it severely underrepresents women who did not participate in the labor force. From 1989 onwards IPO is a representative sample of the Dutch

---

[13] Therefore, our analysis did not take this reform into account and we assumed replacement of final earnings.

[14] We assumed an accrual rate of 1.75% for each year employed.

[15] We assumed a 6.5% actuarial adjustment rate for each year retired early.

population and all sampled individuals are followed over time until they die or emigrate. These individuals are referred to as the heads of households. The spouses of heads of households are followed over time as well but leave the panel when they separate from the head of household and form a new household. For the years before 1996, there is no household identifier, which prevents taking into account spousal's characteristics when calculating social assistance benefits and state pensions (see Sections 2.1 & 2.5).

After selecting individuals aged 55-69, excluding 0.4 percent of individuals who are institutionalized (e.g. living in a nursing home) and excluding 2.8 percent of individuals who are neither head of household nor the spouse of the head of household, the sample sizes are 22,914 in 1981, 46,837 in 1985, and increasing gradually afterwards from 23,437 in 1989 to 36,577 in 2014.

Apart from detailed information on individuals' incomes, IPO also contains information on age, year, gender, disposable household income, homeownership and marital status. There are no missing observations for these variables.[16] Statistics Netherlands assigns a labor force status to an individual based on the largest source of income.

Figure 5 shows that the composition of the labor force at ages 50-54 has changed over time with fewer people on disability and more people being self-employed. For men aged 50-54, from the mid-nineteen nighties onwards the employment rate has risen from 65 percent by about five percentage points until the early two-thousands after which it declined by about the same percentage points. The latter decline appears to have been offset by an equal rise in self-employment. The share of employment and self-employment has steadily risen from about 82 percent in 1994 to 90 percent in 2009, after which it declined by about three

---

[16] For 230 observations with missing household income information we replaced it with (net) labor income of all household members.

percentage points. The latter decline is presumably due to the great recession: Unemployment has risen by about three percentage points from 2009 until 2014. The percentage on DI has fallen sharply from about 12 percent in 1989 to just over four percent in 2014. The percentage in early retirement at those ages is very low, about one to two percent.

For men aged 55-59, the employment rate dropped to 49 percent in 1995 and has risen to about 64 percent in 2014, which is about equal to the employment rate among 50-54 years old men (Figure 5). Over this period, there has been a strong decline in social insurance benefit receipt: A decrease of about 9 percentage points in people on disability, a decrease of about four percentage points in unemployment insurance recipients, and a decrease of about five percentage points in the early retirement rate. These decreases suggest that the reform of the social insurance system has been successful in keeping workers employed longer. The same suggestion emerges for men aged 60-64. The strong decline in employment from about 40 percent in 1981 to 14 percent in 1994, matched with an equal rise in early retirement up to 40 percent in 1994, has been reversed to a strong and continuous employment growth reaching 50 percent in 2014. The latter growth has been matched by an equal drop in the early retirement rate by about 25 percentage points. From the mid-nineteen nineties onwards, the DI rate halved by falling about 10 percentage points at those ages. The steep increase in the combined employment and self-employment rates from 1995 up to 2014 of almost 40 percentage points with a matched strong decline in social insurance uptake suggest successful social insurance reforms. The aim of our analysis in Section 4 is to quantify the importance of the changes in social insurance benefits, as discussed in Section 2, for this reduced uptake of social insurance.

The time patterns in women's employment and social insurance uptake rates are dominated by societal changes that have led to strong increases in women's labor force participation at all ages (Figure 6). Nevertheless, and in line with the patterns for men, also

for women there have been strong declines in early retirement at ages 60-64 and in disability insurance receipt relative to employment.

For men and women aged 65-69, UI and DI play no role. From age 64 onwards all workers receive a state pension, very often supplemented with a private pension. We refer to Figures 2 and 3 for the employment rates of these groups, which include the self-employed. Not reported here is that the shares of self-employment in these numbers have been stable at about 75 percent for men and 65 percent for women from the mid-nineteen nineties onwards.

Figure 5   **Men's labor force status by age and year.**
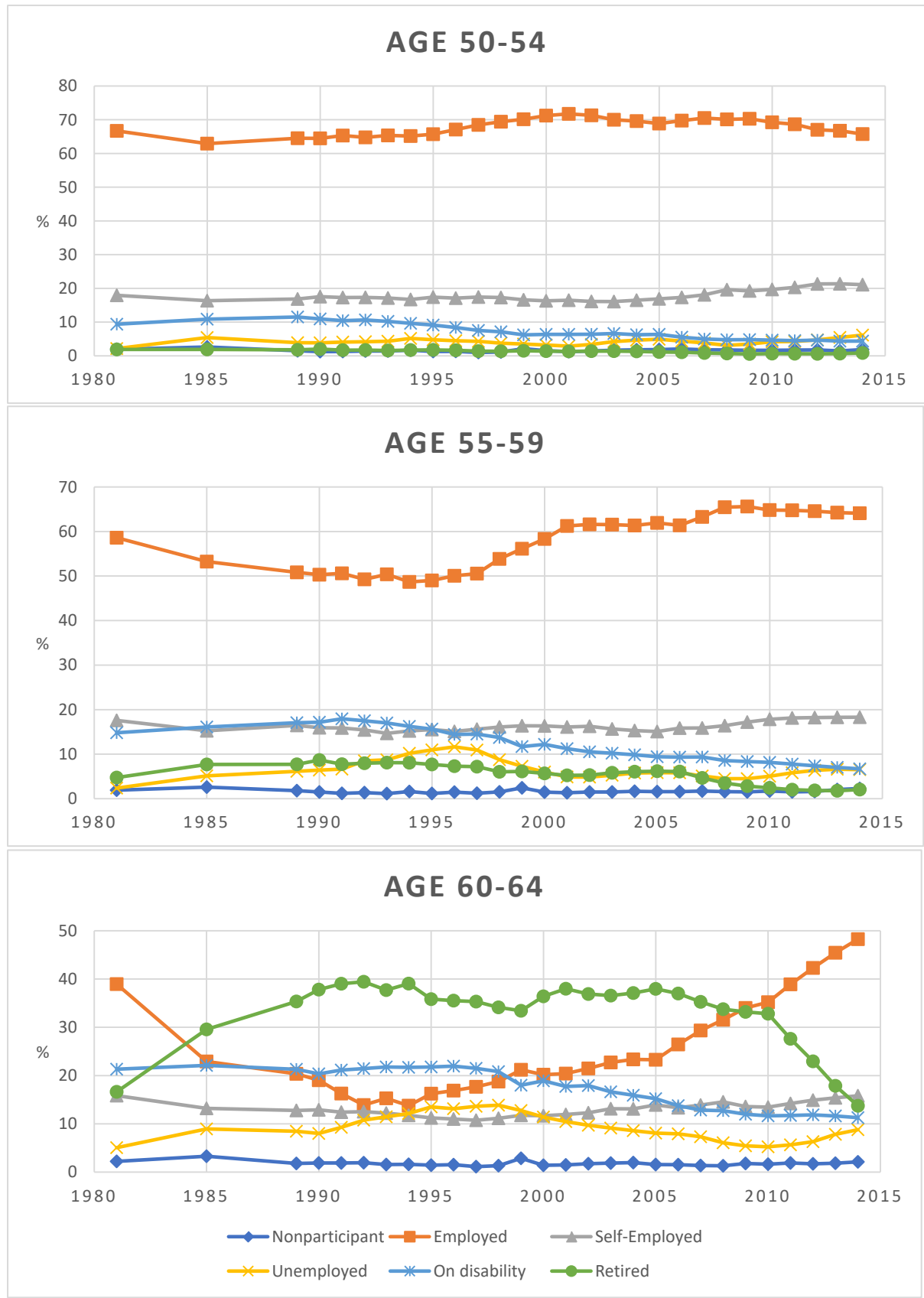
Source: IPO, own calculations.

Figure 6   **Women's labor force status by age and year.**
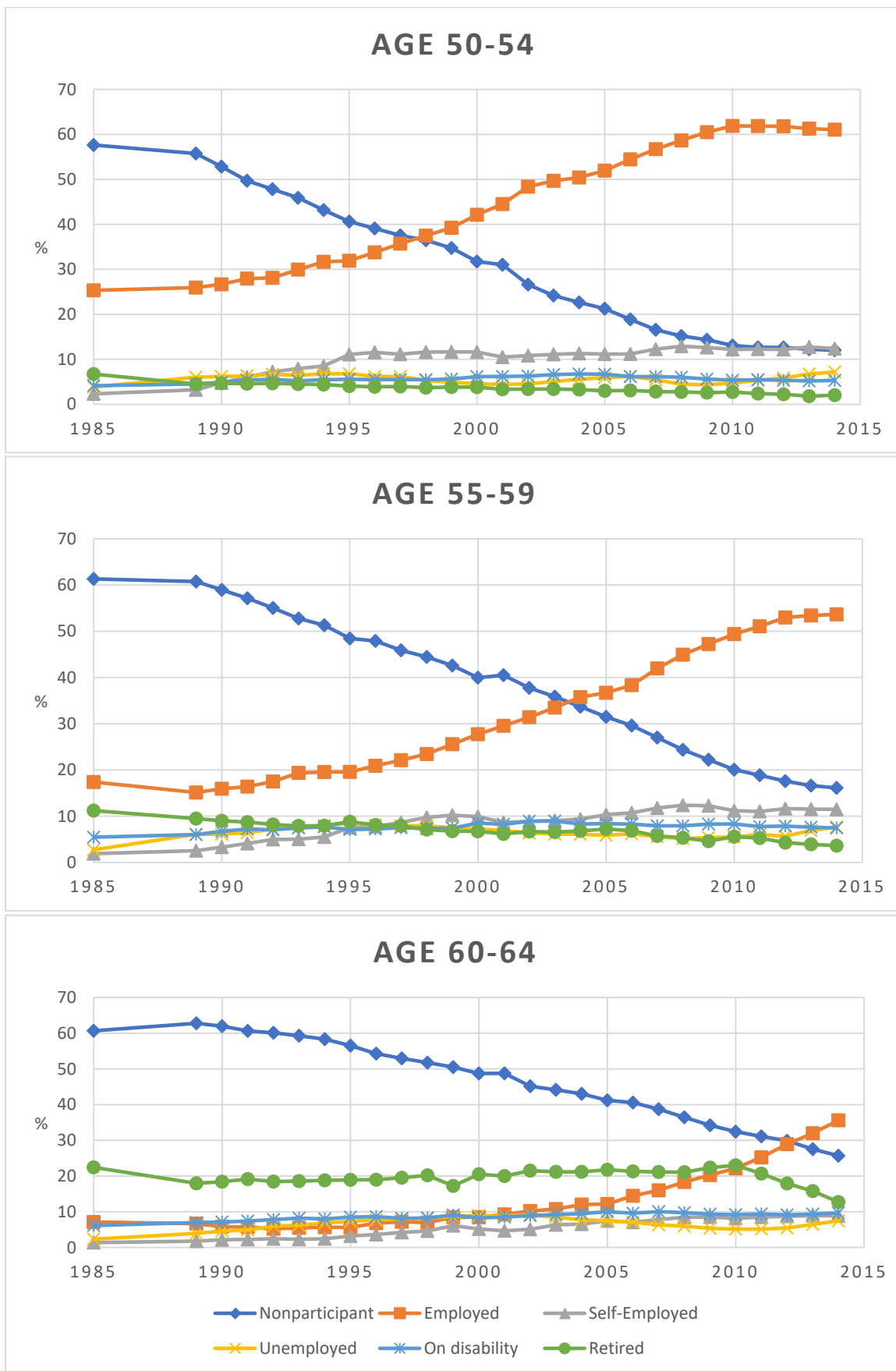
3.1   *Exit rates from employment*

Instead of the stock sample of all individuals aged 55-69 described in the graphs until now, for our empirical analysis in the next section we use a flow sample of employed individuals aged 55-69. We dropped about 9 percent of employed workers, mainly women, with earnings below the level of social assistance as our empirical analysis is not suited for the situation in which a worker has earnings below SA.[17] Workers are followed from the age they entered the sample until they exited employment and received social insurance benefits or exited for other reasons. Also, for this sample of workers, 2013 is our last year of observation, as the exit is based on next year's labor force status. The flow sample consists of 26,128 men and 11,466 women. On average, each year about 18 percent of these workers left employment, of which about nine percentage points retired, two percentage points took up UI, one percentage point took up DI, and five percentage points did not receive any social insurance benefits. Of this latter group, about three percentage points left the panel because of a divorce (or separation) after which the spouse of the head of household was no longer followed in the panel[18], 0.3 percentage points left the labor force, 0.8 percentage points became self-employed, 0.4 percentage points died and about one percentage point remained employed but with earning below the level of SA.

The annual early retirement rate has dropped for both men and women over the observation period: for men from around 13 percent in 1989 to about three percent in 2013,

---

[17] These workers' main activity over the whole year is most likely not employment. They may have had jobs with few hours per week (which we do not observe) or they may not have been employed most of the year. For many of these workers it would be optimal, in our empirical model, to voluntarily stop working and receiving SA, as that would increase their income.

[18] A very small fraction of this latter group may have emigrated or became institutionalized.

while for women the decline was from 10 percent in 1989 to two percent in 2013 (Figure 7). During this period there has been a halving of the rate of new DI receipt: from about two percent in 1989 to about one percent in 2013 for both men and women. For both men and women, the exit rate to unemployment followed the business cycle. Summing over the different social insurance states, from 1989 to 2013 the annual exit rate from employment to receiving social insurance benefits has decreased from 17 percent to 7 percent for men and from 14 percent to 5 percent for women. Not reported here is that the average annual exit rate from employment after age 64 hovered around 57 percent during the entire observation period for both men and women.

Figure 7   Annual exit rates from employment to social insurance (UI, DI or ER) before SPA.
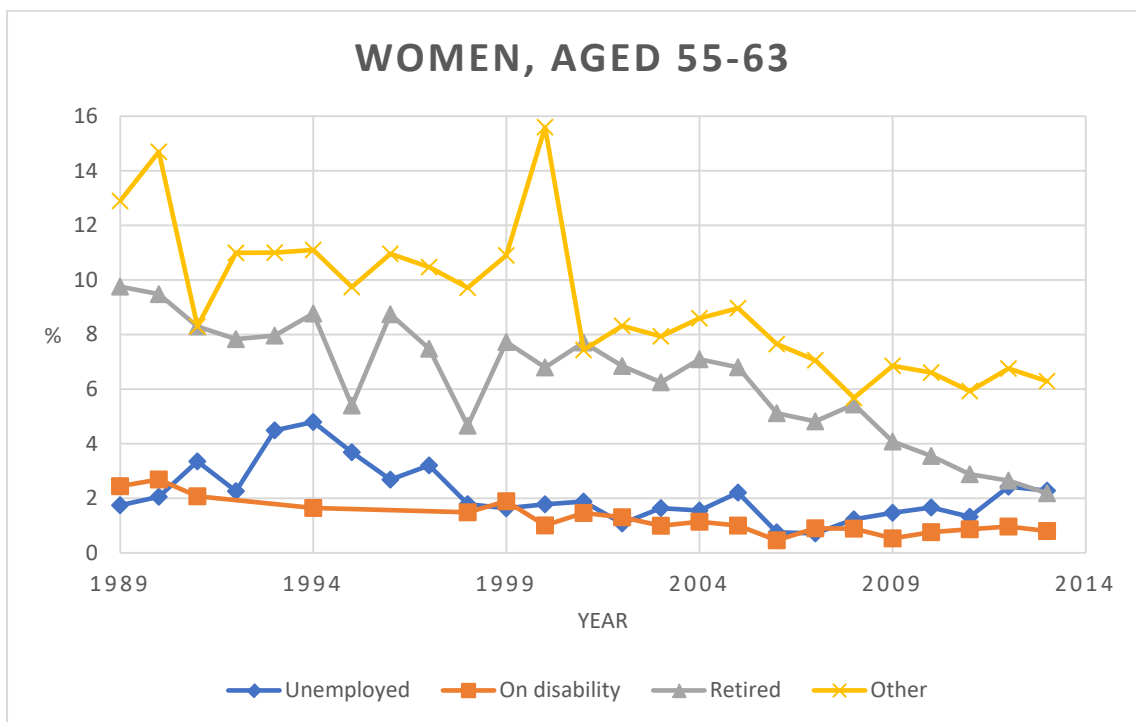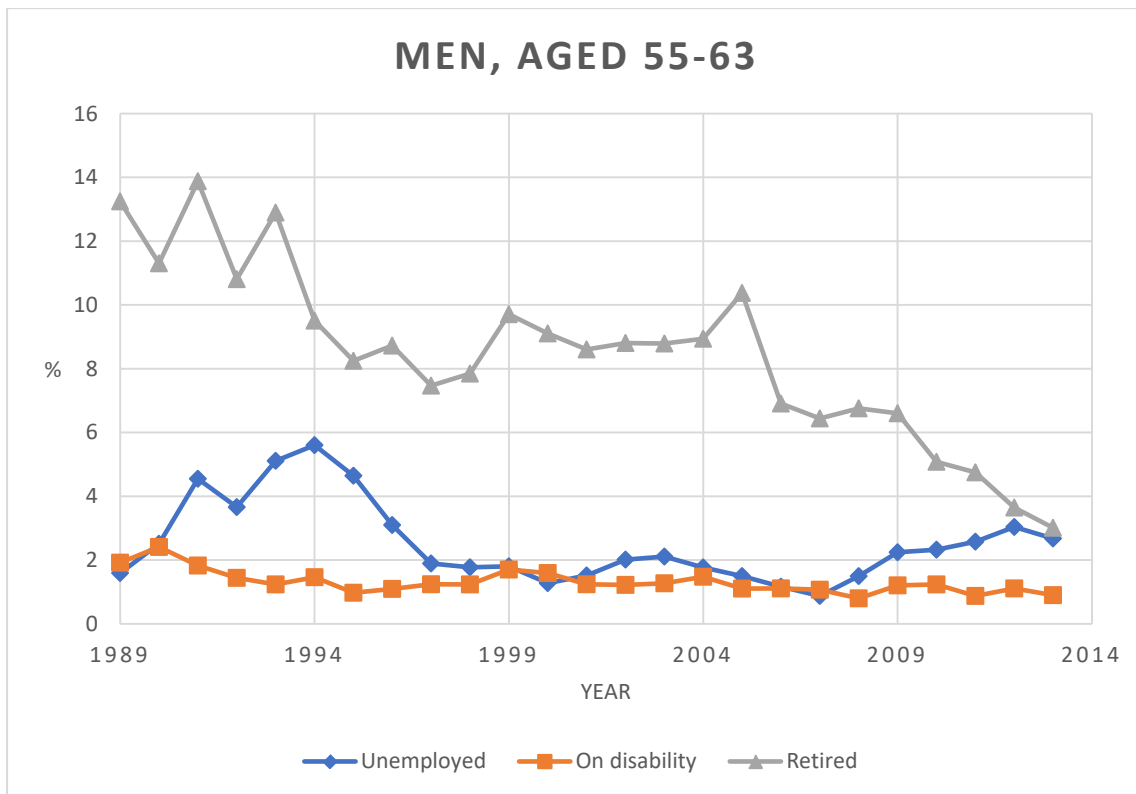
Source: IPO, own calculations.

3.2   *Social insurance wealth (SIW) and implicit tax rates (ITAXs)*

Workers' social insurance wealth (SIW) was calculated at every age in employment and for each of the three different possible exit states (UI, DI or ER). SIW is defined as the present discounted value of future financial benefits and was used to compute the implicit tax rate on continued work (Kapteyn & de Vos 1999). SIW is a function of labor income, the most salient social insurance rules concerning benefits and the durations of benefits (Table A1), the income tax regimes (Table A2), and private wealth measured by homeownership for means tested social assistance (SA). SIW was calculated conditional on being eligible for social insurance. Furthermore, SIW was calculated using the following year's social insurance rules.

Next, the implicit tax rate on continued work (ITAX) was computed as the difference between SIW if one stops working next year (and taking up social insurance; DI, UI or ER) and SIW if one stops working one year later, divided by annual earnings.[19] A positive ITAX is a financial incentive to stop working now and a negative ITAX is an incentive to work longer and not claim DI, UI or ER benefits next year.

Figures 8-11 show sample averages for selected years of SIW and ITAX by age and social insurance program. We do not present these averages for men and women separately as there are no gender differences in the social insurance rules. The implicit tax rates from age 64 onwards are equal to zero as all claims to social insurance cease at SPA. The main features of the changes in social insurance benefits (Section 2) are apparent from these Figures: The UI reforms have provided incentives to claim UI later (Figure 8), the DI reforms have hardly affected the financial incentives to claim once eligible (Figure 9), and the ER reforms have

---

[19] SIWs for these two years were both calculated on the same (next year's) social insurance rules.

resulted in a gradual shift towards more actuarially fair (early) retirement schemes which has provided workers with financial incentives to claim pension benefits later.

Figure 11 shows the weighted SIW and ITAX over all three exit routes using a stock estimator (Wise 2016B)[20]. For this estimator, the eligibility probabilities of the exit routes (UI, DI or ER) were determined based on the observed fractions of the different labor force states in the stock sample, disaggregated by year, age and gender. These states are as defined in Figures 5 and 6 but further disaggregated by age and only considering the social insurance states. Hence, the probabilities of exiting to either UI, DI or ER add up to one and the weighted SIW and ITAX are conditional on being eligible for social insurance. The graph of the implicit tax rates shows that over the years the financial incentives to stop working (one year ahead) at later ages have been reduced. As UI and DI benefits remained generous and have become more important over the years as early retirement became a less frequent exit route (Figures 5, 6 & 10), the implicit tax rates remained until the end of the sample period, on average, positive.

---

[20] In his work, a stock estimator for option values was referred to as the inclusive option value.

Figure 8 (Sample) Average social insurance wealth (SIW) and implicit tax rate (ITAX) for unemployment insurance (UI) by age for selected years.
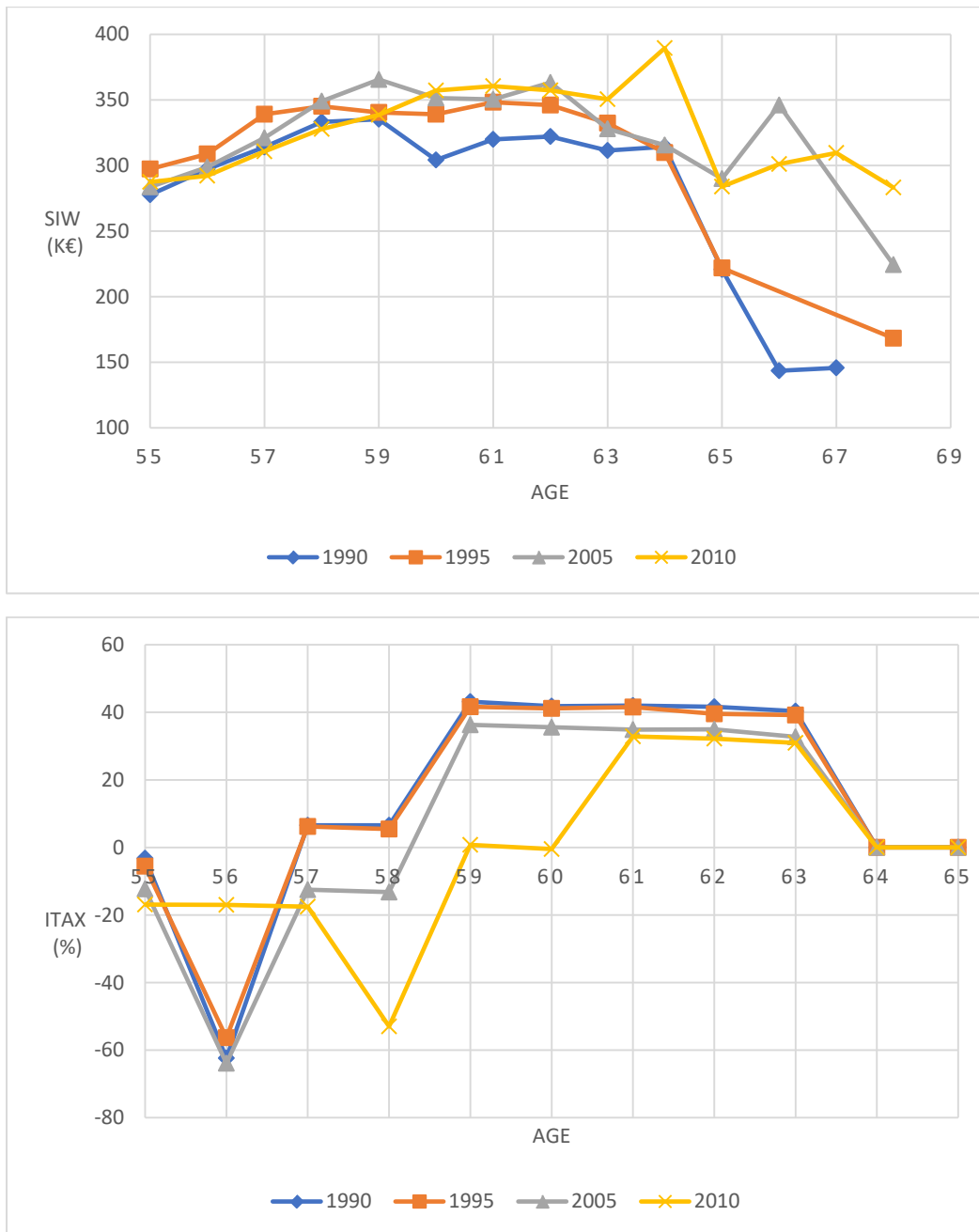
Source: IPO, own calculations.

Note: The implicit tax rate is for continuing work next year and is zero from age 64 onwards.

Figure 9   (Sample) Average social insurance wealth (SIW) and implicit tax rate (ITAX) for disability insurance (DI) by age for selected years.

Source: IPO, own calculations.

Note: The implicit tax rate is for continuing work next year and is zero from age 64 onwards.

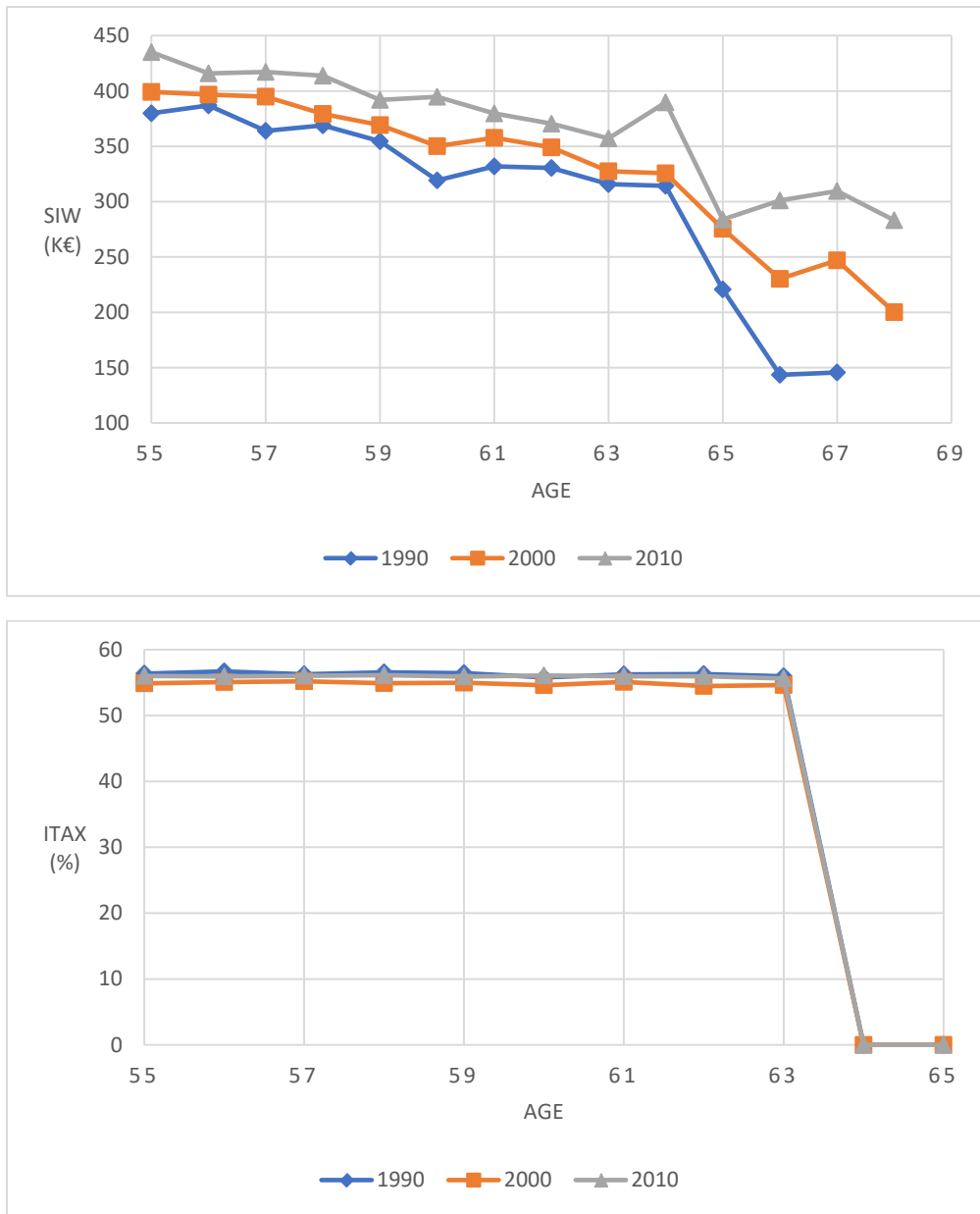**Figure 10   (Sample) Average social insurance wealth (SIW) and implicit tax rate (ITAX) for retirement (ER, SP, PP) by age for selected years.**
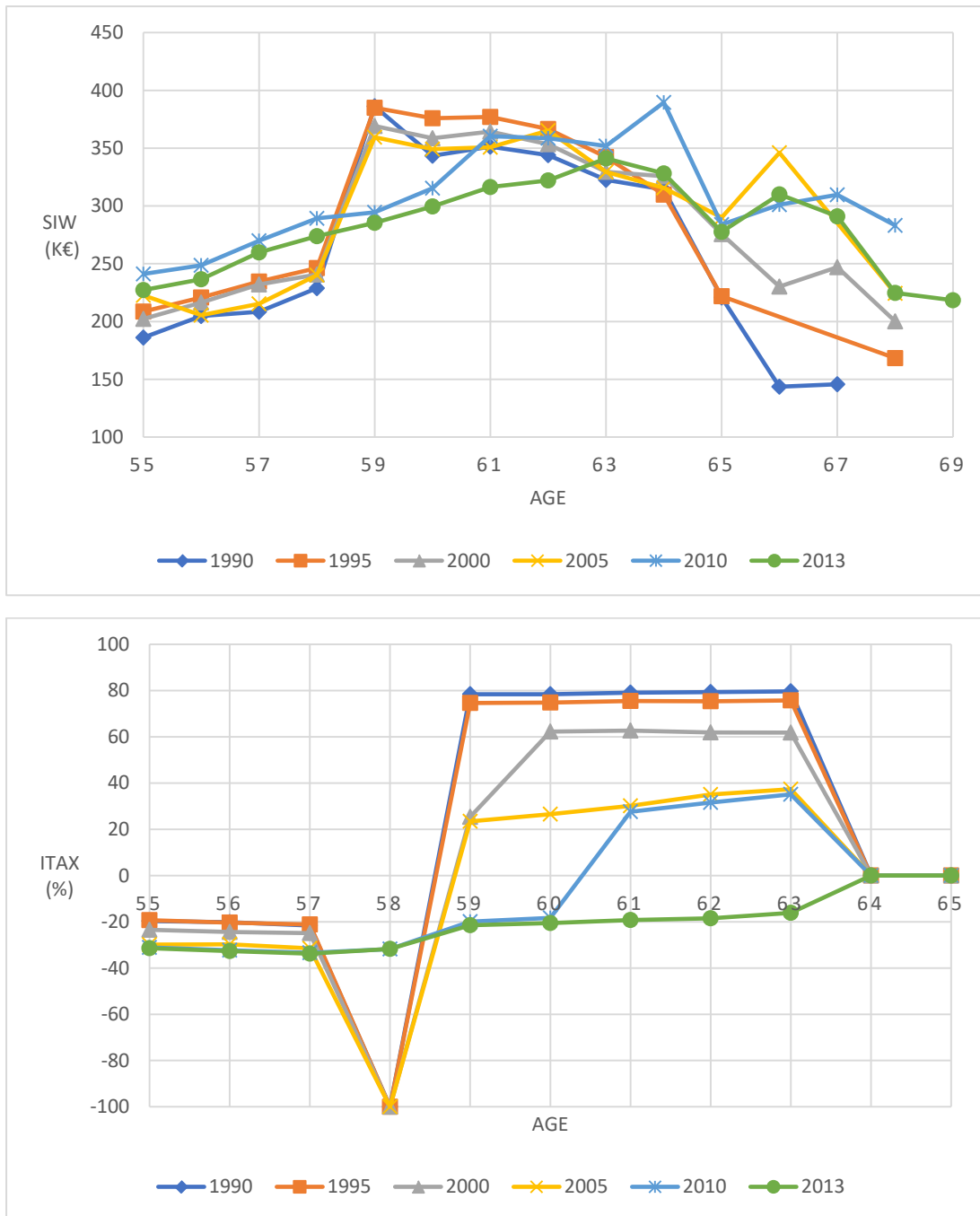
Source: IPO, own calculations.

Note: An implicit tax rate lower than -100 is truncated to -100, but only for this figure. The implicit tax rate is for continuing work next year and is zero from age 64 onwards.

Figure 11   (Sample) Weighted social insurance wealth (SIW) and implicit tax rate (ITAX) for social insurance (SI: UI, DI, ER SP or PP) by age for selected years.
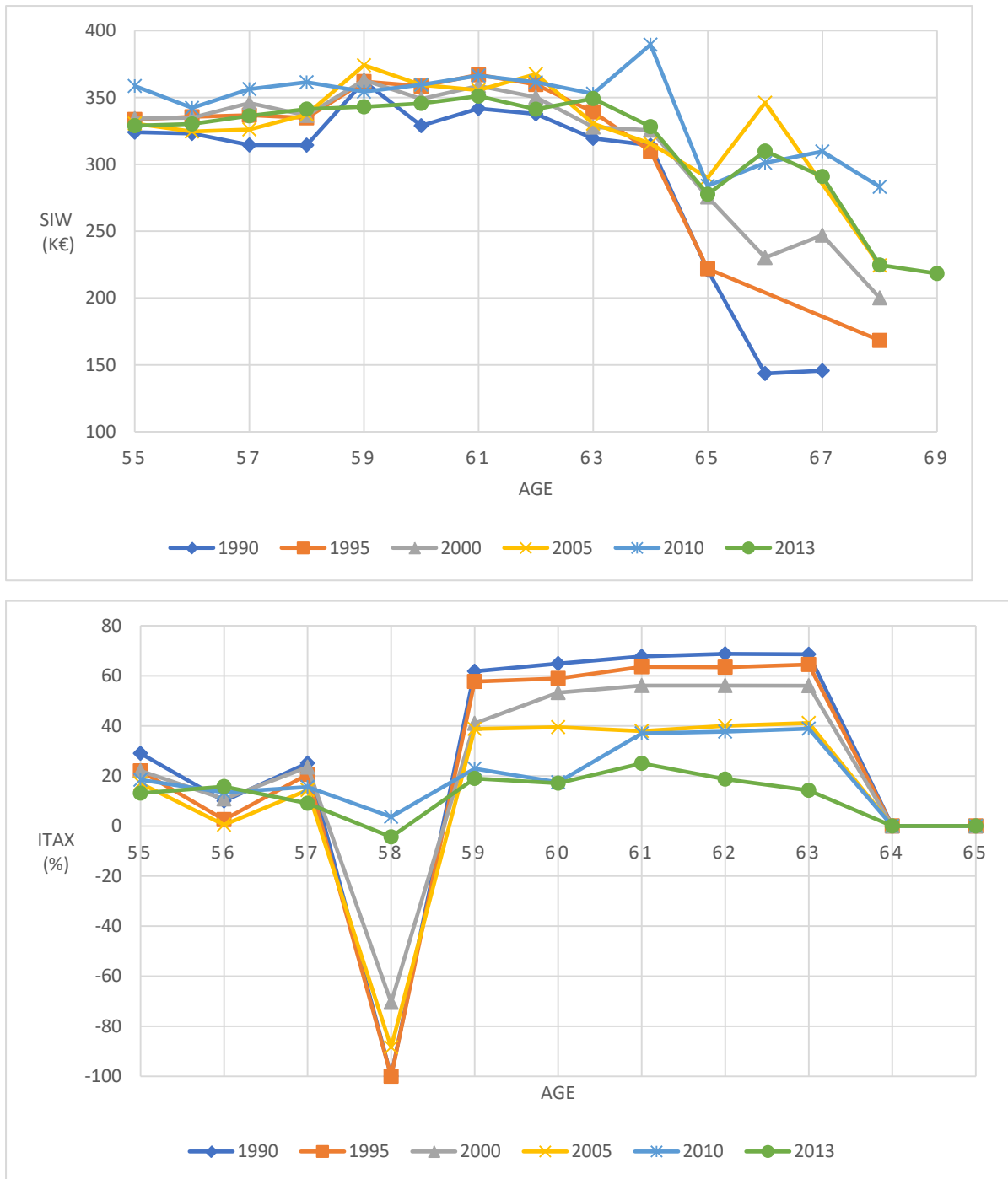
Source: IPO, own calculations.

Note: An implicit tax rate lower than -100 is truncated to -100, but only for this figure. The implicit tax rate is for continuing work next year and is zero from age 64 onwards.

4 Empirical results

The empirical analysis aimed to estimate the effects of (weighted) ITAX on the probability of receiving UI, DI or ER benefits next year, conditional on being employed in the current year. As discussed above, workers may have left employment for reasons other than claiming social insurance, for instance they might have died or emigrated. We assume such events are independent of having received social insurance benefits next year.

Our empirical models also controlled for labor income, age and year specific fixed effects, a homeowner dummy (relative to being a renter), disposable household income, marital status (a couple household versus a single person household) and health. Our health variable was based on the population mortality rate by age, year and gender from life tables. Furthermore, an interaction term between a dummy variable for age 58 and a dummy variable for the years before 2008 was included to moderate the impact of the large downward spike in ITAX at next year's age 59 (see Figure 11). This downward spike was caused by the ER eligibility rule that one needs to be employed and our assumption that workers were ER eligible at the age of 60 while in reality one may as well have been ER eligible before or after the age of 60.

While in our models SIW impacts the exit probability through ITAX, it could be argued that the SIW level matters as well and may have had a positive impact on the exit probability after having controlled for ITAX. The main reason for having excluded SIW, however, is that it is very highly correlated with earnings (a sample correlation coefficient of 0.99)[21], which raises concerns about the robustness of the effects when including SIW (see Appendix B). In addition, there is no strong reason for including SIW after having controlled

---

[21] The sample correlation coefficients between ITAX and SIW, earnings and disposable household income are, respectively, 0.11, 0.07 and -0.003.

for earnings and allowing it to affect the exit probabilities through ITAX. Appendix B reports on the sensitivity of the main results with respect to the specification choices we made.

As discussed in Section 3, (weighted) ITAX is conditional on being eligible for social insurance. Eligibility was not explicitly modelled. We controlled for eligibility by the inclusion of year and age dummies. Other covariates such as earnings may also relate to eligibility as, for instance, low wage workers were more likely to become involuntarily unemployed than high wage workers. Our model, therefore, identified the effects of social insurance benefits on the exit rate from employment conditional on eligibility. The claim we empirically tested is that an increase in ITAX increases the probability of leaving employment and receiving social insurance benefits next year. Finally, to take into account the rather strong gender differences in labor force participation trends over time, we estimated all models separately for men and women.

4.1 Estimation results

Our empirical framework is a discrete hazard model, that is we modelled the probability of employees exiting employment and receiving social insurance benefits the following year. We further restricted our sample of employees aged 55-69 to those who have been continuously employed from age 55 until they exited from employment and who did not return to employment (or at least not before 2015). Our empirical model, a random effects probit model, allows for unobserved time-invariant characteristics such as individuals' preferences for work or education. The estimation results are in Table 1.[22]

For men, we found that a 10 percentage points increase in ITAX increased the exit probability by about 0.9 percentage points. This effect is somewhat smaller for women (0.7

---

[22] Appendix Table B2 reports results based on linear probability models.

percentage points). Most of the other covariates also have the expected effects. Individual income as a proxy for socioeconomic status and skills was negatively associated with the probability of leaving employment. Homeownership (only for men) and household income were positively associated with the exit probability (a possible wealth effect) and health (one-year survival rate) was negatively associated with it. Only for women, being married was associated with a lower exit probability from employment.

Table 1: Estimation results; The dependent variable is the probability of claiming social insurance next year, conditional on being employed in the current year.

Panel A: Men

Number of men	19,205	
Log-likelihood value	-24,852	
Number of covariates	45	

Covariates	Marginal Effect	Standard Error
Implicit tax rate (ITAX, fraction)	0.089**	0.020
Logarithm of net earnings	-0.276**	0.004
Homeowner (dummy variable)	0.017**	0.004
Logarithm of disposable household income	0.138**	0.005
Married or cohabiting (dummy variable)	-0.006	0.006
Health (one-year survival rate) [a]	-0.133**	0.020

Panel B: Women

Number of women	8,666	
Log-likelihood value	-8,766	
Number of covariates	45	

Covariates	Marginal Effect	Standard Error
Implicit tax rate (ITAX, fraction)	0.073**	0.010
Logarithm of net earnings	-0.121**	0.005
Homeowner (dummy variable)	0.006	0.005
Logarithm of disposable household income	0.039**	0.006
Married or cohabiting (dummy variable)	-0.052**	0.007
Health (one-year survival rate) [a]	-0.100*	0.048

[a] Health is defined as minus the mortality rate (in percentages) from life tables (Figure 4).

Notes A full sets of age and year dummies and an interaction term between a dummy for age 58 and a dummy for the years before 2008 are included in the model. Levels of significance: ** $p<0.01$, * $p<0.05$

4.2 Counterfactual exit probabilities

We used the point estimates of Table 1 to quantify the effects of changes in social insurance benefits (and durations of benefits) on the probability of exiting employment and receiving social insurance benefits next year. The thought experiment is as follows: What would be the (counterfactual) exit probability, in a given year, if the benefit schemes of social insurance in 1989 were in place. For this, we computed ITAX for all workers given the social insurance (SI) benefits schemes of 1989. We do so for each of the three social insurance

programs (UI, DI, ER) separately and for all three programs jointly (SI). Furthermore, to obtain some insights into the importance of health improvements for the exit probabilities, and to put the impact of social insurance benefits in perspective, we predict exit probabilities keeping workers' health at 1989 levels. These levels are cell averages, as we have modelled health using life tables (Figure 4).

The most striking observation of the counterfactual exit probabilities for men is the large impact of health (Figure 12, top panel). Should there have been no health improvements for men, the exit probability in 2013 would have been about 57 percent higher. For women, Figure 12 (bottom panel), it is rather difficult to assess the counterfactual exit probabilities but the effect of health is limited and this is likely due to relatively minor reductions in mortality for women (Figure 4). Should there have been no health improvements for women, the exit probability in 2013 would have been about 10 percent higher.

To obtain better insight into the impact of the changes in social insurance benefits on the exit probabilities, we present in Figure 13 the exit probabilities of Figure 12 relative to the baseline predictions. The most striking observations are that the impacts of the reforms kicked in around 2005, are about the same for men and women, and gained strength over time. This latter finding can be attributed to an increasing share of older workers born after 1949 who face an actuarially fair (early) retirement scheme (see Table A1). Hence, we do not expect this upward trend to continue after 2013 when all workers aged 55-63 were born after 1949. The observation of similar impacts for men and women reflects the gender-neutral social insurance system in the Netherlands.

Should the social insurance benefits schemes of 1989 apply, the exit probability would have been about 13.3 percent higher in 2013 for men (Figure 13, top graph). Most of this increased probability is due to early retirement reforms (11.4 percentage points). UI

reforms accounted for about 2.8 percentage points of this increased probability. The DI reforms had an even smaller and negative contribution (-1.1 percentage points). The latter negative contribution is due to the higher DI income replacement rate after 2004. For women the impact of the social insurance reforms was about the same as for men: Should the social insurance financial incentives rules of 1989 apply, the exit probability would have been about 14.2 percent higher in 2013 (Figure 13, bottom graph). Like for men, most of this increased probability is due to early retirement reforms (12.8 percentage points). UI reforms accounted for 2.8 percentage points of this increased probability and DI reforms would have lowered the exit probability with about one percentage point.

Figure 12: Predicted exit probabilities from employment for different scenarios: The financial incentives for exiting to UI, DI, ER or all three (social insurance; SI) of 1989 and health (life tables mortality rates) set to 1989 values.
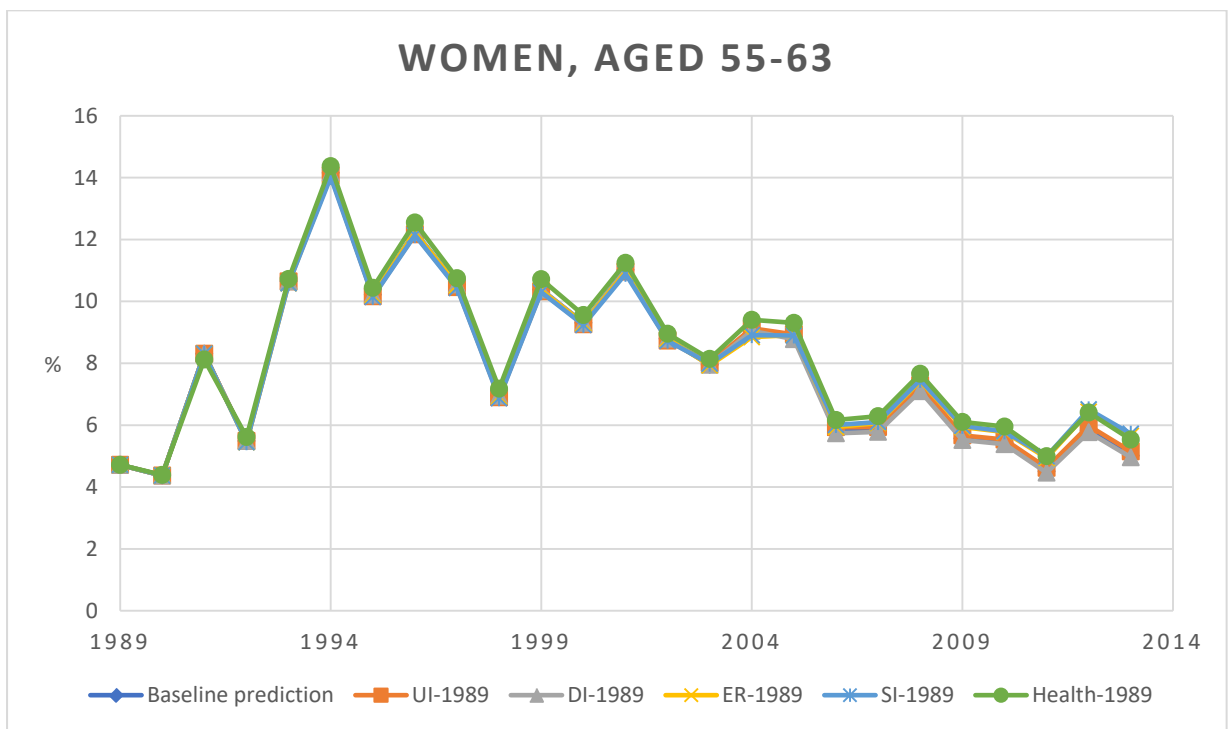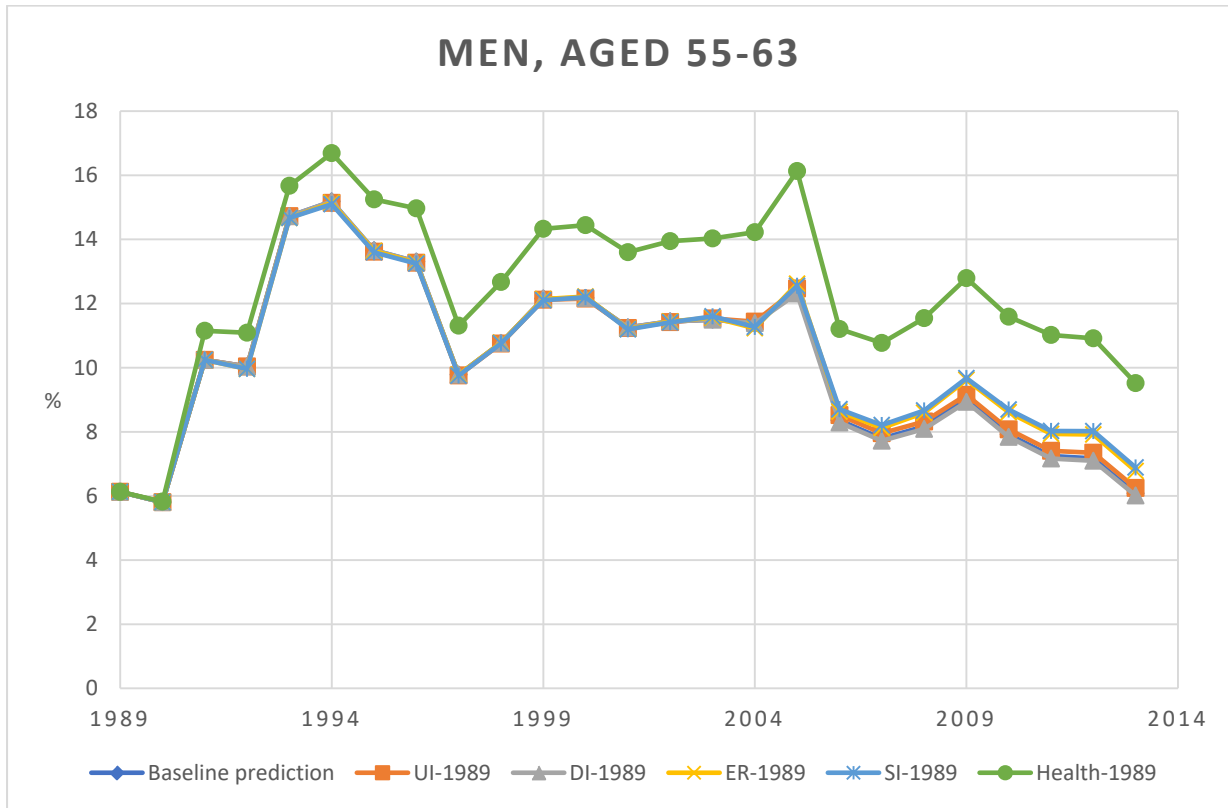
Source: IPO, own calculations.

Figure 13: Percentages differences with the baseline predicted exit probabilities from employment for different scenarios: The financial incentives for exiting to UI, DI, ER or all three (social insurance; SI) of 1989.
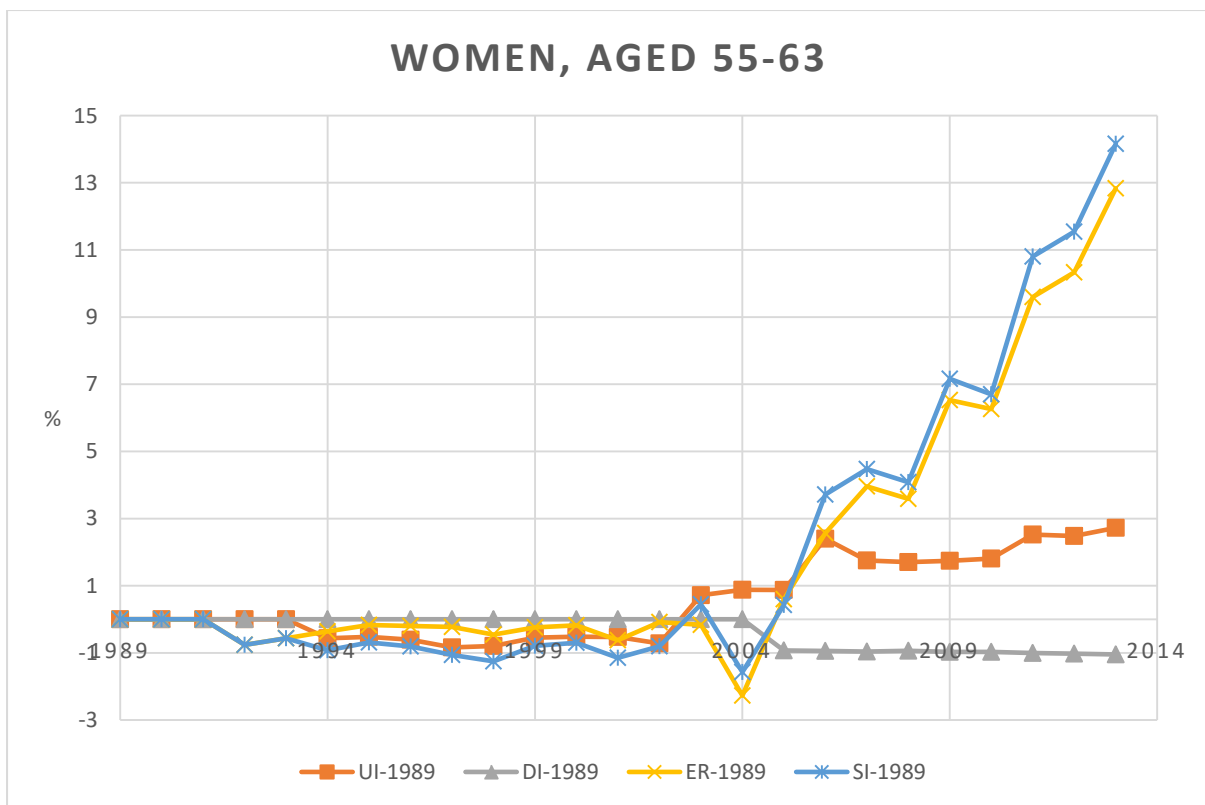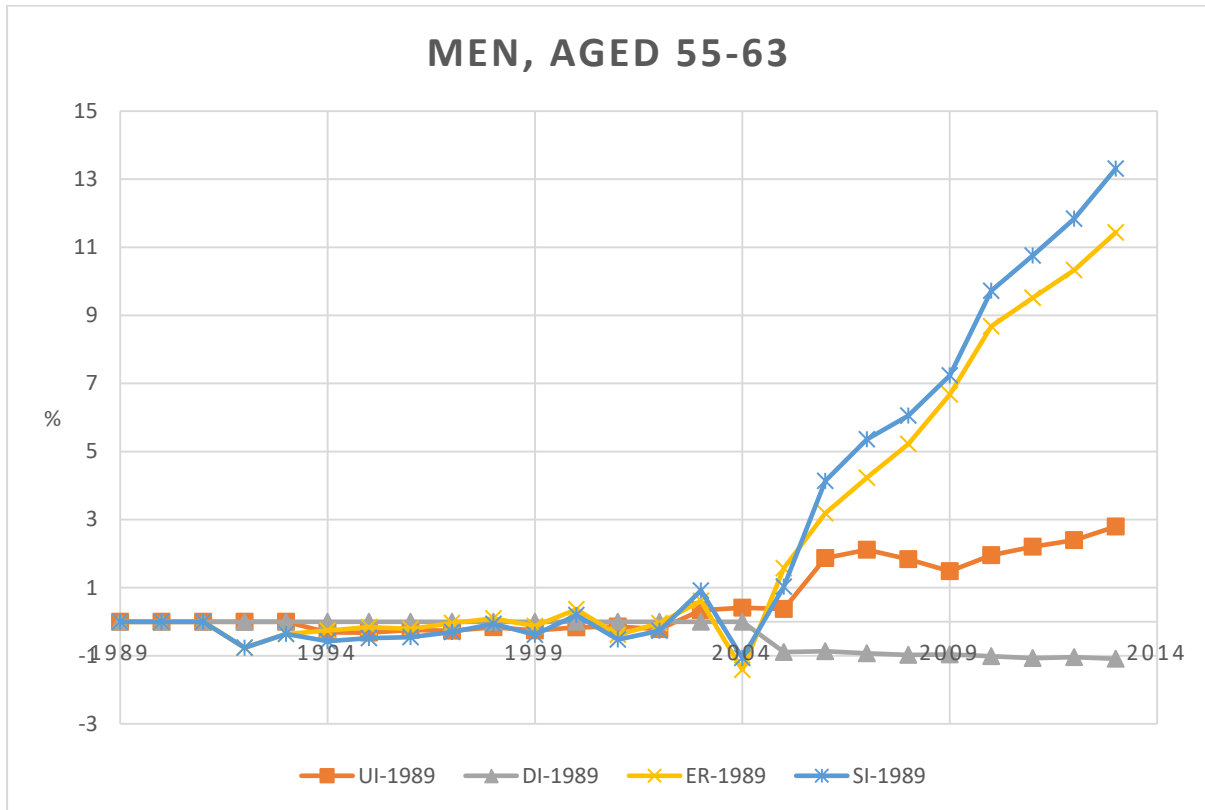
Source: IPO, own calculations.

5.   Summary and discussion

The social insurance reforms over the last two decades in the Netherlands came with stronger financial incentives for working beyond the age of 55 for those eligible for social insurance (SI). Our findings suggest that the small but significant reductions in the employment exit rates that can be attributed to changes in SI benefits are primarily due to making (early) retirement schemes actuarially fair from about 2006 onwards and were to a lesser extent due to lowering the maximum UI benefit duration in 2007. They furthermore suggest that the increased DI income replacement rate in 2006 has had a slight positive effect on the exit rate from employment, given eligibility. Based on our findings, and reported on in more detail in the introductory Chapter of this book, it was estimated that employed men and women aged 55 continued to work for, on average, about four more years in 1989 and about six more years in 2013. For both genders, about 3 months of this two-year increase between 1989 and 2013 can be attributed to changes in the social insurance benefits we have considered in this chapter.

A possible explanation for the relatively small effects of the changes in SI benefits (and its durations) on the exit probabilities from employment is that we have considered only the most salient features of SI benefits schemes and have not taken into account possible sector, firm, or individual specific arrangements (as we do not observe these). Nor did we explicitly model SI eligibility. Hence, individuals may face SI provisions that are less or more generous than described in this Chapter and the resulting measurement errors in individuals' implicit tax rates on continued work (ITAX) may have attenuated its effects on the employment exit probabilities. As mentioned, an advantage of the crude approach we took is that our measure of ITAX, once conditioned on individual earnings and age, can be assumed exogenous for the worker's decision to leave employment. Our estimates of the effects of

changes in SI benefits on the exit probabilities from employment could be considered a lower bound of its true effects.

Finally, financial incentives once eligible for SI might not have played an important role in the strong increases in employment at older ages since the mid-nineteen nineties (Figures 2 & 3). Further explanations of our findings of relatively small effects of the changes in SI benefits on the employment exit probabilities are, therefore, the important roles for changes in worker's skills such as increased levels of education (Kalwij, Kapteyn & de Vos 2018), for improved health (as we have shown here as well), and for tighter SI eligibility criteria such as stricter medical screening for DI (see Kalwij, de Vos & Kapteyn 2016), job search requirements for the older unemployed and higher eligibility ages for early retirement.

References

Bloemen, Hans G., 2011. The effect of private wealth on the retirement rate: an empirical analysis. *Economica*, 78(312): 637-655

Centraal Bureau voor de Statistiek (CBS), 2009. Documentatierapport Inkomenspanel onderzoek (IPO), Centrum voor Beleidsstatistiek, Voorburg

Euwals, R., de Mooij, R., and D. van Vuuren, 2009. *Rethinking Retirement*, CPB Netherlands Bureau for Economic Policy Analysis

Euwals, Rob, and Elisabetta Trevisan, 2011.Early Retirement and Financial Incentives Differences Between High and Low Wage Earners, CPB Discussion Paper, no.195, CPB Netherlands Bureau for Economic Policy Analysis.

van Ewijk, C., Draper, N., ter Rele, H., and E. Westerhout, 2006. Aging and the sustainability of Dutch public finances, CPB report, No. 2001/1

Groot, I. and Heyma,A. (2004) Financiele prikkels voor werknemers bij uittreding,Amsterdam: SEO Economic Research.

Gruber, J., and D.A. Wise, 2004. *Social Security Programs and Retirement around the World: Micro-Estimation*, University of Chicago Press

Jansweijer, Roel M.A., 1996. *Gouden Bergen, diepe dalen: De inkomensgevolgen van een betaalbare oudedagsvoorziening*, WWR Report

de Jong, P., Lindeboom, M., and B. van der Klaauw, 2011. "Screening disability insurance applications", *Journal of the European Economic Association,* 9, 106-129

Kalwij, Adriaan S., 2014. An empirical analysis of the importance of controlling for unobserved heterogeneity when estimating the income-mortality gradient. *Demographic Research*, 31: 913-940

Kalwij, Adriaan, Alessie, Rob, Gardner, Jonathan, and Ashik Anwar Ali, 2018, Inflation experiences of retirees, *Journal of Pension Economics and Finance*, 17(1): 85-109.

Kalwij, Adriaan, Kapteyn, Arie and Klaas de Vos, 2017, Work Capacity at Older Ages in the Netherlands, In *Social Security Programs and Retirement around the World: The Capacity to Work at Older Ages*. Ed. David A. Wise, 243 – 267, University of Chicago Press

Kalwij, Adriaan, Kapteyn, Arie, and Klaas de Vos, 2010. Retirement of older workers and employment of the young, *Netherlands Economic Review (De Economist)*, 158(4): 341-359

Kalwij, Adriaan, Kapteyn, Arie, and Klaas de Vos, 2018. "Why are People Working Longer in the Netherlands?" in *Social Security Programs and Retirement around the World: Working Longer*. Eds. Courtney Coile, Kevin Milligan, and David Wise. The University of Chicago Press, https://www.nber.org/chapters/c14048

Kalwij, A., de Vos, K., and A. Kapteyn, 2016. "Health, Disability Insurance and Labor Force Exit of Older Workers in the Netherlands", in *Social Security and Retirement around the World: Disability Insurance Programs and Retirement*. Ed. David A. Wise, The University of Chicago Press, Chapter 5, 211-249

Kapteyn, A., and K. de Vos, 1999. "Social Security and Retirement in the Netherlands", in: Jonathan Gruber and David A. Wise (eds.), *Social Security and Retirement around the World*, The University of Chicago Press, 269-304.

Koning, P.W.C., and Lindeboom, M., 2015. "The Rise and Fall of Disability Enrollment in the Netherlands". *Journal of Economic Perspectives*, 29 (2), 151-172.

Lindeboom, M. ,1996. Vervroegde uittreding uit de arbeidsmarkt: een empirische analyse naar de determinanten van stoppen met werken, *Tijdschrift voor Politieke Economie*, 19(1): 67-86.

Mastrogiacomo, Mauro, Alessie, Rob, and Maarten Lindeboom, 2004. Retirement Behaviour of Dutch Elderly Households: Diversity in Retirement Patterns across Different Household Types, *Journal of Applied Econometrics*, 19(6): 777-793.

Nelissen, Jan, 2001. *Het effect van wijzigingen in vervroegde uittredingsregelingen op de arbeidsparticipatie van oudere werknemers*, Report for Ministerie van Sociale Zaken en Werkgelegenheid CentER Applied Research, Tilburg

OECD, 2011. Pensions at a Glance 2011: Retirement-income Systems in OECD and G20 Countries, OECD Publishing

van Oorschot, W., 2007. "Narrowing pathways to early retirement in the Netherlands", *Journal of Poverty and Justice*, 15, 247-255

SER, 2006. *Doorwerken na 65*,

Sociale Verzekeringsbank (SVB). 2007. Vijftig Jaar AOW. (www .svb.nl).

SZW (Ministerie), 2005. *Onderscheid naar leeftijd in CAO's,* pp. 27, 28.

UWV, 2013A. *Statistische Tijdreeksen UWV 2012*. Uitvoering Werknemersverzekering, Amsterdam, ISSN 1383-5173

UWV 2013B, Ontwikkelingen wetten en fondsen UWV 2012-2013, Januarinota 2013, Amsterdam

UWV 2013C, Ontwikkelingen wetten en fondsen UWV 2013-2014, Juninota 2013, Amsterdam

UWV 2014A, Ontwikkelingen wetten en fondsen UWV 2013-2014, Januarinota 2014, Amsterdam

UWV 2014B, Ontwikkelingen wetten en fondsen UWV 2014-2015, Juninota 2014, Amsterdam

de Vos, Klaas, Kapteyn, Arie, and Adriaan Kalwij, 2018. Social security programs and employment at older ages in the Netherlands, NBER Working Paper No. 25250

Wise, David A., 2012. *Social Security and Retirement around the World: Historical Trends in Mortality and Health, Employment, and Disability Insurance Participation and Reforms*, University of Chicago Press

Wise, David A., 2016A. *Social Security and Retirement around the World: The Capacity to Work at Older Ages,* University of Chicago Press

Wise, David A., 2016B. *Social Security Programs and Retirement Around the World: Disability Insurance Programs and Retirement,* University of Chicago Press

WWR 2006, Wegnemen belemmeringen voor doorwerken na 65 jaar

Table A1 Parameters for computing social insurance wealth (SIW) for workers aged 55-69 over the period 1989-2014. Income tax rates applied are in Table A2.

Years *Scheme*	Ages (cohort)	Social insurance benefits and durations
Social assistance (SA)		*SA benefits (until SPA; No PP accrual while on SA)*
1989-2006	55-64	Replacement rate: 70%; Means tested
2007-2014	55-60	Replacement rate: 70%; Means tested
2007-2014	60-64	Replacement rate: 70%; Means tested if claimed UI before age 60 (and no longer entitled to UI benefits)
2007-2014	60-64	Replacement rate: 70%; Not means tested if claimed UI at or after age 60 (and no longer entitled to UI benefits)
Disability insurance (DI)		*DI benefits & duration (Affects PP accrual, 30 or 25% lower)*
1989-2005	55-64	70% replacement rate until SPA
2006-2014	55-64	75% replacement rate until SPA
Unemployment insurance (UI)		*UI benefits & duration (No PP accrual while on UI)*
1989-1994	55-57	Replacement rate: 70%; Maximum duration: 4 years + 1 year SA, not means tested, + SA means tested until SPA
1995-2003	55-57	Replacement rate: 70%; Maximum duration: 4 years + 2 years SA, not means tested, + SA means tested until SPA
1989-2003	58-64	Replacement rate: 70%; Maximum duration: 5 years + 3.5 years SA, not means tested (until SPA, effectively)
2004-2006	55-57	Replacement rate: 70%; Maximum duration: 4 years + SA means tested until SPA
2004-2006	58-64	Replacement rate: 70%; Maximum duration: 5 years + SA means tested until SPA
2007-2014	55-59	Replacement rate: 70%; Maximum duration: 3 years + SA means tested until SPA
2007-2014	60-64	Replacement rate: 70%; Maximum duration: 3 years + SA not means tested until SPA
State pension (SP)		*SP benefits*
1989-2014		70% of minimum wage; flat rate until death; SPA=65
Early retirement (ER)		*ER benefits & duration*
1989-2014	55-59	no ER
1989-1992	60-64	Replacement rate: 90% from age 60 until SPA
1993-1996	60-64	Replacement rate: 85% from age 60 until SPA
1997-2005, transition to:	60-64 (<1942)	Replacement rate: 69% at age 60 & 85% from age 61 until SPA
	60-64 (>1941)	Replacement rate: 65% at age 60 & 80% from age 61 until SPA
2006-2014	60-64 (<1950)	Replacement rate: 70% at age 62 & actuarially fair adjusted from age 60 until SPA
2006-2014	60-64 (>1949)	Replacement rate: 70% at age 65 and actuarially adjusted from age 60 until death.
Private pensions (PP)		*PP benefits (until death)*
1989-1996	65+	Replacement rate: 70%
1997-2005, transition to:	65+	Replacement rate: 70% minus years on ER x accrual rate

| 2006-2014 | 65+ (<1950) | Replacement rate: 70% minus years on ER x accrual rate |
| 2006-2014 | 65+ (>1949) | Replacement rate: 70% minus years on ER x accrual rate & actuarially adjusted |

Notes: Means tested is implemented by whether or not homeowner, that is homeowners do not pass the means test. For all year and ages, annual wage growth is 1%, the discount/interest rate is 3%, the PP accrual rate is 1.75%, and the ER/PP actuarial adjustment rate is 6.5%.

Table A2 Stylized income tax regimes and public pension benefits by year for single persons.

Year	'89	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02	'03	'04	'05	'06	'07	'08	'09	'10	'11	'12	'13	'14
First tax bracket, upper bound (K€)	0	0	0	0	0	0	0	0	0	0	10	9	19	19	20	20	20	20	20	20	20	20	20	20	20	20
Second tax bracket, upper bound (K€)	33	33	33	32	31	30	31	31	30	31	31	30	35	35	36	36	36	36	36	36	36	36	36	36	34	34
Third tax bracket, upper bound (K€)	67	67	65	63	62	61	61	63	64	67	67	67	60	60	61	62	62	62	62	61	62	60	60	60	58	58
Old age pension premium (%)	13	16	15	18	18	23	23	24	23	21	21	20	19	19	19	19	19	19	19	19	19	19	19	19	19	19
Long-term care premium (%)	6	6	7	7	8	9	9	7	9	10	10	10	10	10	12	13	13	13	12	12	12	12	12	12	13	13
Tax rate first bracket (%)	0	0	0	0	0	0	0	0	0	0	5	3	3	3	2	1	2	2	3	2	2	2	2	2	6	5
Tax rate second bracket (%)	13	13	13	13	13	7	6	6	5	6	6	7	8	8	7	8	9	10	10	11	11	11	11	11	11	11
Tax rate third bracket (%)	50	50	50	50	50	50	50	50	50	50	50	50	42	42	42	42	42	42	42	42	42	42	42	42	42	42
Tax rate fourth bracket (%)	60	60	60	60	60	60	60	60	60	60	60	60	52	52	52	52	52	52	52	52	52	52	52	52	52	52
Tax exemption, all individuals (K€)	3.1	3.4	3.6	3.8	4.2	4.2	4.4	4.5	4.7	5.3	5.3	4.3														
Tax exemption, individuals < 65 (K€)													2.1	2.1	2.2	2.2	2.3	2.4	2.4	2.4	2.3	2.2	2.2	2.2	2.1	2.2
Tax exemption, individuals > 64 (K€)													0.9	0.9	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.1	1.1
Tax exemption, employed individuals (K€)													1.2	1.2	1.4	1.5	1.5	1.6	1.6	1.6	1.7	1.7	1.7	1.7	1.8	2.1
Tax exemption, individuals>64; income dependent (K€)													0.3	0.4	0.4	0.5	0.5	0.4	0.4	0.6	0.7	0.8	0.8	0.8	1.1	1.1
Public pension benefit (gross); equal to 70% of minimum wage earnings	8.4	8.4	8.4	8.4	8.4	8.3	8.3	8.3	8.4	8.7	8.9	8.9	9.1	9.3	9.4	9.5	9.4	9.8	10.0	9.9	10.0	10.0	9.9	9.8	9.9	10.0

Notes: Annual amounts are in thousands of euros and in 2017 prices.

Appendix B   Sample and model selection

Model B1 (Table B1) includes social insurance wealth (SIW) as an explanatory variable and is estimated on the full sample of employees aged 55-69, as described in Section 3. Not all of these employees have continuously been employed from the age of 55 (either before or after entering the sample). This sample might, therefore, be rather inappropriate to estimate the effect of ITAX on the exit probability as one of the assumptions made when calculating SIW and ITAX is that workers are employed from the age of 55 onwards until they exit from employment (forever). For this reason, Model B2 estimates are based on a sample in which workers are followed from the age of 55 until they exited from employment and never returned to employment (or at least not before 2015). Of course, we still need to assume that workers have worked until the age of 55, or most of the time, as the assumed ER benefits are based on 40 years of work experience.

Model B3 allows for random effects, which may be particularly important as we do not control for individuals' preferences for work, education or skill levels, which are considered important drivers of the increased employment rates at older ages (Kalwij, Kapteyn & de Vos 2018). Statistical theory predicts that ignoring random effects may attenuate the estimates towards zero in transition models (Kalwij 2014).

Models B1-B3 include SIW and its effect on the exit probability changes substantially between models B2 and B3 for men. We have no explanation for this other than that the estimates might be affected by the very highly correlation between SIW and earnings (a sample correlation coefficient of 0.99). This may suggest that the results concerning SIW and earnings are not robust. For this reason, our main results have been based on a model that excluded SIW as an explanatory variable of the exit probability (Table 1). Not reported here, when we included SIW instead of earnings, the effect of ITAX remained virtually unchanged for both men and women.

Table B1: Estimation results. The dependent variable is the probability of claiming social insurance next year, conditional on being employed in the current year.

	Model B1		Model B2		Model B3	
Age entering the sample	55-69		55		55	
Continuously employed until exit	No		Yes		Yes	
Econometric model	Probit		Probit		RE-Probit	
Panel A: Men						
Number of men	26,128		19,205		19,205	
Log-likelihood value	-37,425		-25,737		-24,833	
Number of covariates	46		46		46	
Pseudo R-squared	0.178		0.195			
Covariates	ME	SE	ME	SE	ME	SE
Implicit tax rate (ITAX, fraction)	0.089**	0.009	0.111**	0.011	0.108**	0.010
Logarithm of social insurance wealth (SIW)	0.091**	0.035	0.002	0.039	-0.253**	0.046
Logarithm of net earnings	-0.242**	0.036	-0.159**	0.04	-0.016	0.047
Homeowner (dummy variable)	0.013**	0.002	0.015**	0.002	0.016**	0.004
Logarithm of disposable household income	0.078**	0.003	0.083**	0.003	0.134**	0.005
Married or cohabiting (dummy variable)	0.005	0.004	0.003	0.004	-0.006	0.006
Health (one-year survival rate)	0.097**	0.011	-0.023	0.015	-0.122**	0.020
Panel B: Women						
Number of women	11,446		8,666		8,666	
Log-likelihood value	-12,594		-8,921		-8,767	
Number of covariates	46		46		46	
Pseudo R-squared	0.153		0.166			
Covariates	ME	SE	ME	SE	ME	SE
Implicit tax rate (ITAX, fraction)	0.012	0.01	0.061**	0.012	0.063**	0.012
Logarithm of social insurance wealth (SIW)	0.333**	0.049	0.171**	0.054	0.162*	0.065
Logarithm of net earnings	-0.397**	0.052	-0.228**	0.057	-0.293**	0.068
Homeowner (dummy variable)	0.009**	0.003	0.010**	0.003	0.008	0.005
Logarithm of disposable household income	0.016**	0.004	0.017**	0.004	0.040**	0.006
Married or cohabiting (dummy variable)	-0.028**	0.004	-0.022**	0.004	-0.052**	0.007
Health (one-year survival rate)	0.029	0.035	-0.08	0.041	-0.101*	0.049

Notes: RE-Probit = random effects probit. Average marginal effects (ME) and standard errors (SE) are reported. All models control for full sets of age and year dummies and an interaction term between a dummy for age 58 and a dummy for the years before 2008. Health is defined as -100 times the mortality rate from life tables (Figure 4). Levels of significance: ** $p<0.01$, * $p<0.05$

Table B2: Additional estimation results using different econometric models. The dependent variable is the probability of claiming social insurance next year, conditional on being employed in the current year.

	Model B4		Model B5		Model B6		Model B7	
Age entering the sample	55		55		55		55	
Continuously employed until exit	Yes		Yes		Yes		Yes	
Econometric model	LPM		RE-LPM		FE-LPM		Probit	
Panel A: Men								
Number of men	19,205		19,205		19,205		19,205	
Number of covariates	46		46		46		46	
(Pseudo) R-squared	0.1573		0.156		0.0984		0.1945	
Covariates	ME	SE	ME	SE	ME	SE	ME	SE
Implicit tax rate (ITAX, fraction)	0.204**	0.013	0.211**	0.013	0.120**	0.014	0.101**	0.010
Logarithm of net earnings	-0.182**	0.004	-0.244**	0.005	-0.754**	0.017	-0.143**	0.003
Homeowner (dummy variable)	0.026**	0.003	0.031**	0.003	0.013	0.009	0.013**	0.002
Logarithm of disposable household income	0.096**	0.004	0.129**	0.005	0.199**	0.012	0.075**	0.003
Married or cohabiting (dummy variable)	0.005	0.004	0.005	0.005	-0.017	0.013	0.003	0.003
Health (one-year survival rate)	-0.213**	0.022	-0.328**	0.026	-0.017	0.039	-0.021	0.014
Panel B: Women								
Number of women	8,666		8,666		8,666		8,666	
Number of covariates	46		46		46		46	
(Pseudo) R-squared	0.1227		0.1209		0.0624		0.1656	
Covariates	ME	SE	ME	SE	ME	SE	ME	SE
Implicit tax rate (ITAX, fraction)	0.152**	0.012	0.165**	0.013	0.088**	0.014	0.073**	0.009
Logarithm of net earnings	-0.045**	0.003	-0.073**	0.004	-0.468**	0.020	-0.041**	0.003
Homeowner (dummy variable)	0.018**	0.004	0.020**	0.004	-0.002	0.012	0.007**	0.003
Logarithm of disposable household income	0.017**	0.004	0.026**	0.005	0.062**	0.010	0.015**	0.004
Married or cohabiting (dummy variable)	-0.022**	0.004	-0.035**	0.005	-0.035*	0.015	-0.022**	0.004
Health (one-year survival rate)	-0.224**	0.056	-0.276**	0.060	-0.033	0.080	-0.074*	0.036

Notes: LPM=Linear Probability Model, RE-LPM or FE-LPM = random or fixed effects LPM. Average marginal effects (ME) and standard errors (SE) are reported. All models control for full sets of age and year dummies and an interaction term between a dummy for age 58 and a dummy for the years before 2008. Health is defined as -100 times the mortality rate from life tables (Figure 4). Levels of significance: ** $p<0.01$, * $p<0.05$