Retirement and Income Inequality

Income Inequality in the Netherlands 2014-2018 of Retired and Non-Retired Households

Victoria Isabella Cornelia Smit
s1513885

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Supervision by E. Sauri-Andreu
Public Administration
Leiden University
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List of Abbreviations

Dutch

AOW Algemene Ouderdoms Wet

AIO Algemene Inkomensvoorziening Ouderen

ANW Algemene Nabestaanden Wet

DNB De Nederlandsche Bank

FOR Fiscale Ouderdoms Reserve

VUT Vervroegde Uittreding

English

DHS DNB Household Survey

PAYG Pay-As-You-Go

OLS Ordinary Least Squares

OECD Organisation for Economic Co-operation and Development

PCSE Panel-Corrected Standard Errors

QR Quintile Ratio

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Chapter 1

Introduction

In discussing the welfare state, it were perhaps Esping-Andersen and Miles who said it best:

> "Because it taxes and spends, the welfare state is by definition redistributive, but the degree to which this is associated with more equality is an open empirical question." – Esping-Andersen & Myles, 2009, pp.1

This idea is powerful in provoking questions about the welfare state and its policies, yet it is also a general statement. Inspired by this notion of equality, this thesis focuses on a core policy intertwined with the idea of the welfare state: pension systems. It is difficult, if not impossible, to imagine any modern welfare state without some type of old-age provision. There are many varieties in the implementation of pension policies in different welfare states, and there is ample literature about pensions, their emergence and their fiscal sustainability. The literature considering the impact of pension systems on the income distribution of households incomes, on the other hand, is limited (Van Vliet et al., 2012).

This thesis explores the effects of retirement with respect to income inequality for households in the Netherlands. The pension system of the Netherlands ranks high on adequacy and is found to produce social democratic outcomes. The Netherlands has a three pillar structure, with a Pay-As-You-Go (PAYG) public first pillar, a collective fully funded occupational second pillar and a private fully funded individual third pillar.

The central question is how much the income inequalities differ between retired and non-retired households. From an economic perspective, objectives of a pension system include redistribution and poverty relief (Barr & Diamond, 2006). The particular structure of the pension of the Netherlands could allow for different effects as two pillars are based on household occupation and income over time. The question is also relevant considering the difference in household structures. A second question central to this theme is what happens when the groups are not considered homogenous retired

or non-retired, but rather cohorts based on age? If cohorts face similar labour market conditions over their lifetime, would that not affect their income inequality, rather than retirement alone? Finally, the third central question is to what extent are the three pillars different when exploring the income inequalities?

To investigate these questions, this paper uses DNB Household Survey (DHS) data from 4.343 households for the period from 2014 to 2018. The institutional context for this period is relatively similar and provides an early insight into these questions. Using the Gini index and the Quintile Ratio (QR) as measures for inequality, this thesis employs an Ordinary Least Squares (OLS) regression model with Panel-corrected standard errors (PCSE). It investigates the differences between retired and non-retired households, as well as cohorts. Exploring this topic, this thesis also considers the income inequality measurements for the three pillar system that the Netherlands employs separately through bootstrapping the measures. This novel approach allows for the estimation of standard errors and is a first step towards statistical inference with regards to pension income.

The thesis will continue as follows. Section 2 provides the institutional context of the Netherlands. It discusses a short history of each pillar and the policies relevant to the timeframe of this thesis. Section 3 reviews the literature and provides the theoretical framework. Section 4 contains more details about the data, sample selection and statistical methods employed. Additionally, the summary statistics of the data are given in this section. The results of the analysis are discussed in Section 5. The results are further discussed in Section 6.

Chapter 2

Institutional Context

As stated in the introduction, this thesis concerns the Netherlands. The pension system of the Netherlands is highly ranked on adequacy, and outcomes are generally found to be social democratic (Knoef et al., 2016; Anderson, 2004). Given the specific institutional context of the Netherlands, the country makes an interesting case to research income inequality. This section discusses the specificities of the context, to understand the workings of the system. A summary overview of the context can be found in Figure 2.

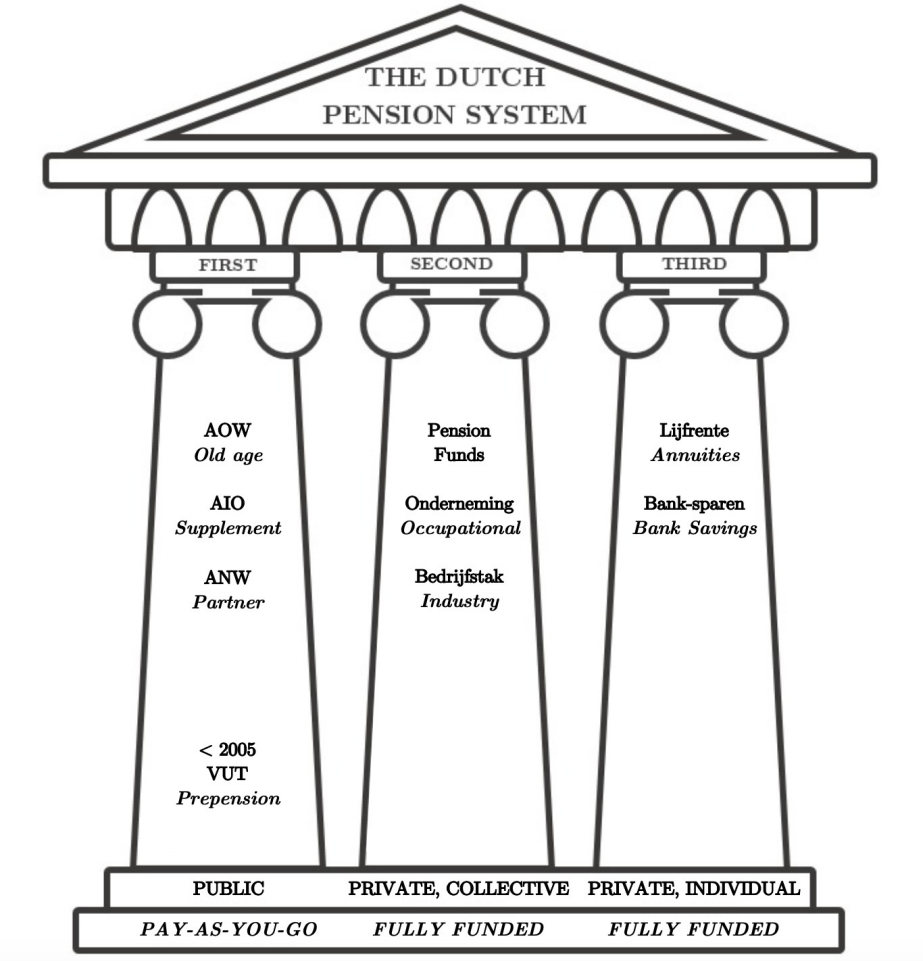
2.1 The First Pillar

The Netherlands started with a public first pillar in 1913 with the introduction of the 'Invalidenwet (ouderen)' *Disabilities law (elderly)*, and the 'Invaliditeits en ouderdoms wet' *Disabled and Elderlaw* in 1919 (Sociale Verzekerings Bank, n.d.). The first step towards the modern public pension was made in 1947 with the introduction of 'Noodwet Drees' *Emergency Law Drees*, where elderly received supplements if they had insufficient income.

In 1957 the public pension was rebranded as 'Algemene Ouderdomswet' (AOW) *General Old Age Law* , of which the name is still used for the first pillar (*Algemene ouderdomswet*, 1956). The AOW is built up conditional upon the years of residency in the Netherlands. For every year of residency in the Netherlands from the pension age minus 50 years two percent is accumulated until the pension age.[1] Before 2013 the official retirement age was 65 years. From 2013 onwards, the age has gradually increased and will continue to do so in the foreseeable future (*Wet verhoging AOW-en pensioenrichtleeftijd.*, 2012). Currently it is the case that AOW is paid out to people of the 66 years and 4 months. Should a person not have enough residency years to obtain an income of 70 percent of the poverty norm, the income is supple-

[1] If the retirement age is 65 years, residents start building up pensions from the age of 15.

Figure 2.1: The Dutch Pillar Pension System



Note: This summary overview contains the most important aspects of the pension system of the Netherlands. The upper part of the foundation contains the public/private distinction. The lower part of the foundation contains the type of funding.

mented.[2] This happens through the 'Algemene Inkomensvoorziening Ouderen' (AIO) *General Income Elderly* as part of the AOW and under the social minimum conditions stipulated by the 'Participatiewet' *participation law*, (*Participatiewet*, 2003).

Besides the AOW and AIO, there are two closely related laws that are generally categorised as the first pillar: laws about dependents of pensioners and a former law about early retirement. The 'Algemene Nabestaandenwet' *General dependent law* (ANW) supplies this basic income to people dependent on the deceased (*Algemene nabestaandenwet*, 1995). When the dependents come of pension age, this basic income stops and the AOW is supplied as income. There is also the partner allowance within the public pension: up to 2015, a person could claim partner allowance if they had a partner that was not of the retirement age and the partner had no source of income. This allowance is still in effect for people who received it prior to 2015 but no longer for people who started receiving public pension from 2015 onwards (Sociale Verzekeringsbank c, n.d.). The law about early retirement was relevant prior to 2007: there was the opportunity to use 'Vervroegde Uittreding' (VUT) *Early Retirement* (*Wet kaderregeling vut overheidspersoneel.*, 1995). In this case, people could retire earlier than the official retirement age.

The first pillar is financed Pay-As-You-Go: people that are employed pay premiums to fund the retired people directly. In sum, the first pillar includes AOW pension, and if necessary AIO supplements. In some cases, ANW is included in the first pillar.

2.2 The Second Pillar

The second pillar are occupational fully funded pensions. There are many variations in type and construction: the type can be 'ondernemingspensioenfonds' or 'bedrijfstakpensioenfonds', respectively *company pension funds* and *industry pension funds*. The company pension funds originate in the late nineteenth century: in 1890 there were roughly 30 of these funds (Kuiper & van der Zwan, 2016). The first industry fund in the Netherlands was for mineworkers and started in the beginning of the twentieth century. The number of these pensions grew with the introduction of the AOW: it made it relatively cheaper for employers to provide an addition to the pension income than to account for the entire pension income (Kuiper & van der Zwan, 2016). Participation in second pillar pensions is not always mandatory and depends on collective bargaining agreements. Currently, there are 44 pension funds registered at 'De Nederlandsche Bank' (DNB) *Bank of the Netherlands* (Bank, n.d.). Dependent on the sector or in some cases occupation, participation may be mandatory. On the other hand, not every person who works can participate in these types of funds: the most common example is self-employed people who have no second pillar pension fund. Occupational pension funds are fully-funded and collective: employees now

[2]The poverty norm is approximately 823 euros in case of a one-person household

pool the funds for a pay-out to themselves later.

Besides the type, there are many variations in the construction of the payments. Some funds offer options on how much to receive and when to receive it.[3] Another point of variation is the way the pension is calculated; some funds calculate based on the final pay, whereas the grand majority calculates pensions based on average pay (around 91 percent used average pay in 2011) (Tweede Kamer der Staten-Generaal, 2013b).

How much premium an employee has to pay depends on their wage. There is a maximum wage of about 100.000 euros where about 2 percent of the wage can be used to pay premiums without having to pay income taxes, introduced in 2014 (Tweede Kamer der Staten-Generaal, 2013a). Above the threshold, the income can be used to fund your premiums but the premiums are no longer income deductible from the income tax, making it fiscally less attractive. The maximum pay for which the premiums can be fiscally attractive is called 'jaarruimte' *annual space*. Having a threshold wage would thus lead to a lower replacement rate of the second pillar, and could lead to some redistribution for the top incomes. In sum, the second pillar is diverse in source and types. The pensions are fully-funded, though since 2014 there are regulations that determine maximum payment from these policies.

2.3 The Third pillar

The third pillar is often less discussed in the institutional context. It consists of private and individually funded financial products, offered by commercial parties such as banks and insurance companies. Little is known about the exact history of all products, but there are two particular products that are associated with the third pillar: 'lijfrente' and 'banksparen', respectively *personal annuities* and *bank savings*. The annuities originate in the 19th century and were anchored in legislation in 1914 (Stigter, n.d.). Personal annuities are non-transferable and cannot be inherited and are supplied by insurance companies, the idea is that they pay the annuities until the death of the person who bought the product. Although the Dutch government commissioned research into possibilities of financial products as a supplemental third pillar in 2001, it was not until 2008 that bank savings were introduced (Stigter, n.d.). Bank savings, contrary to personal annuities, are transferable and inheritable but are not paid out until death. An amount will be paid for a specified time.

What these products have in common is that the products are in part deductible from income tax to make them more fiscally desirable, additionally they are excluded from equity taxes (box 3 taxes in the Netherlands). They are only fiscally attractive if the annual space is not exceeded. In more detail, the annual space is the pension

[3] A 'hoog-laag' *high-low* construction would be receiving more at first and less later) is one such construction. The frequency of payments can also be discussed in some cases.

premiums that can be paid minus the rights from the second pillar, minus the self-employed 'fiscale ouderdoms reserve' (FOR) *fiscal elderly reserve*, minus any extra premiums contributed to the second pillar (*Wet inkomstenbelasting*, 2000). What happens after this annual is exceeded? Before 2019 it was possible to deposit more into bank savings and personal annuities, with the caveat that this was no longer tax deductible (Staatscourant, 2012). This implies that the contribution has no maximum and the income that can be derived from it has no maximum either. The third pillar is therefore only dependent on the choices of private individuals. The third pillar has no redistribution across income groups.

2.4 Other Pillars?

The government of the Netherlands only states the three pillars as part of the pension system in the Netherlands (Rijksoverheid, n.d.). However, there are authors that contend that there are fourth and even fifth pillars. The fourth pillar would be the usage of human capital and the fifth pillar consists of the usage of private savings and other assets, such as housing, to finance a non-working life (Holzmann et al., 2008; Yates & Bradbury, 2010; Bonin, 2009). These pillars could maintain income inequality considering there is no redistribution across income groups. Essentially, if private savings are used to finance retirement then this could maintain income inequality. Excluding the fourth and fifth pillars may impact results if the pillars have an interaction with the first, second and third pillar. This is unlikely considering none of the pillars are directly affected by private savings and other assets. Understanding the interaction with human capital and the three pillars poses an academic challenge. Whereas these topics are interesting to consider, they are beyond the scope of this thesis. Without making a McNamara fallacy, whereby decisions are made solemnly based on what is measurable, this thesis acknowledges that other pillars may deserve due consideration and could be fertile ground for further research in this particular topic. This would mean defining the pillars and considering the theoretical links to income inequality in more depth.

Chapter 3

Literature Review and Theoretical Framework

3.1 General Pension Literature

There are many works that investigate the working of pension systems. In broad strokes, the literature has focused on the rationale behind having any form of pensions in a country, as well as the effects of demographics on pension systems and their funding. Examples of the former can be found in Thompson (1998) and Barr & Diamond (2006). Pension systems from an individual perspective can be created to avoid myopia and increase consumption smoothing: myopia occurs when individuals underestimate the future utility. Collectively transferring consumption from the productive working years to the years of retirement would smooth income over time. From a collective perspective, pensions may work as an insurance as an individual may not be able to calculate how much they would have to save during work to finance their retirement. Pension systems can also be a method for redistribution and poverty relief amongst retirees: people who cannot save enough in their working years are relieved from their poverty in older age. The redistribution and poverty relief arguments will be further explored later in this review. Another broad stream within the literature about pensions is concerned with how demographics affect pensions, particularly in relation to fiscal sustainability. The main idea is that the life expectancy increases, combined with declining labour participation financially constrains the pension systems (Chand & Jaeger, 1996; Bongaarts, 2004; Barr & Diamond, 2006; Verbič & Spruk, 2011). In short, the literature about the general rationales behind pension systems have been researched and the effects of the population and demographic changes have been considered as well. This thesis extends a different direction of the literature, namely the arguments about the redistributional effects of pensions.

3.2 Pensions and Redistribution

Besides the rationales and the fiscal sustainability literature, there is literature that focuses on redistribution. Redistribution is defined as the transfer of income, but from whom and to whom this income is transferred differs in the literature: the life-cycle focuses on individual redistribution over time, intergenerational focuses on redistribution from and to different generations and the last strand focuses on redistribution based on income groups. The life-cycle arguments investigate pension policies with regards to life-savings and other decisions. Examples of these models can be found in Bovenberg et al. (2007) who consider the interaction of public pension funds and the optimal savings rate. Haan & Prowse (2013) investigated life-time earnings and savings in Germany and found that pension reforms can affect retirement decisions, which was also predicted in the Swedish case by Laun & Wallenius (2015). Noteworthy is that Nelissen et al. (1995; 1998) modeled the redistributional effects of the first pillar pension in the Netherlands and found that the net lifetime redistribution effect was smaller than the yearly effects of redistribution: this suggests that the focal point of this thesis (yearly effects) may not necessarily imply that the effects found hold on a life-cycle basis. These findings should be taken into consideration when reading the analysis and its conclusions. The intergenerational redistribution literature is mostly found in the context of fiscal sustainability (Fenge, 1995; Guillemard, 1999; Gál et al., 2003; Song et al., 2015). It seems that the intergenerational redistributions tend to focus on the demographic pressures, which in turn affect the fiscal sustainability of pension systems.

3.3 Redistribution and Income Inequality

The third stream in the redistribution literature, where redistribution is based on income groups is central to this thesis. Focusing on redistributive effects of public and private expenditures in the welfare states, Goudswaard & Caminada (2010) found that the relative weighting of public and private expenditure impact the redistributional effects. Public expenditures are positively correlated with income redistribution whereas private expenditures are negatively correlated with income redistribution. The research did not focus on pension systems but the implications are important for this thesis as it distinguishes between public and private expenditures. The study used macro Organisation for Economic Co-operation and Development (OECD) data to compare countries, but did not thoroughly take into account changing institutional context per country. The redistribution was measured by using income inequality measures, namely the difference in Gini between market income and disposable income. Early research by Disney & Whitehouse (2002) found that the difference in social-security benefits was “the most convincing explanation” for the differences in elderly income in comparing countries. This implies that the difference in social secu-

rity benefits may impact the income inequality of the retired people. One shortcoming of this research is that it did not take into account the relative shares of different social benefits structures (public/ private mixtures) (Disney & Whitehouse, 2002, pp.8).

But this leads to the question of how exactly redistribution impacts income inequality as a next step for this thesis. Inequality, simply put, is when some have more than others, in this thesis that 'have' is income. Piketty (2014) argues that public policies were pivotal to reduce inequality in the twentieth century and pensions were, alongside education and health, the third social revolution. In line with the argument that pensions alleviate poverty by Piketty, Wang et al. (2012) investigated the redistributive effects of taxes and transfers. Using household data, the analysis decomposed the income inequality of OECD countries. They found that public pensions in combination with income taxes accounted for 50 to 60 percent of the reduction of inequality. One important connotation is that the patterns varied across countries. Wang et al. (2014) considered the income redistribution in a cross-sectional temporal design and found a similar conclusion that public pensions accounted for a 60 percent increase of redistribution over the period of 1985-2005 but that once again the patterns were diverse for the various countries.

Brown & Prus (2004) found that elderly income inequality was largely explained by the relative share in public pensions income. Van Vliet et al. (2012) researched the increasing privatisation shift in pensions, but found no significant relationship between increased privatisation of pensions and increase in inequality amongst older people. This research considers 15 European countries and researches the income inequality over time. The findings are contradicted by research from Been et al. (2017), where a larger share of privatisation is associated with higher levels of income inequality. Interesting is that the latter research extends the research by van Van Vliet et al. (2012), thus the contradiction is noteworthy. The contradiction is largely explained by the improvements of the dataset used (the OECD SOCX dataset). This conclusion has large implications: depending on the dataset the results may vary. Therefore, while the data section still has to be discussed, it should be noted that the conclusions made by research done prior to this study may not be translated to the results in this thesis.

The works cited so far compare countries. The main message is that there are redistributional effects of public pensions in cross-countries comparisons. On the other hand, there are advantages to investigating specific countries rather than comparing countries. For example, research by Shimizutani (2005) suggested that public pension benefits in Japan improved absolute and relative poverty in the period from 1981-1999. Another important finding is that on the microlevel, gender and sector also impacted the income significantly. Park (2007) investigated elderly in South Korea, who were at poverty risk, and provided the rationale that this result can best be understood as cumulative disadvantages in the labour market and in the welfare systems. Similar to Shimizutani taking into account old-age pensions, Hwang (2016) found that public

pensions had inequality-increasing effects on the elder population in South Korea, but attribute this to an outsider-insider effect of coverage which is low in South Korea.

This thesis focuses on the effects of retirement on the income distribution in the Netherlands. There is limited research that investigates the link between the pension system of the Netherlands and income inequality. Knoef et al. (2009) have investigated this link using micro-simulations based on econometric models. The focus is largely on predicting the income inequality. They predicted that income inequality amongst pensioners in the Netherlands would increase until 2012 and that the inequality would stabilise after this period. They also contended that inequality would decrease between households with and without occupational pensions. The strength of this paper is that the patterns found in cross-country analysis may not be as straight-forward as they seem. These predictions open up the debate about the exact workings of the pension system of the Netherlands.

3.4 Theoretical Framework

This thesis also considers households as the unit of analysis. It does so as there is little literature about income inequality of households, particularly in this area. It prefers to use households over individual members of the household as the assumption is that people who live in one household share expenses and savings. In addition, households as a unit of analysis makes comparison amongst different groups possible. Research by Disney & Whitehouse (2002) showed that income patterns varied between different age groups. They observed cohort effects whereby average pensioner income declined with pension age. A central assumption is that households that are closer in age are more comparable.

The focus of this paper is income inequality amongst households. In general, the system as a whole is considered redistributive. This is largely supported by the cross-country analyses from the previous sections. At the household level, the expectation is that there is less variation between income from retirees than from non-retired households, thus less income inequality amongst retired households. The operationalisation and methodology are discussed in the next section.

But, to what extent does this general idea hold when cohorts are introduced? If cohorts face similar conditions in the labour market throughout their lives, and similar institutional contexts, then cohort effects would affect income inequality rather than retirement. This is supported by Disney & Whitehouse (2002). Therefore, this thesis also researches how people born in similar cohorts affect income inequality. It is assumed that cohorts are more similar to each other than to the general 'retired' or 'non-retired' groups. If households are introduced, it is expected that the effects of retirement are smaller than when this is not taken into account. This analysis is novel for the data of the Netherlands.

Another puzzle concerns the specific three pillar structure of the Netherlands.

What impact do they have on the income redistribution? Generally, the first pillar (public pensions) would be associated with less income inequality. This is supported by the idea that flat-rate benefits may relatively benefit lower income groups (Van Vliet et al., 2012). One argument that is also raised is that a relative (to other European countries) public pension may off-set any inequality caused by other sources of income (Van Vliet et al., 2012). The second pillar, private pensions, may on the one hand be dependent on prior earnings thus leading to more income inequality. This would be supported by the reasoning that Park (2007) employs, where pension earnings are cumulative disadvantages in the labour market. On the other hand, there may be elements of redistribution if the private pensions are not actuarially fair and negotiated in the context of large labor contracts (Van Vliet et al., 2012). It can not be argued that all private pensions are negotiated in this context. Another aspect to consider about private pensions that may impact the distribution is the maximum amount that can be contributed and is fiscally attractive. The third pillar, private individual pensions, are expected to not decrease income inequality. The reasoning is that private individual pensions tend to benefit from tax exemptions which would favour individuals on the higher end of the income distribution Van Vliet et al. (2012). There is another reason to consider that private individual pensions would not decrease income inequality: they are largely dependent on individuals who have the capacity to invest in their own third pillar. Though this comes with the caveat that, much like the second pillar, there was a cap on the amount that could be deducted from the income tax, which may deter households from investing in third pillar products. Nonetheless, in theory the contributions and benefits derived from the third pillar can maintain the income inequality at the very least.

Chapter 4

Data and Methods

4.1 Data Source

The data used for this thesis is micro data as supplied by the DNB Household Survey, which provides unique longitudinal data about financial behaviour of the Dutch population. This survey started in 1993 and is collected from 2.000 households per year in the CentERpanel through an internet survey. The panel reflects the composition of Dutch-speaking population of the Netherlands. For a full history and methodology of the survey, see Teppa et al. (2012).

4.2 Software

This thesis makes use of statistical software R and Rstudio (R Core Team, 2019). Additionally, it used libraries Foreign, Tidyverse, DplyR, MagrittR for data handling and wrangling (R Core Team, 2018; Wickham & Henry, 2019; Wickham et al., 2019; Bache & Wickham, 2014). For visualisation, libraries ggplot2, gglorenz, ggsci, ggrepel, xtable, extrafont, and grid were used (Wickham, 2016; Xiao, 2018; Slowikowski, 2019; Dahl et al., 2019; Chang, 2014; Auguie, 2017). For analyses, packages ineq and pcse were used (Achim Zeileis, 2014; D. Bailea; J.N. Katz, 2011).

4.3 Data and Operationalisation

Given that the institutional context for all three pillars has been as described in Section 2, the data from the survey waves 2014-2018 are used, since the policies are relatively similar for these years. The unit of observation in the data is at the individual level, but also contains a household identifier. This paper uses households as the unit of analysis, thus the household heads are chosen to represent the household.

In total, the dataset started with 10.966 observations of individuals, but keeping only household heads and removing one erroneous observation the dataset analysed contains 4.343 observations of households.[1] The summary statistics will be explored in Section 4.5

For the first comparison, the household was considered retired if the household head indicated that they were retired, or when the household head received pension income and indicated that they were not working. The retirement variable is binary. In an ideal world, the comparison would be between households that retired and households that do not retire at a given age. In this observational research, it is the case that nearly every household retires around the retirement age. The central assumption in this research is that households closer in age are more comparable, particularly so when including income. For example, comparing household heads who are 30 are arguable not as advanced in their careers as people who are 50. Therefore, only observations where the household head was born between 1930 and 1964 were included in this analysis. Control variables in this analysis are for gender and high education. The gender variable is derived from household composition variables in the dataset, and controls for gender differences in households (Harkness, 2013). For households where the gender composition was not available, the number of men and women were set to be balanced. The household is considered highly educated if the head obtained a diploma for a university of applied sciences of university. This variable is taken as higher education may also impact income distributions (Gregorio & Lee, 2002).

With respect to the cohorts, the question arises which cohorts should be included? As stated earlier, households where the head was born between 1930 and 1964 were included in this analyses. Households were categorised into cohorts with a width of 5 years. The reasoning is rather practical, through the width of 5 years a reasonable amount of observations was attained per cohort.

This paper uses net equivalised income to compare the retired and non-retired households.The net equivalised income is the household income divided by the weight of the members of households. This paper uses the modified OECD scale (Chanfreau & Burchardt, 2008). The household head gets a weight of 1, each additional adult household member gets a value of 0.5 and children are given a value of 0.3. The rationale for using equivalised household income is that it makes single households comparable to households with multiple people. Using net, rather than gross income, takes into account redistribution such as taxes and transfers. It is assumed that the net incomes from retired households and non-retired households are comparable, except that retired households receive income from pension and non-retired households from wages. This paper does not take into account so-called double-dippers. Double-dippers are households that obtain pension income while also working. If households

[1] One observation was removed, whereby the income was in the billion (10e9) order whereas the incomes from this household for other years in the dataset averaged 40.000.

indicated that they were working the household was considered not retired.

The data is unique as the incomes from the pillars (gross) have been included. The first pillar is the income derived from the AOW and ANW, additionally the dataset is limited as it does not provide the AIO for the years 2014-2017. The second pillar and third pillar are available. Total pension income is generated as the sum of the three pillars. All of the incomes are gross, and the incomes have been equivalised to account for household differences. One problem is that this value was not available for all households that indicated that they were retired. That is why the net income was used for the comparisons. On the other hand, the income from the pillars can still be useful for other analyses such as this bootstrap analysis.

4.4 Methodology

To determine the income inequality, two common measurements are used based: the Gini index and the Quintile Ratio (QR). Additionally, the Lorenz Curve is plotted for all analyses to explore inequality (Roser & Ortiz-Ospina, 2013). The Gini index ranges from 0 (perfect equality) to 1 (perfect inequality). Lower scores on the Gini are thus associated with less income inequality. The Gini index is calculated as the area of A divided by the total area (A and B), as seen in Figure 4.1. The Gini utilises all incomes from a group to form the index. The QR is the total income from the richest 20 percent of the population divided by the total income from the poorest 20 percent of the population (Langel & Tillé, 2011). A QR of 1 would mean perfect equality: the richest households earn as much as the poorest households. Higher values indicate more inequality. It may happen that these two measures, the Gini and the QR, do not yield the same results as the QR does not use all available data and leaves out the middle classes. Another reason for not yielding the exact same results lies in the method of computing: in theory, a QR can have extremely large values whereas the Gini is has an upper bound of 1. The justification for choosing these two measures is that they are both common in literature about income inequality. These measures can be calculated for each potential group and each source of income. Both measures will be used to provide a fuller picture of the situation. The Gini and QR are calculated for each year in the dataset. A disadvantage of these measures is that they cannot be used to investigate how much each group (retired/non-retired) contributes to total inequality. Measuring the contribution requires a decomposition, which is not possible for these measures.

The first central question of this thesis is what the effect of retirement is on income inequality. To investigate this, the Gini and QR are dependent variables and tested against the retired and non-retired population using analysis of an ordinary least-squares (OLS) regression model with panel-corrected standard errors. A regression model is chosen as methodology because of its flexibility in modelling variables and the ability to include control variables. The retired and non-retired group are

operationalised as dummy variables.This tests the null hypothesis of no difference in average Gini or QR across the retired and non-retired groups. It is expected that the retired group will have a lower Gini and a lower QR compared to the non-retired group. As an extension, control variables are taken into account such as higher education and the percentage of females across groups in a linear regression model. Panel-corrected standard errors are introduced to account for the repeated measures of the years (Bailey & Katz, 2011).[2]

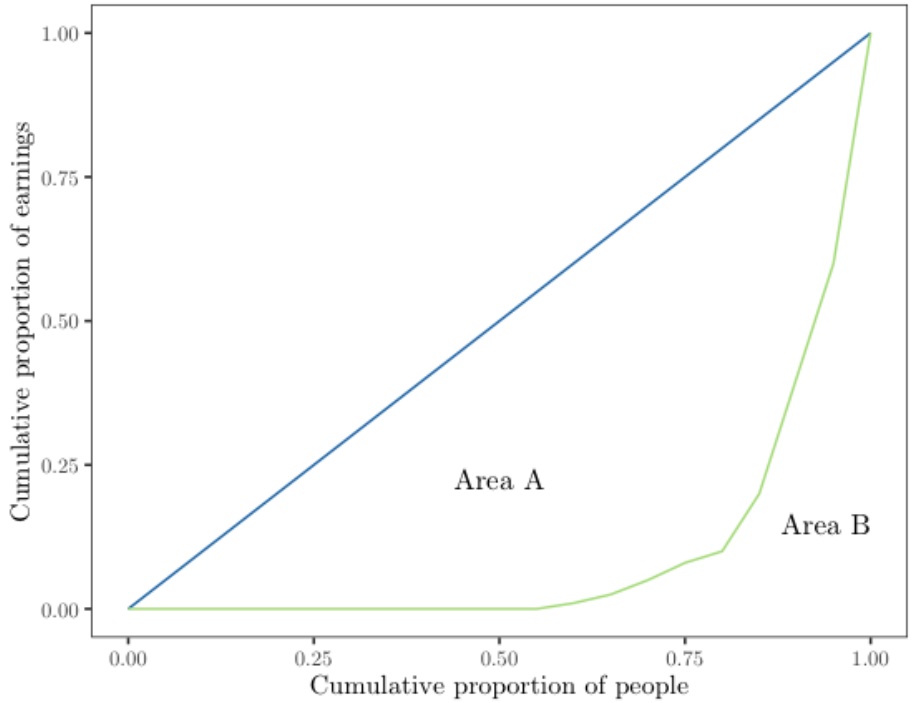
The second question of this thesis is whether or not cohorts may have an effect on income inequality. Thus far, the households have been compared based on retired or not retired, but this treats the groups as homogenous and does not take into account potential cohort effects. Therefore, the Gini coefficients and QRs are calculated for all cohorts for the 5 years in the dataset. To check whether more retirees leads to a lower Gini, an ordinary least squares regression is performed and with panel-corrected standard errors to account for repeated measures. The independent variable is now the percentage of retired households per cohorts, and a cohort is introduced as dummy variable. Additionally, the regression controls for higher education and percentage females across groups and includes the panel-corrected standard errors.

The last question, how the pillars are different with respect to income inequality is a different analysis: it requires to compare using the source of income. It is, given this dataset, not possible to perform linear regression analyses as there would be too few observations (e.g. not every cohort has income from the third pillar). To gain some insight into the Gini and the QR this thesis uses bootstrapping. The central analogy is that the population is to the sample as the sample is to the bootstraps (Fox, 2015). Bootstrapping samples from the original sample with replacement. Suppose that the original sample contains 100 households, then the bootstrap contains 100 observations sampled out of those 100 households with replacement. This research generates 50 bootstrap samples will be drawn for each of the pillar incomes. The reason is that 50 bootstrap samples are often enough and more than 200 are rarely necessary (Rizzo, 2019). The standard errors of the bootstraps are also reported.[3] It should be noted that this is exploratory but extends beyond merely reporting the Gini and QR as a first step towards statistical inference. The estimates are not used for regression and the control variables from the previous section are not taken into account.

[2]It should be noted that this approach only works under the assumption that there are no time effects and the data is normally distributed. Based on the similar institutional context and on the summary statistics, this is assumed, but definitely a limitation and will be further explained in the discussion section. The latter is assumed.

[3]The standard error in the bootstrap context is not the same as the linear regression standard error. The standard error is the standard deviation of a sample, corrected for the loss in degrees of freedom. In a bootstrap the standard error is corrected for a loss of 1, whereas in a linear regression this is a loss of 2 degrees of freedom. For a full discussion see Fox (2015)

Figure 4.1: Explanation of the Gini Index



Note: The Gini is defined as the area of A divided by the area of A and B. The diagonal blue line would be associated with perfect equality, and the green line indicates the division of income. This is a fictional example.

4.5 Descriptive and Summary Statistics of the Data

Table 4.1 shows the summary statistics of the categorical variables in the dataset. It can be seen that there are more retired than non-retired households in this dataset. The gender is slightly unbalanced, representing more females than males. There are less high educated households than educated households. The number of observations for each year range between 786 and 944, which is also a slightly unbalanced.

Table 4.1: Categorical Variables Descriptive Statistics, All Years Pooled

Position	Percentage	Year	Count
Retired	58.3	2014	786
Non-Retired	41.7	2015	944
		2016	898
Gender	Percentage	2017	891
Female	51.8	2018	824
Male	48.2		
Gender	Percentage		
High Educated	34.6		
Not High Educated	63.4		

Note: The total number of households is 4.343. The household is retired if this is indicated by the household head, or the household received a form of pension income. A household was high educated if the household head received a diploma from the university of applied sciences or university.

Pooling all years, the summary statistics of the incomes can be found in Table 4.2. It can be observed that all incomes have large standard deviations, indicating high variation. The table also points towards right-skewed distributions as the means are higher than the medians, except for the first pillar where the reverse is true. The Gini index and Quintile Ratio from the whole dataset, separated by year are given in Table 4.3.

Table 4.2: Summary Statistics of Incomes, All Years Pooled

Variable	Min	Q1	Median	Q3	Max	Mean	Sd	N
Net Income	186	13878	19287	27285	578999	22920	20890	4343
Pension income	4	12000	19332	27859	163348	20824	13836	2381
First pillar income	13	6534	10000	13461	46667	9963	4790	2196
Second pillar income	4	5117	11986	19225	140000	13794	11971	1908
Third pillar income	74	1395	3000	6542	160957	5762	11520	240

Note: All incomes have been equivalised. The pension income and pillar incomes are gross. The summary statistics have been rounded.

Table 4.3: Summary Statistics of Inequality Measures

	2014	2015	2016	2017	2018
Gini	0.318	0.307	0.351	0.300	0.322
Quintile Ratio	5.134	4.654	5.775	4.769	5.374

Note: The Gini and Quintile Ratio are calculated for the dataset as a whole. Over time the statistics seem to vary little.

4.5.1 Retired and Non-Retired

The first comparison in this thesis is between retired and non-retired households. The summary statistics, pooled with the years can be found in Table 4.5.1. The distributions seem right-skewed as the mean is higher than the median for both household groups. The income of the retired households is on average slightly lower than the non-retired households. The standard deviation of the retired group is smaller than that of the non-retired group, indicating that there may be more variation of incomes in non-retired households.

Table 4.4: Incomes of Retired and Non-Retired Households, All Years Pooled

Group	Min	Q1	Median	Q3	Max	Mean	Sd	N
Non-Retired	186	13654	19267	27741	578999	23980	25950	1809
Retired	216	14114	19302	26946	312629	22164	16311	2534

Note: All incomes have been equivalised and are given net. The summary statistics have been rounded.

Table 4.5 shows the inequality statistics for both groups. There seem to be little year-effects as the changes per year for both statistics are not that large.

Table 4.5: Inequality Statistics per Household Group, per Year

Condition	2014	2015	2016	2017	2018
Gini Retired	0.29576	0.29577	0.29572	0.29619	0.29607
Gini Not Retired	0.35026	0.35003	0.35075	0.34976	0.34983
QR Retired	4.4107	4.44446	4.40283	4.48664	4.45868
QR Not Retired	5.40332	5.39068	5.32604	5.39119	5.33207

Note: The Gini and QR seem to vary little over the years, but largely between the groups. These will be used for the regression analysis.

4.5.2 Cohorts

The incomes per cohorts are given in Table 4.6. On average the cohorts seem to be comparable, and the medians of all cohorts are also relatively similar. Given that the median is smaller than the mean, it seems that the distributions are right-skewed. The standard deviations tend to be higher for cohorts that have not completely retired. There are relatively few observations for the eldest two cohorts, which is to be expected given the average life expectancy. Figure 4.2 provides a graphical representation of the summary statistics of the cohorts over the years. For every year, the cohorts seem to exhibit similar behaviour, and all boxplots indicate right-skewed distributions.

Table 4.6: Summary Statistics of Cohort Incomes, All Years Pooled

Cohort	Min	Q1	Median	Q3	Max	Mean	Sd	N	Retired %
1930-1934	2148	14327	18497	24564	105831	22106	13365	213	99
1935-1939	850	12661	17698	24193	163661	20018	12429	421	99
1940-1944	825	14271	19782	27147	173221	21865	12780	579	97
1945-1949	291	14981	19865	27437	578999	22969	23335	1005	94
1950-1954	186	13258	19126	27555	456101	23492	26548	861	40
1955-1959	396	14031	19853	28516	263068	24514	21063	647	5
1960-1964	628	13349	19360	27494	296539	23624	20217	617	1

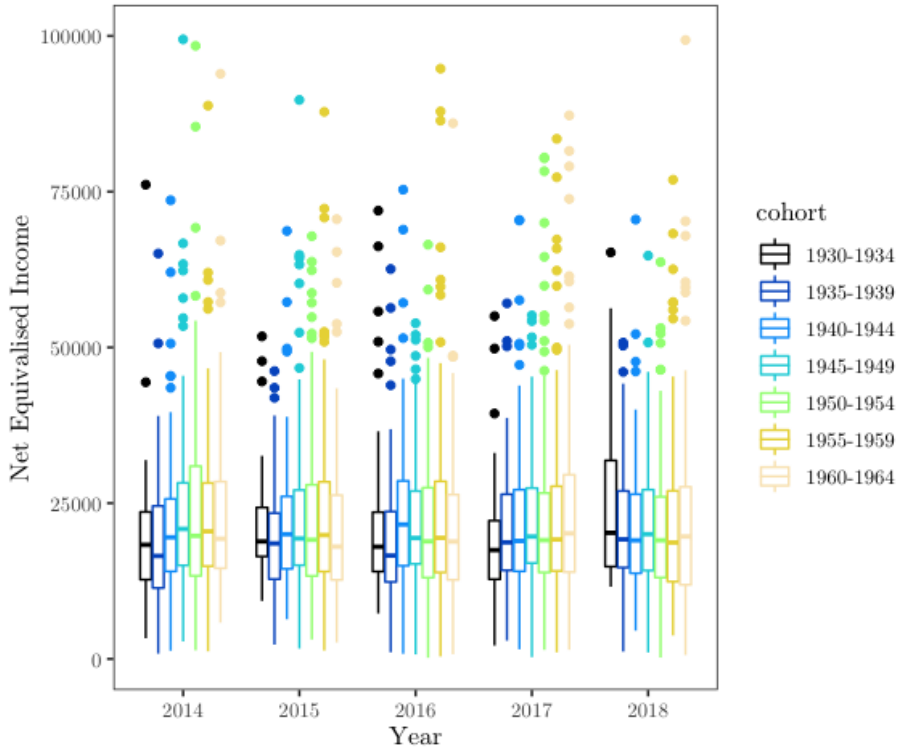
Note: All incomes have been equivalised and are given net. The incomes are averaged over the years of the dataset.

Tables 4.7 and 4.8 show the calculated Gini and QR for each of the cohorts respectively. What can be deduced from these numbers is that there is little variations over time within cohorts, but somewhat more variation between cohorts. These statistics are used in the regression model of the analyses.

4.5.3 Pension Income

The pooled pension income summary statistics can be found in Table 4.2. The number of observations show that there are some households that receive pension income in general, but very few households receive third pillar income. Taking into account that this table contains the observations for 5 years, this supports the methodology for the pillars. There would be too few observations to do classical statistical inference on the Ginis and QRs calculated from very few observations. This table also supports using net income for households to compare retired and non-retired: the number of

Figure 4.2: Summary Statistics of Cohorts per Year



Note: The boxplots all exhibit similar behaviour and point towards right-skewed distribution. The y-scale has been cut to 100.000 euros to improve legibility of the graph, though there are higher observations. The original version of this figure can be found in the appendix.

Table 4.7: Gini per Cohort, per Year

Cohort	2014	2015	2016	2017	2018
1930-1934	0.28354	0.28380	0.28464	0.28314	0.28295
1935-1939	0.28758	0.28774	0.28763	0.28751	0.28816
1940-1944	0.27572	0.27614	0.27575	0.27565	0.27543
1945-1949	0.29550	0.29407	0.29390	0.29462	0.29554
1950-1954	0.34463	0.34499	0.34496	0.34547	0.34618
1955-1959	0.34942	0.34878	0.34957	0.34858	0.34847
1960-1964	0.34683	0.34631	0.34650	0.34598	0.34632

Note: The Ginis seem to change little over the years. There seems to be more between-cohort variation than within-cohort variation. These Ginis will be used for the regression in the analysis part.

Table 4.8: Quintile Ratio per Cohort, per Year

Cohort	2014	2015	2016	2017	2018
1930-1934	4.19076	4.19068	4.18530	4.25023	4.18335
1935-1939	4.52491	4.56874	4.61728	4.60997	4.59787
1940-1944	4.26495	4.30993	4.27933	4.27647	4.29312
1945-1949	4.57251	4.57762	4.58572	4.51720	4.54856
1950-1954	5.80991	5.84959	5.84101	5.79880	5.86761
1955-1959	5.87217	5.87244	5.87510	5.84260	5.92587
1960-1964	6.06724	6.00037	5.98877	6.01265	6.00657

Note: The Quintile Ratios (QR) seem to change little over the years. There seems to be more between-cohort variation than within-cohort variation. These QRs will be used for the regression in the analysis part.

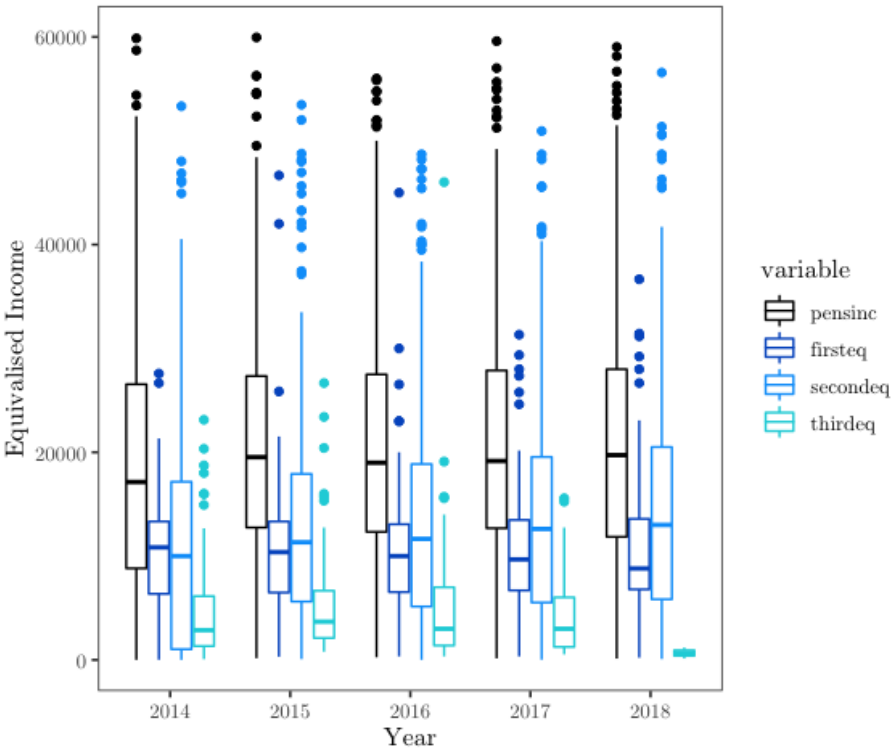
households that receive pension income is lower than the percentage of households who indicate that they are retired.[4]

To understand the distributions of the years, boxplots were made as to be seen in figure 4.3. It can be observed that the largest range is found in the pension income total. Furthermore, the median pension income is higher than the income of any pillar, suggesting that most households that receive pension obtain the income from more than one source. The first pillar seems less dispersed than the second pillar. The third pillar, as a reminder, has very few observations, particularly in 2018. The general picture does not suggest any year effects.

Contrary to the previous sections, the Gini and QR will be given in the analysis

[4]One potential explanation for this phenomenon could be non-response where some retired households may know their net incomes but not enough about their pension gross incomes. This would be a problem if pension income is used for the analysis, but is circumvented by using net income.

Figure 4.3: Summary Statistics of Sources of Pension Income by Year



Note: The boxplots all exhibit similar behaviour and point towards right-skewed distribution. The legend variable names stand for pension income total, first pillar income (equivalised), second pillar income (equivalised) and third pillar income (equivalised), respectively. The y-scale has been cut to 60000 euros to improve legibility of the graph, though there are higher observations. The original version of this figure can be found in the appendix.

section. The calculated Gini and QR by pension income pillar are part of the results and calculated using the bootstrap method.

Chapter 5

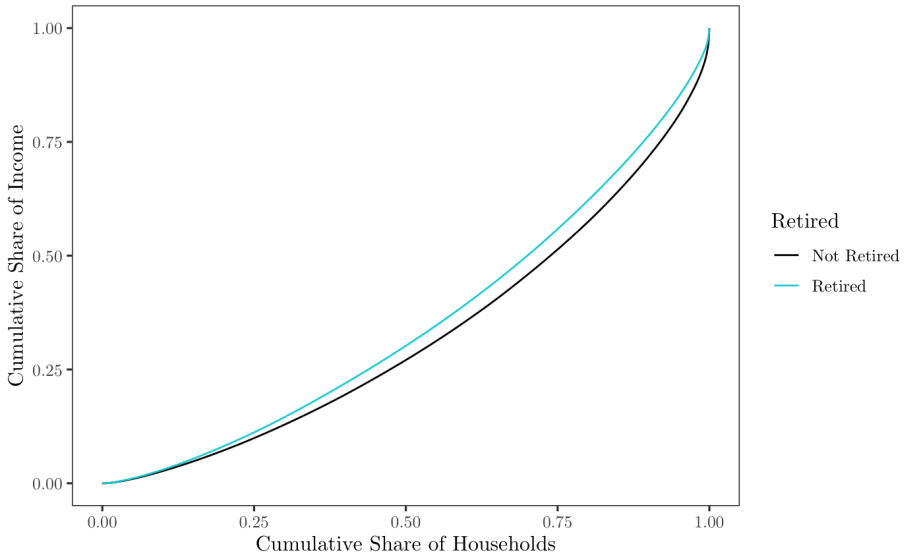
Analysis and Results

5.1 Retired and Non-Retired

Figure 5.1 shows the Lorenz curve with all years pooled. It can be seen that the retired group is closer to the 45 degrees line that indicates income equality, whereas the not retired group is more skewed and therefore associated with more inequality. This is in line with the general hypothesis that there is less income inequality amongst retired people than non-retired people. When considering the different years as can be seen in Figure 5.2, this difference is less pronounced in years 2014, 2015 and 2018 but still present.

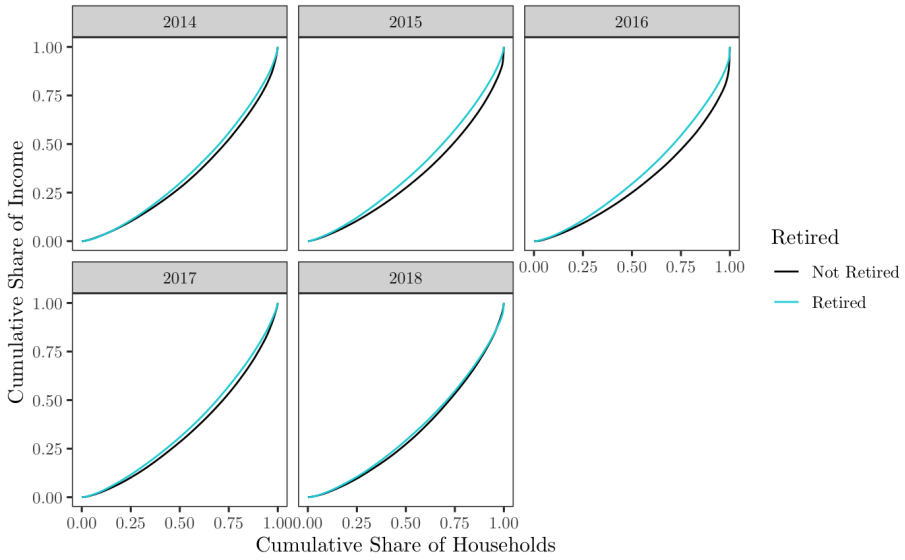
The results from the regression with panel-corrected standard errors can be found in Table 5.1. Model 1 is the simple model to investigate whether retirement has an effect on the Gini index. It seems to be the case that the retired groups have a significantly lower Gini, which is in line with the expectation that retirement would lead to less income inequality. When adding control variables, retirement still leads to a lower Gini index as seen in Model 2. The story for the QR is similar: Model 3 indicates that the retired group has a lower Gini index, this also holds when controlling for the percentage females in the households and the high education percentage, as seen in Model 3. The R^2 adjusted is reported, rather than the R^2 as the adjusted variant penalises the addition of variables that do not add to explanation of variance.

Figure 5.1: Lorenz Curves of Retired and Non-Retired, all Years Pooled



Note: This image displays the Lorenz curves of non-retired and retired households. The retired households have a line closer to the 45 degrees equality line (not pictured). All years are pooled.

Figure 5.2: Lorenz Curves of Retired and Non-Retired by Year



Note: This image displays the Lorenz curves of non-retired and retired households. The retired households have a line closer to the 45 degrees equality line (not pictured) over time.

Table 5.1: Regression Results Gini and Quintile Ratio

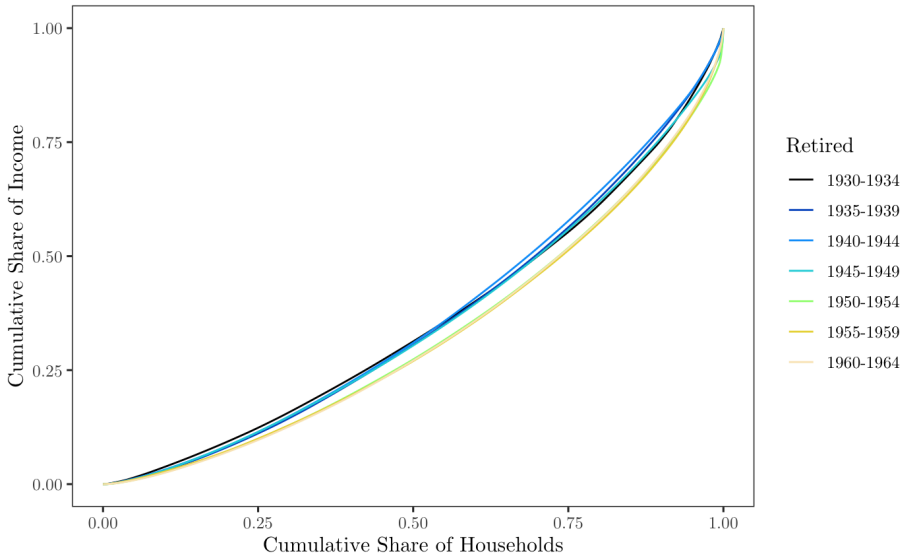
	Gini Model 1	Gini Model 2	QR Model 3	QR Model 4
Constant	0.3489 (0.012)***	-0.5636 (0.501)	5.8110 (0.253)***	-8.1840 (11.662)
Retired	-0.0534 (0.010)***	-0.1149 (0.034)*	-1.1830 (0.209)***	-2.1260 (0.798)*
Percent Femals		0.0170 (0.009)		0.2683 (0.231)
Percent High edu.		0.0010 (0.002)		0.0186 (0.0497)
Observations	10	10	10	10
adj. R^2	0.5315	0.5129	0.5340	0.4450
Omnibus F	0.0101	0.0651	0.0090	0.0940

Note: The coefficients have been given and the panel-corrected standard errors are in between brackets. * significant at the 5 percent level, ** significant at the 1 percent level, *** significant at the 0.1 percent level.

5.2 Cohort Effects

The next question is whether there are cohort effects. As in the previous section, this section will start with the figures of the Lorenz curves as depicted in Figure 5.3. These are somewhat less informative as the cohorts all tend to cluster together, but tentatively it does seem that the younger cohorts, indicated with yellow colours do seem to have steeper lines. This would carefully indicate that the income inequality is somewhat different for the younger cohorts. This, in turn, would be in line with the idea that the working cohorts would have more income inequality. The differences seem less pronounced when taking into account the different years as depicted in Figure 5.4. Nonetheless, it appears that the younger cohorts seemingly are more unequal for all years except 2017.

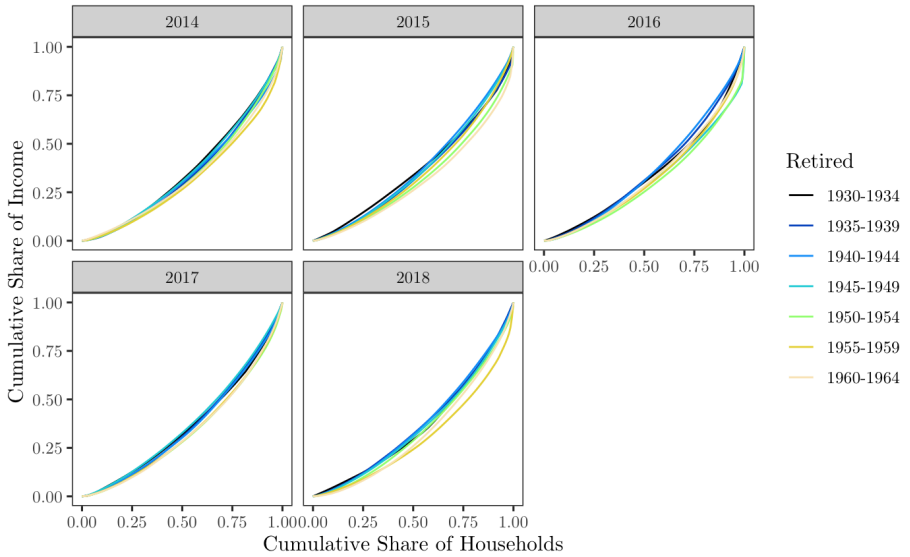
Figure 5.3: Lorenz Curves of all Cohorts



Note: This image displays the Lorenz curves of all included cohorts per year. The elder cohorts tend to be closer to the equality line at 45 degrees, though some variation over the years can be observed.

The full results of the Gini regression with cohorts can be found in Table 5.2. Model 5 introduces the percentage of retired households as a variable, and the coefficient is negative and significant. More retired people in a cohort leads to a lower Gini. This is in line with the general hypothesis that retirement would lead to less income inequality. This effect disappears when cohort dummies are introduced in Model 6. Even more noteworthy is that the retirement has a positive coefficient which is different from the conclusion from Model 5. The retirement percentage of Model 6 is not statistically significant, thus the conclusion is that an increase in retirement percentage within a cohort would not lead to a change in income inequality.

Figure 5.4: Lorenz Curves of all Cohorts



Note: This image displays the Lorenz curves of all included cohorts. All years are pooled. The elder cohorts tend to be closer to the equality line at 45 degrees.

The cohort dummies appear to be larger for younger cohorts but are not statistically significant. This leads to the conclusion that the cohorts are not different from the reference group (Cohort 1930-1934, as captured by the constant). When introducing control variables in Model 7, no variable is significant, thus it cannot be said that any of these variables contribute to the change in Gini. In sum, whereas the increase in percentage of retirement households seemed to have less income inequality, this effect disappears when cohort effects are introduced.

Table 5.2 shows the results for the regression with the Quintile Ratio as the dependent variable. Model 8 demonstrates that an increase in the percentage of retired per cohort is associated with a decrease in the QR. However, when introducing the cohort dummies in Model 9 this effect disappears. The older cohorts tend to have lower coefficients than the younger cohorts. Cohorts 1935-1939, 1940-1944 and 1945-1949 are different from the reference group (cohort 1930-1934 captured by the constant). This conclusion is different from the Gini regression, and might partially be explained by different uses of data. The Gini uses 100 percent of the data to calculate the index whereas the QR only uses 40 percent. In Model 9, the younger cohorts (from 1950 onwards) have larger coefficients, but are not statistically significant. When introducing control variables in Model 10, none of the variables are statistically significant. This leads to the conclusion that no variable significantly changes the QR. Therefore, Model 10 would suggest that neither retirement nor cohort effects explain the

Table 5.2: Regression Results Gini Regression with Cohorts

	Model 5	Model 6	Model 7
Constant	0.3536 (0.0007)***	0.2626 (0.1012)*	0.1968 (0.1563)
Retired Percent	-0.0007 (0.0001)***	0.0002 (0.0010)	0.0004 (0.0011)
Cohort 1935-1939		0.0061 (0.0108)	0.0012 (0.0191)
Cohort 1940-1944		-0.0031 (0.0101)	0.0002 (0.0126)
Cohort 1945-1949		0.0132 (0.1397)	0.0175 (0.0299)
Cohort 1950-1954		0.0737 (0.0612)	0.0093 (0.0773)
Cohort 1955-1959		0.0845 (0.0961)	0.1111 (0.1049)
Cohort 1960-1964		0.0823 (0.1005)	0.1110 (0.1105)
Female Percent			0.0001 (0.0032)
High Education Percent			0.0011 (0.0013)
N	35	35	35
R^2 Adj.	0.5084	0.4687	0.4370
P val. F-test	< 0.001	< 0.001	0.0032

Note: The coefficients have been given and the panel-corrected standard errors are in between brackets. * significant at the 5 percent level, ** significant at the 1 percent level, *** significant at the 0.1 percent level.

differences in the QR, and thus in income inequality.

Table 5.3: Regression Results Quintile Ratio Regression with Cohorts

	Model 8	Model 9	Model 10
Constant	5.9180 (0.2272)***	2.1025 (1.9443)	-3.1500 (3.8963)
Retired Percent	-1.7414 (0.3017)***	1.6163 (1.9460)	1.3120 (2.3456)
Cohort 1935-1939		0.6607 (0.2420)*	0.2153 (0.5270)
Cohort 1940-1944		0.4693 (0.1332)**	0.2994 (0.3179)
Cohort 1945-1949		0.8234 (0.2286)*	0.1036 (0.7497)
Cohort 1950-1954		2.9418 (1.1594)	2.3174 (1.8426)
Cohort 1955-1959		3.5107 (1.8630)	3.2870 (2.4380)
Cohort 1960-1964		3.6559 (1.9746)	3.3939 (2.5987)
Female Percent			0.1027 (0.0815)
High Education Percent			0.0154 (0.0394)
N	35	35	35
R^2 Adj.	0.4873	0.5043	0.4874
P val. F-test	<0.001	< 0.001	0.001

Note: The coefficients have been given and the panel-corrected standard errors are in between brackets. * significant at the 5 percent level, ** significant at the 1 percent level, *** significant at the 0.1 percent level.

5.3 Exploratory Gini by Source

The results from the previous paragraphs indicate that there may be differences between retired and non-retired households in the income inequalities. On the other hand, the effects of retirement disappear when cohort effects are introduced. The last question of this thesis is whether the three pillars have different income inequalities. The bootstrap estimates can be found in Table 5.4 for the Gini index and in Table 5.5 for the QR. The estimates also give the standard error of the mean, which shows that the years are relatively different. This result is surprising as the summary statistics did not show too much variance over the years. In general, what can be observed is that the first pillar has a Gini lower than the total pension income in all years: the first pillar has an income inequality decreasing property. The second and third pillars, on the other hand have Gini's that are considerably higher than the total pension income. This suggests that both the second and third pillar are not income inequality decreasing. It should be noted that the third pillar 2018 observation is missing, this is due to the fact that there are too few observations (only two) for a bootstrap analysis. In sum, the bootstrap results suggest that the first pillar is income inequality decreasing, while the other pillars are not.

Table 5.4: Gini Indices per Pillar per Year

	2014	2015	2016	2017	2018
Total Pension Income	0.39869	0.32936	0.33177	0.34353	0.34293
	(0.00265)	(0.00182)	(0.00177)	(0.00187)	(0.00161)
First Pillar	0.24958	0.24447	0.25207	0.25679	0.26308
	(0.00145)	(0.00184)	(0.00131)	(0.00115)	(0.00131)
Second Pillar	0.53287	0.42319	0.42082	0.41478	0.40976
	(0.00333)	(0.00202)	(0.00209)	(0.00207)	(0.00189)
Third Pillar	0.52513	0.52087	0.48964	0.59766	
	(0.00432)	(0.00318)	(0.00637)	(0.01697)	

Note: In total, 50 bootstraps have been performed to estimate the mean and the standard error of the mean. The first pillar has a lower Gini than the second and third pillar. It is also lower than the total pension income.

The Quintile Ratio by pillar as shown in Table 5.5 confirms the findings of the Gini coefficient. All years seem to be different, and one outlier is the second pillar in 2014. It is likely that there are a few high observations in 2014 and some very low observations in 2014. This is visible for the Gini coefficient too but less drastically, most likely because the QR only utilises 40 percent of the data whereas the Gini uses all data. The other estimates for the QR seem to be within an acceptable range. Considering that 2018 only has two observations for the third pillar, the QR cannot be estimated. The first pillar has a QR that is lower than the other pillars, suggesting

it decreases income inequality. The second and third pillars have higher QR values, therefore seem to not have the income inequality decreasing capacities.

Table 5.5: Quintile Ratio per Pillar per Year

	2014	2015	2016	2017	2018
Total Income	15.08074	7.56538	7.09073	7.54394	8.21811
	(0.38485)	(0.15242)	(0.10658)	(0.10003)	(0.09715)
First Pillar	3.69678	3.58367	3.79181	3.80922	3.76102
	(0.03707)	(0.03263)	(0.04239)	(0.04825)	(0.04779)
Second Pillar	4376.29975	13.57169	15.09881	14.17237	13.27765
	(121.01962)	(0.21561)	(0.29143)	(0.31243)	(0.20348)
Third Pillar	17.02563	11.38349	15.76899	26.96909	
	(0.67775)	(0.33004)	(0.44276)	(1.93388)	

Note: In total, 50 bootstraps have been performed to estimate the mean and the standard error of the mean. The first pillar has a lower QR than the second and third pillar. It is also lower than the total pension income. The second pillar has a high estimate for 2014, most likely caused by a few observations with large

Chapter 6

Discussion

This thesis set out to investigate whether, and to what extent, retirement plays a role in income inequality in the Netherlands. Comparing retired households to non-retired households there was evidence for less income inequality: the Lorenz curves were lower, the regression models showed significantly lower Gini indices and Quintile Ratio's even with control variables. Upon further inspection of the Gini and introducing cohorts dummies, however, the percentage of retired households seems to no longer contribute to lower income inequality. The cohort effects, on the other hand, are neither significant nor robust upon introduction of control variables. Model investigating the QR had similar conclusions: the cohort effects are not significant. One difference between the QR and the Gini regression could be found when only cohort effects are introduced: not all cohorts are statistically similar to one another. The cohorts that were older were significantly different from the eldest cohort group.

The literature suggests that retirement is redistributive and consequently income inequality decreasing. This is confirmed by the general comparison between the retired and non-retired population in the analyses. The groups, if treated as homogenous, are statistically significantly different. On the other hand, when cohort dummies are introduced to differentiate between cohorts, the effect of retirement is no longer significant. This suggests that there may be more factors at play than just being retired or not.

Upon inspection of the income derived by the pension pillars specifically, the first pillar had lower values for the Gini and QR. The second and third pillars have considerably higher Gini and QR outcomes. The Gini and QR also seem to be different for the years, which is particularly interesting given that the institutional context for the pillars is the same for all these years. This result is thus surprising and warrants further research into the topic.

There are limitations to this thesis, and this would be time to acknowledge them. The research thus far has been largely descriptive and does not control for many other variables, such as labour market position. This could be grounds for further

research, though this would require more observations and stronger assumptions in model building. The number of observations in this thesis is also relatively small and the years is limited from 2014-2018. The original reasoning was that the institutional context for this period is relatively stable. But further research could exactly look at what changes in the institutional context could do with regards to the income inequality. Furthermore, potential time effects were not taken into account in the regression, which makes it difficult to state whether the results hold for longer periods of time.

One other path forward that this thesis proposes is to research this topic with administrative data. While the DHS data may provide a starting point for analysis the reader should be reminded that most of the incomes are self-reported.The few observations for the third pillar, for example, may not entirely provide reliable estimates. Furthermore, more people indicated that they were retired than those who reported pension income from the pillars. This mechanism behind the missing data has not been researched as the data from the pillars was not utilised to compare retired and non-retired household. If further research wants to compare these pillars, it is necessary to investigate the mechanism behind the missing data, or alternatively, it should consider to use data from administrative sources could provide further estimates.

Additionally, with regards to the operationalisation, future research could look into how the pillars contribute relative to the overall inequality. As stated prior, the Gini coefficient is not perfectly decomposable, and splitting households into groups would create residual terms making a Gini decomposition difficult to interpret. The same holds for the QR: it is not decomposable. On the other hand, alternative methodologies such as Theil decompositions have the added advantage of begin decomposable, but this comes at the cost that the coefficient is less easily interpreted. It may be worthwhile to investigate this.

A final limitation of this study to highlight is that the assumption is made that the working households of older age are a good match to compare with the retired households of today. The assumption is that people that are closer together in age face more similar conditions in terms of the labour market and institutional context. This paper investigates households where the household head is born before 1964, whereas the eldest are born in 1930. This is a difference of 34 years, which is nearly the difference between parents and children. The justification for using the data anyways is that the youngest are relatively close to retirement and to be able to make some sort of comparison.

Notwithstanding these limitations, this thesis provides a picture far more nuanced than the literature available. It advocates the usage of data to investigate the consequences of the specific institutional context. The starting point provided in the introduction, that pensions may be redistributive is something that should be considered with more nuance when researching the policies of the welfare state.

Chapter 7

Conclusion

This thesis set out to answer three questions. First: whether there were differences in income inequalities between retired and non-retired households. Second: whether there were income inequality differences when cohorts are introduced. Third what differences are between pillars when considering income inequality. The institutional context for these questions were the relevant policies in the Netherlands from 2014 to 2018. The three pillar system, with a public pay-as-you-go first pillar, a privately funded second pillar and an individual funded third pillar, had policies that were very similar from 2014 to 2018.

The literature about pensions pay little attention to the effects of the pension systems when it comes to income inequality. There is evidence that pensions are redistributive, but the question what happens when cohorts are introduced is largely unexplored. With respect to the particularities of the three pillar system, the framework was that the first pillar should have lower income inequality statistics than the other pillars.

To test the theoretical framework, data from the DNB Household Survey was used for the years from 2014-2018. The unit of analysis in this thesis were households, given the common spending assumptions. The sample contained the households were the head was born between 1930 and 1964. Income inequalities were operationalised as Gini Indices and Quintile Ratios per year, and the methods used were ordinary least squares regression with panel corrected standard errors. There were differences between retired households and non-retired households for both statistics.

Upon the introduction of cohorts, however, the retirement effects were not robust. Assuming that cohorts face similar labour market conditions and institutional contexts, this may influence the retirement effect on the income inequality. Neither cohorts nor retirement effects were found. This picture is far more nuanced than the literature suggested before.

The DHS data was unique, as it also provided income from the three pillars of the pension system per household. Through bootstrapping the sample and calculating the

Gini and QR, early evidence suggests that the pillars have different effects from each other. The first pillar was associated with less income inequality whereas the other pillars are not. What was particularly surprising is that the Gini and QR varied by year, more so than in the regression analysis. Many reasons can be considered for this but phenomenon, such as the self-reporting aspect of the data. This is an interesting puzzle that requires further attention.

There are limitations to this thesis, most notably the limited number of observations of the Gini and the QR. Whereas the justification for using a stable institutional context period from 2014-2018, more years may show a different picture. The choice of type of income may also be a subject of debate: using net equivalised income includes more sources than just income from work and retirement. The overall contribution to the literature, however, is clear: this research provides new insights into the workings of the pension system.

Nonetheless, this thesis provides some early evidence that the pension-income redistribution link may not be as clear in reality as thought of in the literature. It demonstrates that this topic is often complex and requires more attention. Returning to Esping-Anders and Myles, the very first citation in this thesis: this thesis does not provide a clearcut answer to which the pension system of the Netherlands is associated with more equality. It therefore remains an open empirical question, but at least it is clear that more nuance is required.

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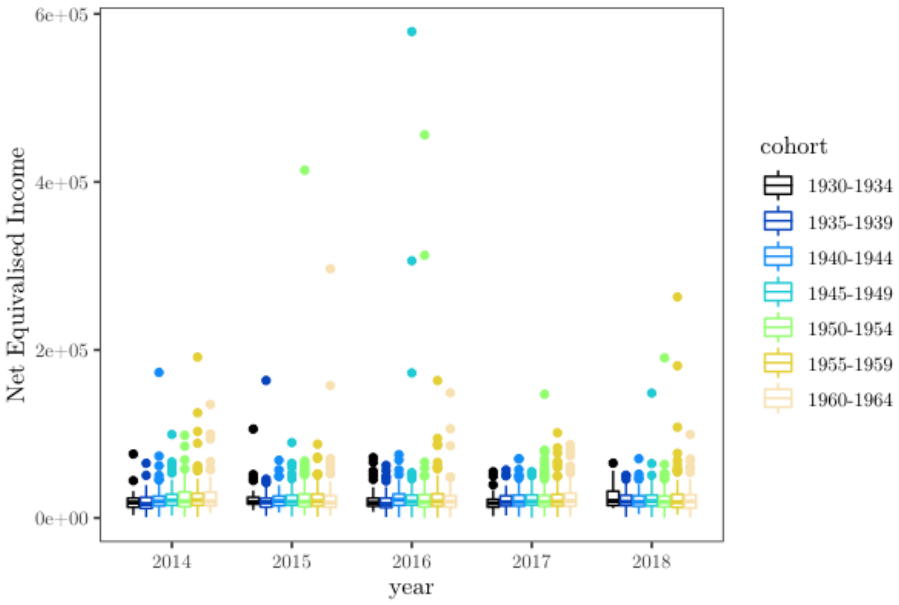
Appendices

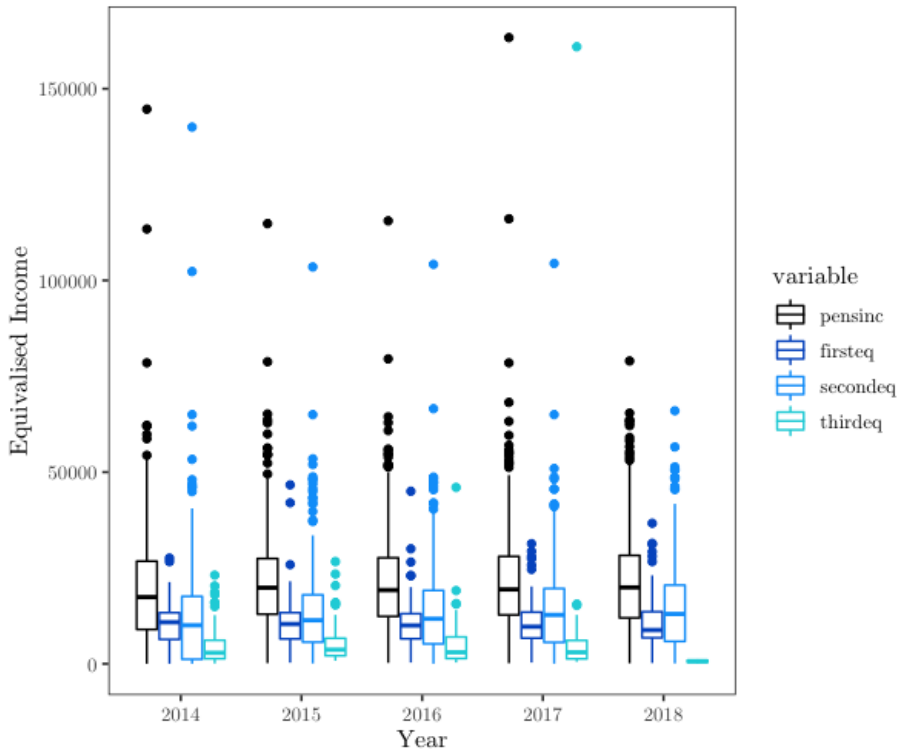
Appendix A

Figure A.1: Summary Statistics of Cohorts by Year, Full Version



Note: The boxplots all exhibit similar behaviour and point towards right-skewed distribution.

Figure A.2: Summary Statistics of Sources of Pension Income by Year, Full Version



Note: The boxplots all exhibit similar behaviour and point towards right-skewed distribution.