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Equity Release Products

Analysis for the Netherlands

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Equity Release Products

Analysis for The Netherlands

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Contents

Abstract

Equity release products are currently barely available on the Dutch financial market. However, these products are likely to gain more interest in the future. A lot of research has been done regarding reverse mortgage products but little towards other products such as home reversions and variations of home reversions. In this thesis different equity release contracts are analyzed from both a provider's and consumer's perspective. A vector autoregressive (VAR) model is used to capture the dynamics of the economic variables, create scenarios for the future and determine the associated stochastic discount factors. A sensitivity analysis is preformed and the currently offered products in the Dutch market are analyzed.

1 Introduction

In the Netherlands people are reminded on a daily basis that society is aging and due to the state of the economy and the low interest rates their pension value is decreasing. Besides, a trend is seen in which health care costs are rising and these costs are mostly made at an older age, after retirement. [CPB, 2013]

This is also a concern of the government and institutions. The Taskforce Verzilveren has therefore been established by the Dutch government and is an investigation which aims to provide insight in the possibility for elderly to use equity release products. Taskforce Verzilveren was published in May 2013 [Taskforce Verzilveren, 2013]. On June 1, 2015 it was announced by the "Vereniging Eigen Huis" that still no additional products were available at the market but steps were made to develop more of these home equity release products.

During the MIT Sloan School of Management Second Annual Conference the issues of the structure, marketing, funding and valuation of reverse mortgages have been addressed by Merton and Campbell. This indicates that the subject is currently under a lot of attention both nationally and internationally. [Merton, 2015] [Campbell, 2015]

Home equity release products have increased in popularity over the last couple of years in countries such as the US, UK and Australia. Dillingh et al. [2013] investigated that the potential demand for the Netherlands is large but the products are yet still quite unknown. Since the Dutch pension system today is well funded and a health insurance is mandatory for everyone there is no immediate need for these products. However the Netspar investigation by Dillingh et al. suggest that especially for consumption smoothing and cushioning pension shocks equity release products can be appealing to the Dutch elderly.

These home equity release products can be divided into three different types. The first one; selling your house and move to a cheaper home or rental, is the most basic option and does not involve complex financial products. The other two options are reverse mortgage products and home reversion products.

Home equity release products are especially designed for elderly people. According to figure 1, the Dutch households capital increases with age. Currently the oldest age cohort (65 and over) have the largest capital amount. The high financial wealth that the elderly hold is partly due to natural selection. This implies that in general wealthy people live longer [Dillingh et al., 2015]. However, in the majority of the cases this wealth is housing wealth which implies that the money cannot be extracted that easily. In order to transfer the housing wealth into cash, equity release products can be used [CBS]. This is the so-called House-Rich, Cash-Poor phenomenon [Case and Schnare, 1994].

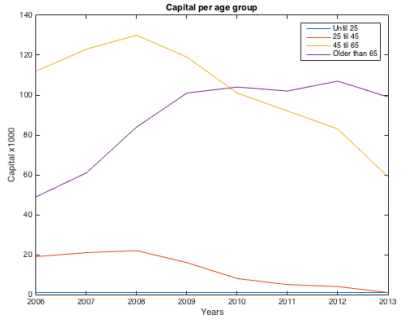

Figure 1: Capital of Dutch Households per age cohort

The total additional accumulated value in houses in the Netherlands is €500 billion. The retired population holds 38% of this and the people of age 50 and over even 80%. Next to this on average 60% of the total financial capital value consists of housing wealth.[Taskforce Verzilveren, 2013]

In the Home and Mortgage survey conducted by ING Bank in 2015 the market perception across Europe, US and Australia has been measured. The survey concluded that over 70% of the Europeans do not consider their home as part of their pension. In the Netherlands only 13% of the survey did consider their home as part of their pension. Strong differences were found within age cohorts. From the population 55 and over only 9% consider their home part of their pension while for the population 18 to 24 this percentage is 27%. This indicates that there is a mentality shift to come over the next decades. In the US, UK and Australia these percentages are much higher, this is in line with the popularity of equity release products. [ING International Survey Home and Mortgages, 2015]

Reverse mortgage and home reversion products are not only a solution for the elderly to access their money. It has also been investigated that reverse mortgage products are able to boost consumption, reduce public pension liability and mitigate the demand for long term care [Mitchell and Piggot, 2003]. However, in order for these products to be attractive, government regulations should be imposed. This protects the consumer against unexpected costs, high risk products and create awareness.

The cash value that can be released using a equity release product does not only benefit the individual consumer but also the government could benefit from these products. Taking into account the increasing health care costs and uncertainty of the pension income these equity release products can provide additional income without the help of the government.

This thesis is organized in the following way: section 2 till 4 will provide additional information about equity release products, country differences and the risks. Section 5 discusses the parameters, the VAR model and the stochastic discount factors. Section 6 shows the forecast and explains how the scenarios are created. Section 7 provides an analysis of the products. Section 8 gives from a consumer's perspective an overview of the current products. Finally section 9 provides the associated conclusions and suggestions for further research.

2 Equity Release products

Equity release products are available in a few different forms. In this section the different equity release products will be discussed.

The most basic home equity release product is selling your house and moving to a cheaper house or rental. However for most people this is not favorable and they prefer to remain living in their own house. In the Netherlands people value living in their own home highly and the willingness to move decreases with age. Besides moving, another option to release equity in your house would be to take a second traditional forward mortgage (interest only) on the accumulated value of your house. These traditional forward mortgages are only provided by banks when certain income and health standards are met which makes them not accessible for everyone. Besides, these mortgages are usually only meant for construction work, paying off debt or covering a portion of the down payment[1].

2.1 Reverse Mortgage

A reverse mortgage is a financial product which gives the elderly the opportunity to take out a loan against their home equity. Unlike a forward mortgage no mortgage payments will be made but the interest accumulates and is added to the total loan value. The payment of this loan plus interest takes place when either the home owner moves out, sells the house or dies. Many reverse mortgage providers protect their borrowers with a no negative equity guarantee (NNEG). This implies that the risk that the value of the loan plus the interest plus additional costs exceeds the total value of the house is covered by the lender or another institution. This is the so called cross-over risk and will be discussed later in this thesis. The amount that can be borrowed strongly depends on the age of the borrower, the value of the house and the interest rate.

Reverse mortgages can be used to smooth consumption over time or already provide part of the bequest to the heirs [Merton, 2007]. With large health costs and declining pension values the reverse mortgage market is already widely developed in the United States and has been increasing in recent years to over 900.000 reverse mortgages in 2015 (US Department of Housing and Urban Development). A decline in popularity has been seen during the financial crisis, which is also visible in the graph below. Apart from this promising growth, the market still only accounts for 2%-3% of all eligible homeowners in 2011.

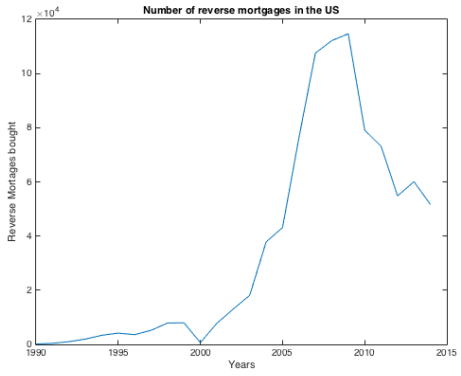

Figure 2: Number of Reverse Mortgages in the US

[1] www.eigenhuis.nl

2.2 Home Reversion

Home reversion products are financial products which give the elderly the opportunity to sell (part of) their home but still continue to live in their house. There are two kinds of home reversion products: a sale-and-lease product and a sale-and-mortgage product. In a sale-and-lease contract the ownership of the house passes over to the provider and the consumer leases it back for life. In a sale-and-mortgage product the ownership stays in the hands of the consumer. The provider is then given a mortgage over the property. Just like reverse mortgage products home reversion can be used to smooth consumption over time or create extra income during retirement [Alai et al., 2014].

In the UK and Australia both reverse mortgage products and home reversion products are offered to the consumer. However it is seen that the Australia market is currently dominated by reverse mortgage products. About 75% of all home equity releasing products consist of reverse mortgages and only 25% of home reversion products [ASIC, 2005]. This is mainly due to the fact that home reversion products are more difficult to understand than reverse mortgage products.

Alai et al. [2014] investigated whether home reversion products can be favorable over reverse mortgage products. Their conclusions were that in markets with a high loan-to-value ration (LVR) such as the United States the reverse mortgage products are preferred. While in the markets of the UK and Australia, where the LVR is lower, home reversion would better suit the participants. If the loan to value ratio can be increased in these countries this also stimulates the reverse mortgage market. Later in this thesis it will be discussed if this would also be the case for the Dutch market.

2.3 Payments

The cash payments can take different forms. A lump-sum payment can be chosen or an annuity can be taken out. Below the different options are presented.

Lump-sum payment A lump-sum cash value which will be provided to the borrower at once

Tenure Monthly payments as long as the borrower is alive and occupying the principal home

Term Monthly payments for a fixed period

Line of credit Withdrawals up to a maximum amount

Modified tenure Tenure option is combined with a line of credit

Modified term Term option is combined with a line of credit

In the research of Dillingh et al. [2015] the interest in reverse mortgage products is investigated. When looking at the different types of loan arrangements it is striking that over 40% of the respondents would prefer the line of credit.

2.4 Product differences

The main advantage of a home reversion in the consumer's view is the fact that no debt is taken out while this is the case in a reverse mortgage contract. In a home reversion contract part of the property will be sold which is turned into money. The risks involved with reverse mortgages (inflation risk, longevity risk, housing price risk) are diminished or can be pooled [Deloitte, 2011].

2.5 Current demand

The current demand for home reversion products is very little. Just as for the reverse mortgage products there is a lack of awareness and a high level of financial illiteracy. For investors liquidity is an important concern [Alai et al., 2014]. The government could solve these issues by better education and providing liquidity.

3 Risks and Barriers

Providing an equity release product is not without risks. For both the provider and the consumers there are risks associated with these products. Even if these risks would be minimized there are still market barriers why these products are not taken out / offered as much as expected. The next section describes the risks and market barriers for equity release products.

3.1 Reverse Mortgage Risks

3.1.1 Cross-Over Risk

The cross-over risk is the risk that the total loan balance will be larger than the total property value. The graph below provides a visual representation of the the cross-over risk when the total loan value increases over time to such extent that it becomes larger than the property value. The cross-over point is the point where both lines intersect.

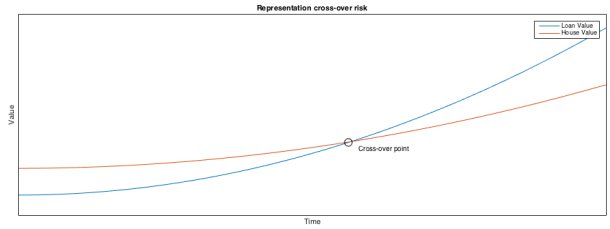

Figure 3: Cross-over risk

The cross-over risk is mainly influenced by the property value, the interest rate and longevity risk. Decreasing property value, increasing interest rates both result in a cross-over point which lies closer ahead than expected. The risks are also dependent on the payment option that is chosen. A lump-sum payment comes with different risks than a tenure contract. Therefore the payment option is also an important variable which the consumer and the provider need to take into account.

3.1.2 Housing Prices

During the years before the crisis the housing market was booming. During the financial crisis the values started decreasing and people were left with unpayable mortgages. The next graph shows a comparison between the consumer price index and the development of the housing prices in the last ten years in the Netherlands.

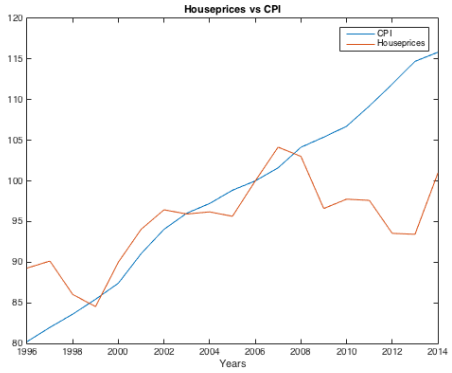

Figure 4: Development CPI vs House prices in the Netherlands, 2006=100

As one can see the house prices and the consumer price indices follow a similar upward trend. During the financial crisis the trend for housing prices started to decrease and follow a different path than the CPI. This resulted in a loss for the consumer[2].

Consequence for cross over risk:
When housing prices decrease the cross-over point is reached earlier in time.

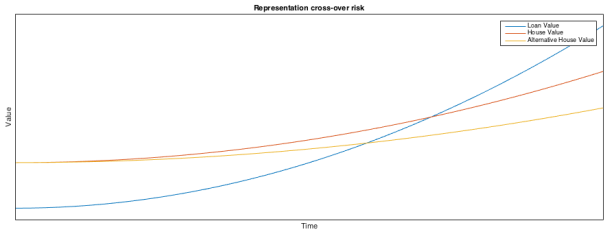

Figure 5: Cross-over Risk when house prices decrease

Housing price risk is a major risk for the Dutch mortgage market. Currently 30% of all Dutch houses are "under water", meaning that the mortgage value exceeds the actual house value[3]. This is not only due to the declining house values but also due to the mortgages contracts which were offered. In the early 2000's it became popular to take an interest only mortgage on your house. This implies that only the added value can be used to provide equity since the base house value will not be part of the capital of the consumer. Since 2014, these interest only mortgages are no longer available on the Dutch market.

3.1.3 Longevity Risk

Longevity risks is the risk of outliving your assets. The average lifetime of an individual in a Western country has increased steadily over the last decades. This has a strong effect on the pension and insurance market since the present value of the liabilities increases [De Waegenaere et al., 2009]. Especially when taking out a tenure contract in a reverse mortgage product the longevity risk also needs to be taken into account. When people live longer the payout phase increases and this implies that the provider has to make more payments to the consumer than expected. This increases the

[2]CBS, Statline
[3]DNB 2014

costs for the provider. On the contrary this also implies that for both lump sum and tenure contracts the loan value will accumulate longer. If the cross-over point was not reached yet this benefits the provider. However if the cross-over point was already reached this also implies extra costs for the provider.

3.1.4 Interest Rate Risk

When the interest rate increased the value of the loan balance increases since the interest accumulates faster than expected. This may result in a cross-over point which is closer by in the future than anticipated [Brueckner and Lee, 2014].

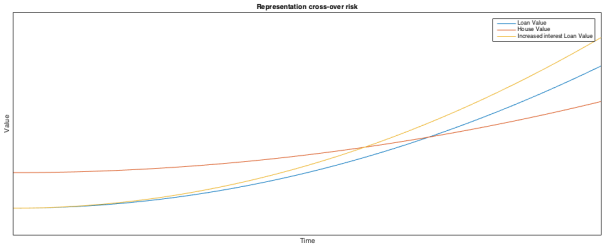

Figure 6: Cross-Over Risk with an increased interest rate

3.2 Home Reversion Risks

3.2.1 Housing Prices

Home reversion products face different risks compared to reverse mortgage products. For the provider the main risk is the risk that the house will decrease in value. The provider is entitled to part of the profit made on the house when it is sold. When the house decreases in value the profit for the provider will also become less.

3.2.2 Longevity Risk

In a home reversion contract the provider does not have to make any payments to the consumer. When the couple lives longer in the property than expected this implies that the provider will receive more rent payments. The house will be sold at a later date which could both be favorable and unfavorable since the house value could have increased or decreased.

3.3 Other Risks

3.3.1 Adverse Selection and Moral Hazard

Equity release products are not taken out as much because of the combination of high costs and the fear of moral hazard and adverse selection. Adverse selection arises if consumers are expecting an unusually long life, low mobility or low rates of appreciation enter into reverse mortgages at a rate disproportionate to the population average [Davidoff and Welke, 2005]. The provider will then have to pay a larger amount than expected for the reverse mortgage. This reflects on the other participants of a reverse mortgage contract who now have to pay more.
For both reverse mortgage contracts and home reversion contracts it holds that the provider benefits if the house value increases. Moral hazard can occur when the original owners fail to properly

maintain their property which causes the house value to decrease [Davidoff and Welke, 2005].
It has actually been shown in the US that the market is advantageous rather than adverse[Meza and Webb, 2001]. A reverse mortgage is intended to let you live longer in your own house. Davidoff and Welke [2005] compared mobility rates between reverse mortgage borrowers and regular borrowers. They concluded that reverse mortgage borrowers are more likely to sell their property early and repay the debt before they die or move into long term care. In the numerical illustration in chapter 7 it is shown why this might be the case.

3.3.2 Regulatory Risk

The government has a large influence on the popularity of the equity release market. In countries where reverse mortgages are widely available it has been seen that the government or another governmental institution provides a no negative equity guarantee. When the government (or the institution that provides this insurance) changes their regulation this can have a large influence on the security of these products.

Changes in the tax regime is another aspect which can influence the decision of a consumer to take out an equity release product. For regular mortgages there are tax advantages in place for home owners which stimulates buying of property instead of renting. For equity releasing products also tax rules apply. If the government was supposed to change these tax rules the products can become more/ less attractive [Nederlandse Vereniging van Banken, 2014].

3.4 Market Barriers

One of the main drivers in the willingness to undertake a reverse mortgage is the way people look at reverse mortgages. In Italy it has been shown that people tend to see reverse mortgages as a "last resort" option [Fornero et al., 2011]. Homeowners in Italy tend to see a reverse mortgage as personal debt which leads to aversion against the product. Another finding was that in Italy elderly home owners do not seem to be very concerned about their standard of living since they highly rely on family. Home reversion is especially not popular in Italy because it limits the possibility for the heirs to fully inherit the property.

3.4.1 Financial illiteracy

One can argue that reverse mortgages are appealing products for the elderly. However these products are still not taken out a lot. One of the reasons why reverse mortgages are not used as much is financial illiteracy [Reed, 2009], [Davidoff et al., 2014]. Financial illiteracy implies that people do not have the appropriate financial knowledge to understand the products and conditions. Reverse mortgages are considered complex products containing uncertain economic and demographic variables which are hard to explain.

The market for home reversion products is even smaller than the reverse mortgage market. The population is even less aware of the existence of home reversion products. Next to this it also holds for home reversion that the product is complex and therefore not straightforward to fully understand.

In an investigation by the US Consumer Financial Protection Bureau it was concluded that some homeowners are not aware that reverse mortgages are loans. They did not understand why interest had to be paid or other extra fees applied. This contributes to the fact that older homeowners are not well aware of the reverse mortgage product [Bureau, 2015].

3.4.2 Costs

Most countries or institutions which provide equity release products have a so called"no negative equity guarantee". This implies that the consumer, or his heirs, will never be left with debt. In order for the NNEG to hold, many additional insurances need to be taken out to diversify the previously discussed risks. However, this makes the product expensive and therefore also less attractive [Reed, 2009].

Marketing costs for equity release products are large because of the apparent hesitance of potential consumers. After the financial crisis it was harder to sell complex financial products which are related to the housing market. Because of this many providers in the US left the market [Dillingh et al., 2015]. In the Dutch market some providers of reverse mortgages have dropped out after the financial crisis because of too many uncertain risks.

3.4.3 Uncertainty

Especially in the Netherlands people do not prefer moving when they get older. A few reverse mortgage plans have restrictions that in case the value of your house becomes less the house will be sold. Uncertainty is perceived as negative and therefore a reverse mortgage product under these conditions might not be favorable [Rouwendal, 2009].

3.4.4 Trust in the financial market

Due to the financial crisis the trust in the financial market has decreased. The concept of reverse mortgages has been discussed by the media and has gained some negative attention (TrosRadar,"De Opeethypotheek"). Before the financial crisis there were a few providers in the Netherlands for reverse mortgages. Most of them have shut down their practice due to uncertain fluctuating markets. They were no longer able to price reasonably without facing a lot of risk. If the government would step in as a regulating officer this could potentially increase the reverse mortgage market in the Netherlands. A pure home reversion market is non existing in the Netherlands at this moment. There are however a few providers who offer variations of home reversion products. These are discussed later in this thesis.

3.4.5 Cultural constraints

In some countries a house is still seen as something which is passed on from generation to generation. Therefore selling part of the house and thus the inheritance is not perceived favorably. Due to the high unemployment rate among the younger generation, parents sometimes also keep supporting their children at a higher age. Especially in the southern European countries these are still very important cultural aspects [Fornero et al., 2011]. Supporting your children might be a good reason to take out an equity release product. But for southern European countries this does not live up to the same demand as inheriting the property.

Nowadays children are less reluctant when it comes to equity releasing product in order for their parents to support themselves [Towers Watson, 2013]. One can therefore argue that cultural constraints against equity release products will diminish partly within the next generations.

3.4.6 Regulatory issues

Solvency II and other legal barriers are problems which companies who offer equity releasing products face. For example in some countries only banks are allowed to sell these products which limits the private insurance market. Solvency II gives such strict regulations that many insurance companies are not entering the market. A limited number of providers is a barrier to the evolution of the equity releasing market [Towers Watson, 2013].

3.4.7 Financing

Banks and Insurers need to have sufficient funds to finance these products. When offering equity release products long term investment will have to be made. After and during the financial crisis this became especially difficult [Towers Watson, 2013].

3.4.8 Necessity in the Netherlands

In countries such as the United States equity releasing products are needed to cover high health costs or other unexpected costs. In the Netherlands however these unexpected costs during the retirement phase occur less. Generally Dutch households do not depend on such products since they have enough pension savings and social security so they can afford to still live in their house and pay the housing costs such as interest and installments [Nederlandse Vereniging van Banken, 2014].

4 Existing Reverse Mortgage products

In a few countries reverse mortgage products already widely exist. This section will provide an overview of these countries, the offered products and the conditions.

4.1 United States

Data shows that in 2014 a total of 49.194 reverse mortgages are taken out by elderly in the United States[4] with a total value of $6.3 billion. In total 2%-3% of the total amount of eligible people take out a reverse mortgage. The most commonly used reversed mortgage program is the Home Equity Conversion Mortgage (HECM). These mortgages are subject to the Financial Housing Administration limits and an eligibility age of 62.

In the United States distinction can be made between 3 types of reverse mortgage products.

- Single-purpose reverse mortgages. Such mortgages are offered by the state, the local government or non-profit organizations.
- Federally-insured reverse mortgages. The HECM products, Home Equity Conversion Mortgage, are backed by the HUD, US Department of Housing and Urban Development.
- Proprietary reverse mortgages. These mortgages are private loans backed by companies.

Single-purpose reverse mortgages can only be used for one purpose such as a repair to your house or paying property tax. These loans are usually taken out by people with low er moderate incomes.

Federally-insured reverse mortgages such as the HECM are widely available in the US Market. These mortgages usually come with high costs and are only favorable if you are planning to stay living in your home for a reasonable amount of time. [Federal Trade Commission, 2011]

HECM

The home equity conversion mortgage is the most used reverse mortgage in the US (90%) [Gotman, 2011]. This mortgage has a so called NNEG, no negative equity guarantee, which implies that if the house is sold within 12 months for the market price no debt will be left. This is even the case when the total loan value is larger than the total property value. The total loan value consists of the initial loan, part of the mortgage that is still outstanding, plus the accumulated interest plus insurance costs and other outstanding fees.

4.2 United Kingdom

The first home reversion product was sold in 1965 in the UK. This earlier version of the product was poorly designed and barely sold. In 1991 the SHIP (Safe Home Income Plan) was established. Nowadays called the Equity Release Council. This institution provides a similar guarantee as the no negative equity guarantee in the US.

In the UK both home reversion and reverse mortgage products are offered. The latter has a market share of 99% [5]. The total number of equity releasing product in the UK sold is 20.000 in 2012. The projected mean of the volume is expected to increase thereafter. [Towers Watson, 2013]

[4] `https://www.reversemortgages.com/statistics`
[5] Equity Release Council, 2012

4.3 Australia

Equity releasing products such as reverse mortgages and home reversion have been growing in popularity over the last couple of years. On December 31, 2013 over 40.000 reverse mortgages loans were issued in Australia with an average loan size of 86.000 dollar [Deloitte, 2014]. Out of the settlements in 2013, 94% were lump sum and only 6% income stream contracts which is in line with previous years. The proceeds are mainly used for three categories; home improvement (1/7), debt repayment (1/3) and extra income (1/2). The rest uses reverse mortgages for activities such as traveling.

The Senior Australian Equity Release Association, SEQUAL, has created a strict code of conduct which forces reverse mortgage providers to offer a no negative equity guarantee. Unlike the US market the provider thus has to offer the no negative equity guarantee.

The home reversion market is still very small in Australia. Just as in the UK there is less knowledge about these products and reverse mortgages have been more popular. Homesafe Solutions Pty Ltd offers home reversion products, Homesafe wealth release, since 2005. The product is only offered in Sydney and Melbourne.

4.4 Italy

The reverse mortgage market in Italy is almost non existing. In the paper by Fornero et al., it is concluded that only for three reasons reverse mortgages can be appealing.

- Homeowners who are prepared to sell are more likely to be interested in reverse mortgages.
- Respondents perceive reverse mortgages as debt. Debt aversion predicts low interest rates.
- Homeowners who are concerned about their well being after retirement are more likely to be interested in reverse mortgages.

In Italy people see a reverse mortgage as a last resort. A high bequest motive and reliance of their family is especially present in these countries. This all contradicts the reasons given above which indicate when someone would favor a reverse mortgage.

4.5 The Netherlands

The Dutch mortgage market is not as established in equity release products as the other mentioned countries. There are however a few equity release products available and these will be discussed below.

4.5.1 Sell and rent back

The sell and rent back construction implies that the home owner sells the house to a commercial provider and rents the house back from this provider. There currently are two of these providers in the Dutch market; Verzilvermijvast and Zilver Wonen Fonds. Both are explained in detail below.

Verzilvermijvast

Verzilvermijvast is an initiative set up by a group of financial professionals who created reverse mortgage products in the Dutch market.[6] They have contracts with local financial advisory pro-

[6] http://www.verzilvermijvast.nl

fessionals which in their way can advise their clients about the "verzilvermijvast" products. The product looks as follows:

At first the house needs to be valued. After this valuation 50% of the value will be paid out as a lump-sum, the first payment. The consumer will now start paying rent to Verzilvermijvast, the rent is equal to 6% the value of the house on an annual basis. When the consumer moves out or dies the second payment takes place. This payment is equal to 50% of the remaining difference between the house value at that point in time and the first payment. If an increase or decrease in house value occurs over the time span 50% of these profits/losses will be for Verzilvermijvast. The minimum age for taking out this product is 55 years, the property value must be between €150.000 and €400.000 and no mortgage must be left on the property.

Zilver Wonen Fonds

Another equity release product has been brought to the market in August 2015, Zilver Wonen Fonds. The product offers a sell and rent back construction. First the property will be sold for 80% of the current market value to Zilver Wonen Fonds. The original owners will start paying rent to stay living in the house. The rent is equal to 5,5% of the market value of the property on an annual basis. When the original home owners move out of the property it will be sold to the market. Therefore another 1,5% of the current market value needs to be paid to the provider. The requirements for the product are a minimum age of 65 and a property located in the Randstad area.

4.5.2 Using your home as collateral for a credit mortgage

This mortgage is offered by the Rabobank and is similar to applying for revolving credit. The house is used as collateral and therefore the interest rate is much lower.

Rabobank KeuzePlus Hypotheek

The"Rabobank KeuzePlus Hypotheek" (extra choices mortgage) is a mortgage where the additional value of your house can be used to subsidize large expenses. There is no age requirement, the interest rate is fixed and you are not protected against a negative equity value. This mortgage therefore lacks the important characteristic of the no negative equity guarantee and will not be considered a"pure reverse mortgage".

4.5.3 Reverse Mortgage

Florius is currently the only provider who offers a reverse mortgage product in the Dutch market.

Florius Verzilver Hypotheek

The"Florius Verzilver Hypotheek" is a reverse mortgage which can be undertaken on the additional value on your house. The following requirements apply; you need to be 60+ years of age, the amount depends on your age and the value of your house, you are allowed to borrow up to 55% of the additional value, you are protected against negative equity, you are allowed to stay living in your home and they offer a fixed interest rate.

At first this reverse mortgage product seems secure and of low risk, but when reading the fine print this is not the case. Within 12 months after the borrower deceases the loan needs to be paid

back by the heirs. One can image that in a highly fluctuating market with uncertain housing prices it is not guaranteed that the house can be sold against the market price set by Florius at that time. Florius provides a so called guarantee that the heirs will not be left with debt. This only holds in case the house is sold at a price equal or above the market price. In case the house is sold at a lower price than the market price the heirs are left with a debt equal to the difference between the market value and the selling price of the house.

5 The model

The next section will discuss the parameters for the model, the model itself and describes the approach of finding the stochastic discount factors.

5.1 Parameters

5.1.1 Mortality

In order to quantify the longevity risk, first the mortality changes need to be discussed. The Royal Actuarial Association has established the AG2014 mortality model. This model shows the mortality rates per individual for both males and females[7].

An equity release contract is terminated when either the home occupant dies or moves out. The probability of dying is derived from the AG2014 model. One can argue that the occupant would only move out of the property in case he needs to be admitted to long term care. Equity release products are designed solely for persons who do not want to move out of their home.

On the contrary it has been found by Davidoff and Welke [2004] that in the United States consumers who take out equity release products on their property tend to sell their house quicker than people who do not have an equity release product. Since there is no data available for the Netherlands it is assumed that the product is taken out only when people have the intention to stay in their house and thus do not move out because of other incentives (which apply in the US). The only two factors considered why people leave their property are decease and moving into long term care.

The next graph shows the percentage of elderly in long term care per age group for the Netherlands.[8]

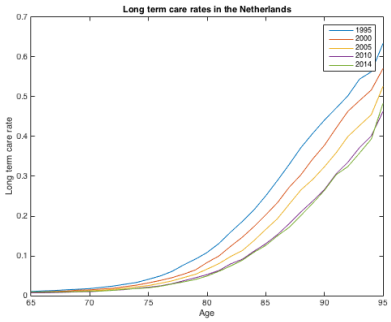

Figure 7: Ratio of people into long term care for the Netherlands

The graph shows that the probability that people turn into long term care is significant to incorporate in the termination risk of the contract. Therefore the mortality rates should be adjusted in order to combine both chance of decease and chance of moving out. The chance of moving out is set equal to the chance of getting into long term care. These rates can be found in table 31. The appendix contains detailed information how these rates are obtained.

The mortality rates are denoted by q_x where x denotes the current age. The probability of moving

[7] `www.ag-ai.nl`
[8] CBS Statline

into long term care in the upcoming year is given by ${}_1LTC_x$. This implies that the probability of being alive and not having to move into long term care in t years can be expressed in the following way:

$$ {}_tp_x^* = (1 -_t q_x)(1 -_t LTC_x) \tag{1} $$

With one year probabilities denoted by ${}_1p_x^* = p_x^*$, implying that the one year probability of staying at the property is:

$$ p_x^* = (1 - q_x)(1 - LTC_x) \tag{2} $$

Since most of the households are couples who take out a home equity release products, couples will be considered when simulating the amounts at risk [Deloitte, 2014]. The asterisk probabilities include the long term care probabilities. This alters the probability of not leaving the property into:

$$ {}_tp_{x:y}^* = 1 -_t q_x^* \times_t q_y^* \tag{3} $$

5.1.2 Mortgage rates

The actual mortgage rate that needs to be paid depends on the contract of the consumer. Generally one can choose from a variable mortgage rate up to a fixed mortgage rate for 30 years. When a variable or short period mortgage rate is chosen this rate usually follows the Euribor interest rate (for countries outside Europe this is usually the LIBOR) plus a fixed addition. The mortgage rate therefore roughly follows the same pattern as the 3 month Euribor. It can therefore be argued that mortgage rates do not have to be included in the vector autoregressive (VAR) model which will be determined in this section.[9]

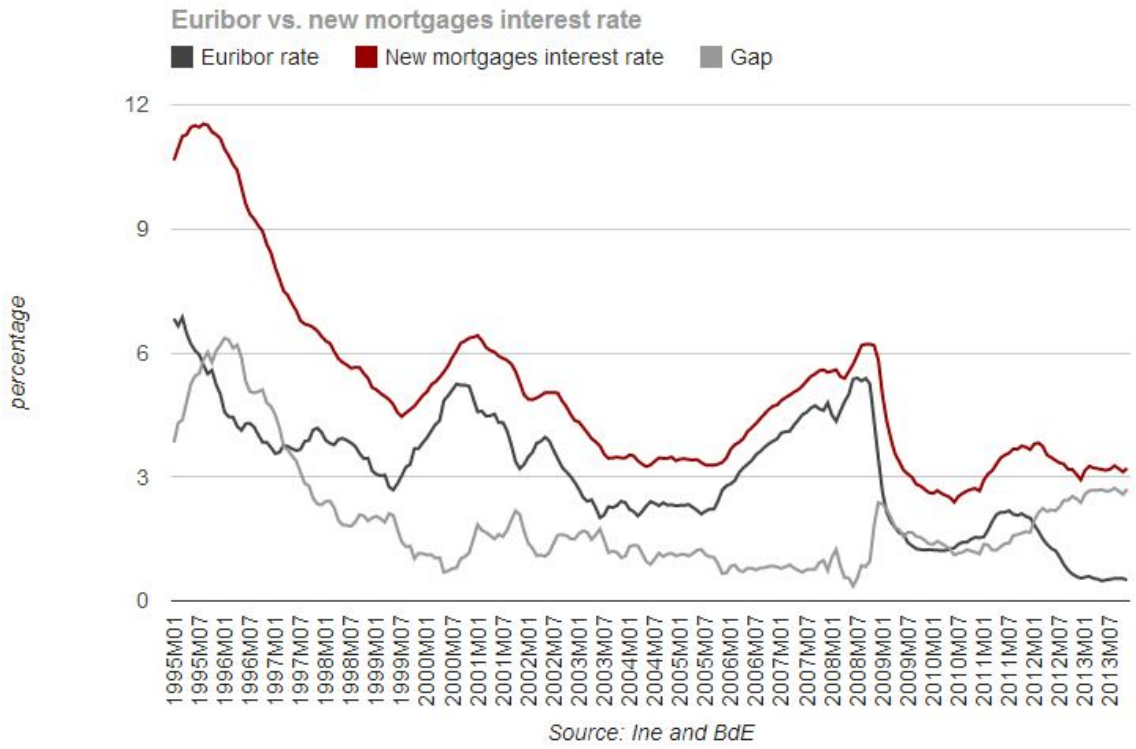

Figure 8: The Euribor and Mortgage rates over time

[9] `nl.euribor-rates.eu/hypotheek-en-euribor.asp`

5.2 Model variables

Besides mortality also other variables need to be taken into account.
The table below gives an overview of the variables, their frequency, adjusted frequency and the source. The variables are adjusted such that all have the same frequency and time interval. The CPI, GDP and HPI are adjusted to index numbers with 2010 as base (2010=100). The sources are the Dutch Central Bank (DNB) and the CBS statline.

Variable	Definition	Frequency	Adjusted Frequency	Period	Source
$r^{(1)}$	3-month Euribor rates	Daily	Quarterly	31-12-1998 - 24-07-2015	DNB
$r^{(10)}$	10-year zero coupon bond rate	Daily	Quarterly	01-01-1990 - 24-07-2015	DNB
H	House price index	Quarterly	Quarterly	1995 Q1 - 2015 Q1	CBS
G	Nominal GDP the Netherlands	Quarterly	Quarterly	1996 Q1 - 2015 Q1	CBS
C	Consumer Price Index the Netherlands	Quarterly	Quarterly	1996 Q1 - 2015 Q1	CBS

Table 1: Overview of the variables

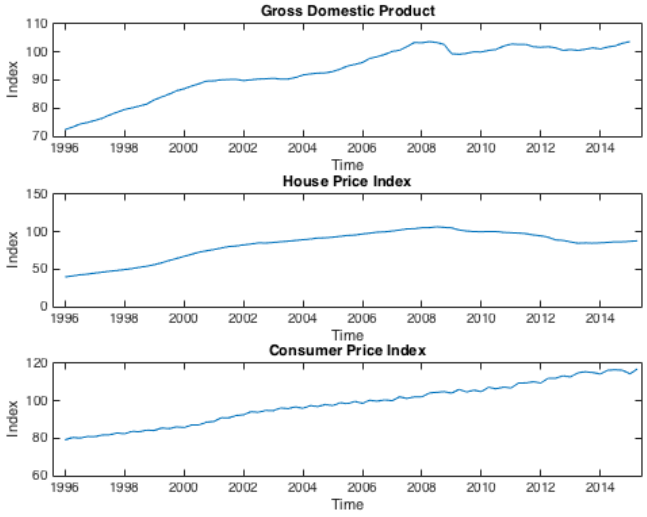

Figure 9: The plotted raw data with indices values

The variables for house prices, gross domestic product and consumer price index are all indices. The indices are transformed into continuously compounding growth rates on a quarterly basis. This is done by taking the differences of the log indices.

$$HPI_t = log(H_t) - log(H_{t-1}) \tag{4}$$

$$GDP_t = log(G_t) - log(G_{t-1}) \tag{5}$$

$$CPI_t = log(C_t) - log(C_{t-1}) \tag{6}$$

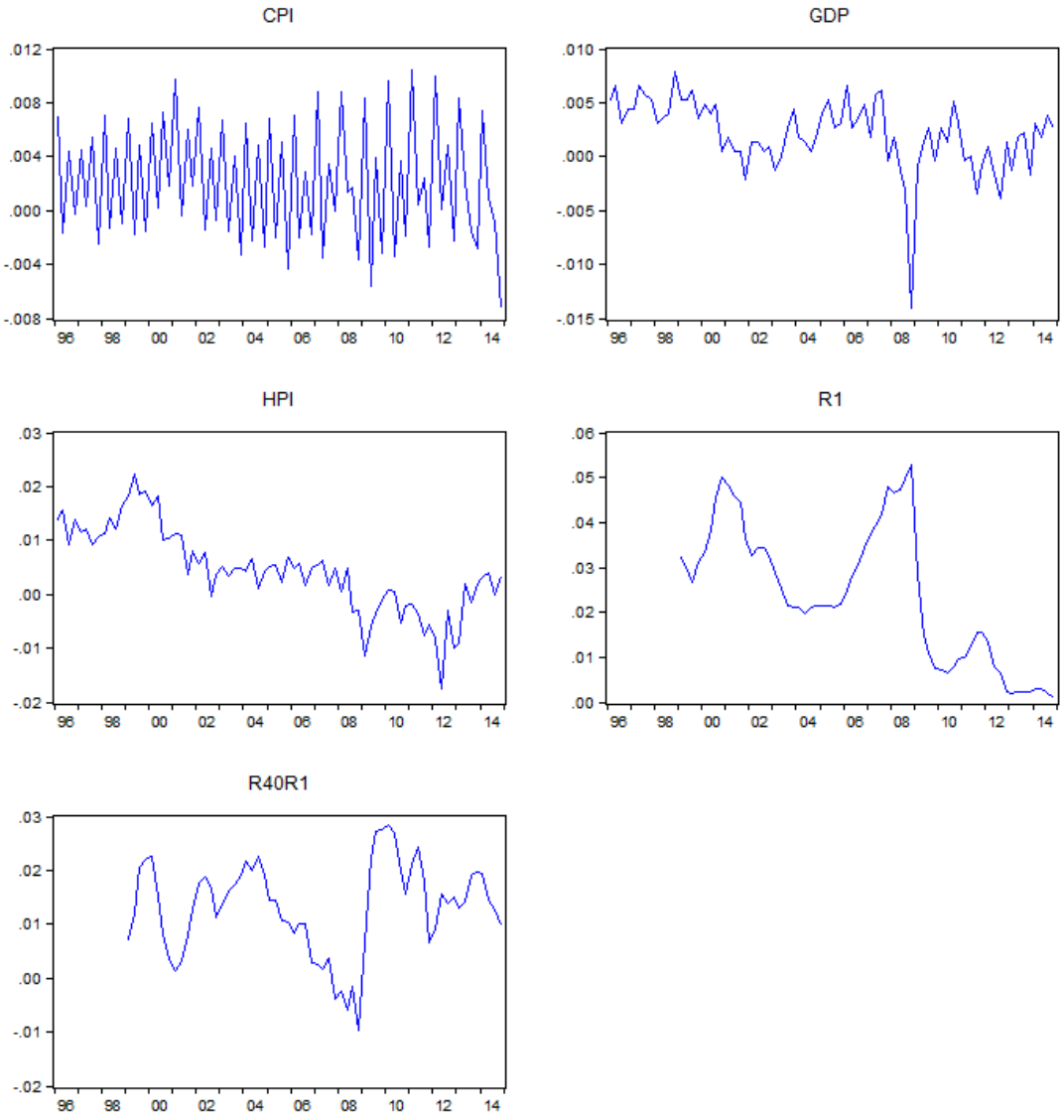

Figure 10: The plotted variables

5.3 Vector Autoregressive Model (VAR Model)

Following the approach of [Shao et al., 2015], [Alai et al., 2014] and [Werner-Huibers, 2013] a vector autoregressive model is created to capture the dynamics of the variables.
A VAR(p) process generally looks as follows, where z_t is the dependent variable.

$$z_t = c + \phi_1 z_{t-1} + \phi_2 z_{t-2} + ... + \phi_p z_{t-p} + \epsilon_t \qquad \epsilon_t \ i.i.d. N(0, \Sigma) \qquad E(\epsilon_t) = 0 \tag{7}$$

$$E(\epsilon_t \epsilon_\tau') = \begin{cases} \Sigma & \text{for t} = \tau \\ 0 & \text{otherwise} \end{cases}$$

Where $\Sigma = (n \times n)$ is a symmetric positive definite matrix. [Hamilton, 1994]
The VAR(p) will from now on be written as

$$z_t = c + \phi_1 z_{t-1} + \phi_2 z_{t-2} + ... + \phi_p z_{t-p} + \Sigma^{\frac{1}{2}} \epsilon_t \qquad \epsilon_t \ i.i.d. N(0, 1) \tag{8}$$

According to Zivot and Wang [2006] the vector autoregressive model is very useful when describing the dynamic behavior of economic and financial time series and while performing forecasts of these variables.

Lag Selection

When using a VAR model the optimal lag length has to be chosen. Multiple tests can be performed in order to choose this optimal length. The table below shows an overview of a selection of tests with their results.

AIC = Akaike information criterion
SC / BIC = Schwarz information criterion / Bayesion information criterion
HQ = Hannan - Quinn information criterion

Lag	AIC	SC / BIC	HQ
0	-37,38846	-37,2124	-37,31973
1	-42,66245	**-41,60607***	-42,25008
2	-43,33871	-41,40202	-42,5827
3	-43,39337	-40,57637	-42,29373
4	-44,04324	-40,34593	**-42,59996***
5	**-44,16286***	-39,58523	-42,37594

Table 2: Lag selection

The asterisk (*) indicates the optimal lag length for each test. The optimal lag selection is given by the lowest value. It depends on the test whether a lag length of 1, 4 or 5 needs to be chosen. It differs per criterion what kind of penalty is applied for adding parameters. [Brandt and Williams, 2012]
In the paper by Medel and Salgado [2013] it is explained that BIC is a dominant criterion over AIC when modeling stationary auto regressive processes. Therefore only two vector auto regressive models will be considered, VAR(1) and VAR(4).

VAR(1) Model

$$z_t = c + \phi z_{t-1} + \Sigma^{\frac{1}{2}} \epsilon_t \tag{9}$$

with ϵ_t standard normally distributed $N(0, 1)$.

Where z_t is equal to: $z_t = \begin{pmatrix} CPI \\ GDP \\ HPI \\ r^{(1)} \\ r^{(40)} - r^{(1)} \end{pmatrix}$

The VAR(1) model is calculated using EViews. The output for the model is shown below. The brackets denote the standard deviation. In the appendix the covariance and correlation matrix are given.

	c(5 × 1)			$\phi(5 \times 5)$		
CPI	0,00246	-0,66495	-0,19959	0,06138	0,04629	0,00132
	(0,00206)	(0,10034)	(0,16778)	(0,08342)	(0,05147)	(0,07760)
GDP	0,00366	-0,04160	0,16308	0,25657	-0,10378	-0,04544
	(0,00150)	(0,07336)	(0,12267)	(0,06099)	(0,03763)	(0,05673)
HPI	-0,00365	0,22884	0,51080	0,64347	0,07056	0,11294
	(0,00232)	(0,11314)	(0,18919)	(0,09406)	(0,05804)	(0,08750)
$r^{(1)}$	-0,00322	-0,03234	0,91244	-0,01073	1,01974	0,07445
	(0,00208)	(0,10164)	(0,16996)	(0,08450)	(0,05214)	(0,07861)
$r^{(40)} - r^{(1)}$	0,00688	0,02452	-0,61596	0,20860	-0,12758	0,73501
	(0,00279)	(0,13625)	(0,22783)	(0,11327)	(0,06989)	(0,10537)

Table 3: Output VAR(1) Model

As described for instance by Hamilton [1994] a vector autoregressive model is stationary when all eigenvalues of ϕ lie inside the unit circle. This is called covariance stationary. It must thus hold that $|\lambda| < 1$. The table below shows the modulus for the VAR(1) model as well as the results of the Augmented Dickey fuller test and the Philips Perron test. These tests can be used to test if there is a unit root and thus if the process is stationary or not. All modulus values are smaller than one implying that no roots lie outside the unit circle and the VAR model satisfies the stability conditions. The ADF and PP p-values reject the null hypothesis of presence of a unit root, concluding that there is no unit root and thus the process is stationary.

Modulus	ADF (p-value)	PP (p-value)
0,893375	0,0004	0,0000
0,893375		
0,767958		
0,701864		
0,049409		

Table 4: VAR(1) tests

VAR(4) Model

$$z_t = c + \phi_1 z_{t-1} + \phi_2 z_{t-2} + \phi_3 z_{t-3} + \phi_4 z_{t-4} + \Sigma^{\frac{1}{2}} \epsilon_t \tag{10}$$

Where z_t is equal to: $z_t = \begin{pmatrix} CPI \\ GDP \\ HPI \\ r^{(1)} \\ r^{(40)} - r^{(1)} \end{pmatrix}$

Comparison VAR(1) and VAR(4)

A VAR(1) model is defined in a much easier way than a VAR(4) model. Brandt and Williams [2012] state that a model with fewer lags should be preferred since the difference in the fit of the model might not be large enough to overcome the extra costs of expanding the model. Thus the VAR(1) will be used in this thesis.

Limitations

The used VAR(1) model is used in combination with at least 64 quarters of data for all variables. The historical data is the input for the model and has a large impact on the correctness of the model. The house prices index showed a steady increase until the financial crisis. During and after the crisis the house prices dropped and this disturbed the trend of increasing house prices. Two other variables that need an extra remark are the interest rates. The long term interest rate has declined from almost 6% in 1996 to 0,3% in 2015[10]. The short term interest rate also shows a very high volatility and is currently almost equal to zero. Interest rates and house price development are the two most important factors in the later used analysis of the products.

5.4 Stochastic Discount Factors

To correctly price the assets, stochastic discount factors need to be created in order to develop a pricing kernel. The approach of Alai et al. [2014], Werner-Huibers [2013] Hoevenaars [2008] and Shao et al. [2015]. Shao et al. [2012] is used to develop this pricing kernel which can be used to price the nominal assets. The market prices of risk depending on time are denoted by λ_t and need to be estimated to derive the appropriate discount factors.

The approach of Hoevenaars [2008] is used to relate the pricing kernel to the assumed state variables in the vector autoregressive model. Hoevenaars uses the approach by Ang et al. [2006] to relate the pricing kernel to the state variables in order to develop the affine term structure model under the no-arbitrage assumption.

The stochastic discount factor M_{t+1} is:

$$M_{t+1} = \exp(-\delta_0 - \delta_1 z_t - \frac{1}{2}\lambda_t^{'}\Sigma\lambda_t - \Sigma^{\frac{1}{2}}\lambda_t^{'}\epsilon_{t+1}) \tag{11}$$

with ϵ_{t+1} standard normal distributed $N(0,1)$.

In the VAR(1) model the short rate is included. This is reflected by $-\delta_0 - \delta_1 z_t$ in the stochastic discount factor. $-\frac{1}{2}\lambda_t^{'}\Sigma\lambda_t - \Sigma^{\frac{1}{2}}\lambda_t^{'}\epsilon_{t+1}$ relates the shocks in the state variables to the pricing kernel.

The market prices of risk are captured by the variable λ_t and look as follows:

$$\lambda_t = \lambda_0 + \lambda_1 z_t \tag{12}$$

λ_1 is a (5×5) matrix which captures the time-variation in the risk premia. Note that negative values in this matrix do not imply that the market price of risk is negative.

The formula has a practical implication which states that when the values of innovations are high a positive λ_t (market price of risk) leads to low values for the according stochastic discount factor.

According to Cochrane [2001] the price of an asset is equal to $P_t = E_t(M_{t+1}X_{t+1})$ where M_{t+1} is the stochastic discount factor and X_{t+1} is the payoff of the asset. For an n-period nominal bond the price looks as follows:

$$P_t^{(n)} = \ln E_t(M_{t+1}P_{t+1}^{(n-1)}) \tag{13}$$

[10] DNB

With $P_t^{(0)} = 1$. For a one quarterly bond rate this implies that $P_t^{(1)} = \ln E(M_{t+1} \cdot 1) = -\delta_0 - \delta_1 z_t$. In order for the short rate $r^{(1)}$ and the VAR(1) model to match it should hold that $\delta_0 = 0$ and $\delta_1 = (0, 0, 0, 1, 0)$ and thus $z_t^{(1)} = -\delta_0 - \delta_1 z_t = r^{(1)}$

Following the approach of Shao et al. [2012] it is assumed that the zero-coupon bond prices are exponential linear functions of the lagged state variables using the time span of 3 months per period:

$$P_t^n = \exp[A_n + B_n' z_t] \tag{14}$$

The parameters A_n and B_n can be solved using the following difference equations:

$$A_n = -\delta_0 + A_{n-1} + B_{n-1}'(c - \Sigma^{\frac{1}{2}}\lambda_0) + \frac{1}{2} B_{n-1}' \Sigma B_{n-1} \tag{15}$$

$$B_n = -\delta_1 + (\phi - \Sigma^{\frac{1}{2}}\lambda_1)' B_{n-1} \tag{16}$$

The initial values for A_n and B_n are both 0.

Using the above created terms the quarterly estimated yield rates look as follows:

$$\hat{r}_t^{(n)} = \frac{-A_n + B_n z_t}{n} \tag{17}$$

To calculate the market price of risk the minimum of the sum of the squared differences of the estimated yield rates needs to be estimated

$$min_{\lambda_0, \lambda_1} \sum_{t=1}^{T} \sum_{n=1}^{N} (\hat{r}_t^{(n)} - r_t^{(n)})^2 \tag{18}$$

For N = 1, 4 and 40 (3 month euribor, 12 month euribor, 10 year zero coupon)

Using the approach described above, the market price of risk (λ_t) is determined. The next table provides an overview of the market price of risk parameters.

	$\Sigma^{\frac{1}{2}}\lambda_0(5 \times 1)$	$\Sigma^{\frac{1}{2}}\lambda_1(5 \times 5)$				
CPI	-0,008130	-0,001300	0,006349	-0,006720	0,002795	-5,7E-05
GDP	0,013091	-0,008370	0,038728	-0,043940	0,011402	0,004608
HPI	0,091776	0,003692	-0,028990	0,014086	-0,024970	0,002219
$r^{(1)}$	-0,008170	0,029176	-0,136450	0,152592	-0,046680	-0,013080
$r^{(40)} - r^{(1)}$	-0,078940	-0,015490	0,080443	-0,077160	0,034238	0,002906

Table 5: The Market Price of Risk

The historical stochastic discount factor can be determined using the known values for the variables. There are 1.000 paths for the future stochastic discount factor. One of the sample paths is presented below.

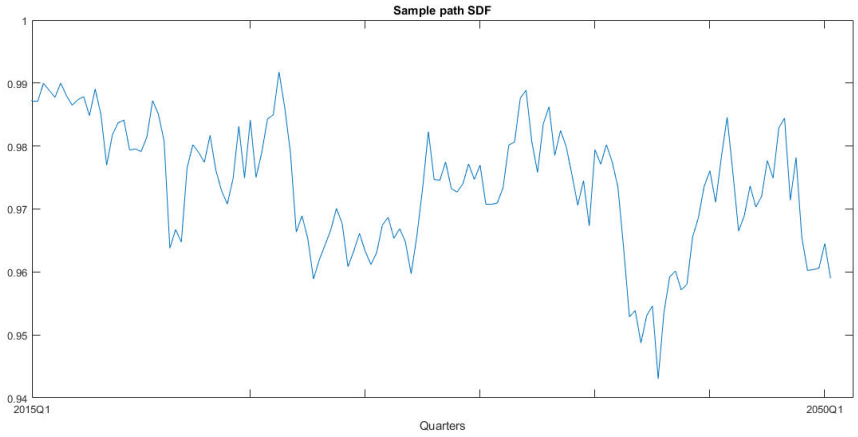

Figure 11: Stochastic Discount Factors

6 Forecasting

In order to create an estimate of the risk differences between the products we need to create a forecast into the future.

6.1 Forecasted variables

The next graphs show the average forecast for our base variables into the future. The variable average moves to a constant value towards the year 2025. After 2025 the mean of the distribution is, according to the VAR(1) model, expected to stay equal to the value in 2025.

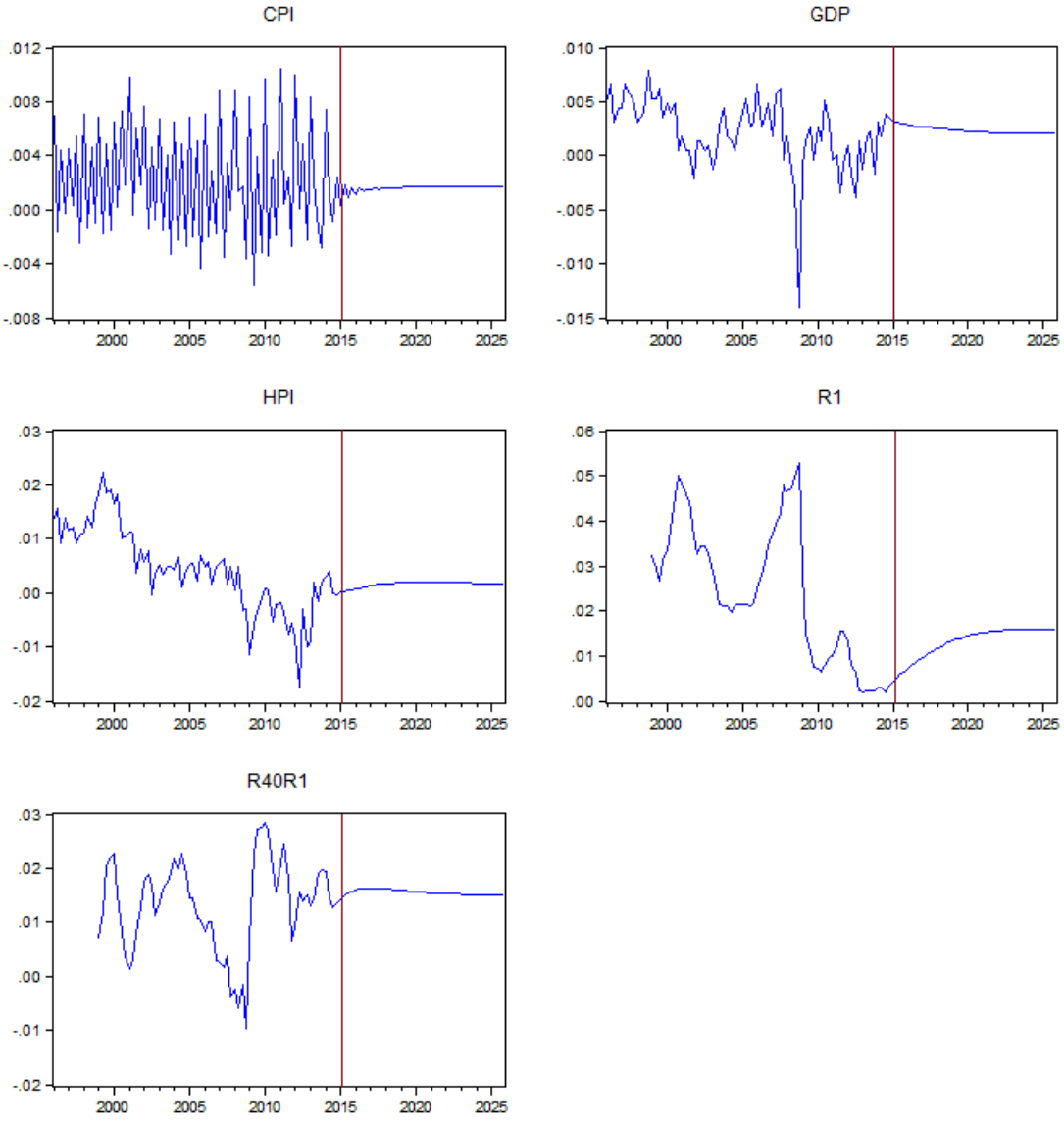

Figure 12: Forecasted variables

For this forecast a dynamic approach is chosen instead of static since a vector autoregressive model is used. In order to properly evaluate different scenarios for the development of the variables over time also a 2 standard deviation confidence interval is presented below.

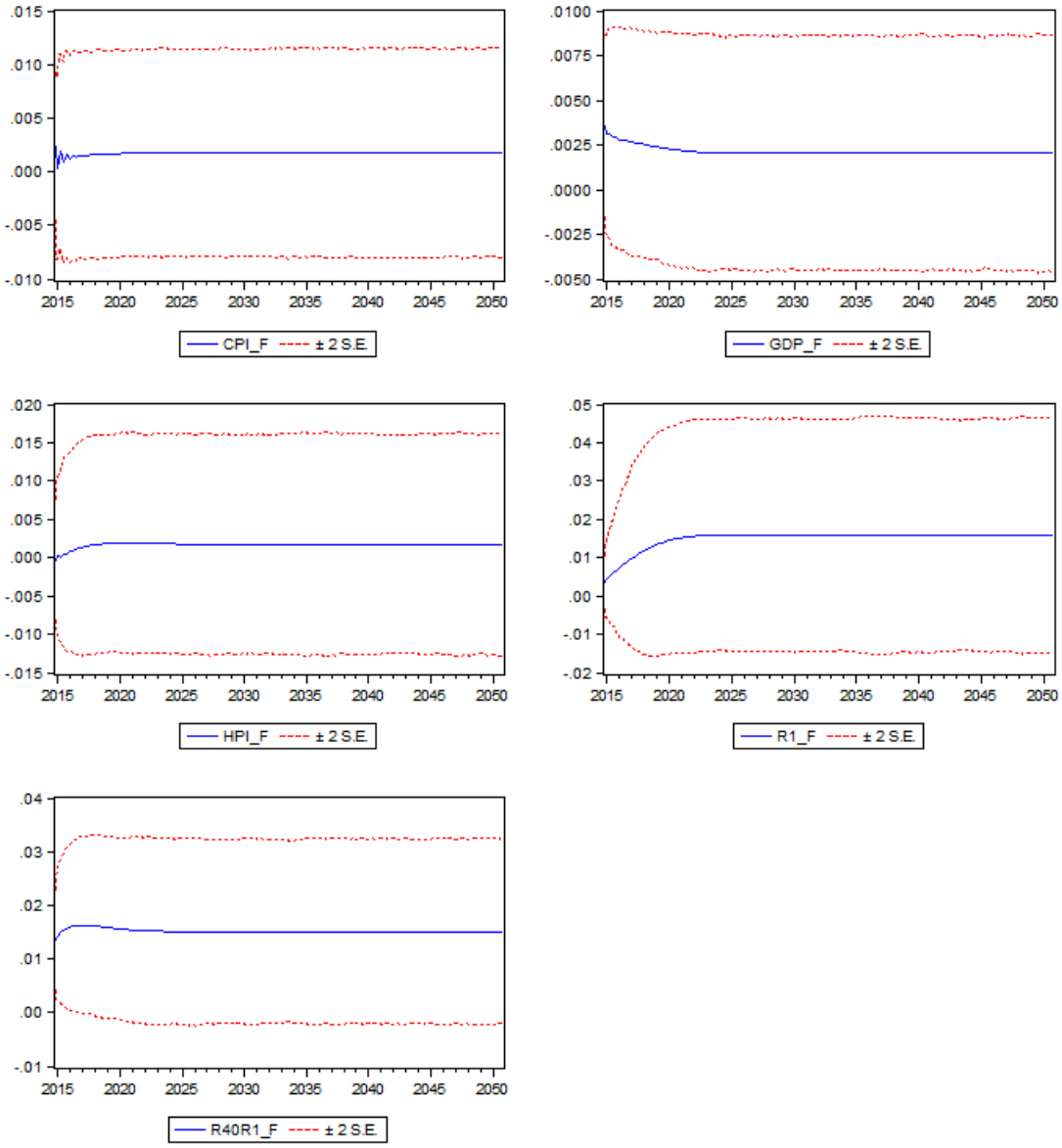

Figure 13: Forecasted variables including the confidence interval

6.2 Scenarios

The VAR(1) model is used to create 1.000 possible scenario paths for the interest rate and the house price development. The VAR(1) model was defined as follows:

$$z_t = c + \phi z_{t-1} + \Sigma^{\frac{1}{2}} \epsilon_t \tag{19}$$

With ϵ_t i.i.d N(0,1).

The disturbance term (ϵ_t) is used to create these paths. From the standard normal distribution 1.000 random matrices of size (5×140) are created because there are 140 quarters, 35 years. In the next section these paths will be used. The values found in the section are within the confidence interval shown in section 6.1.

7 Analysis

In order to access the differences between the equity release products that are discussed a fictional couple is created with an average house value and average expected mortality rates. This case will be called the base scenario. To make sure all possible scenarios are taken into account a set of 1.000 different scenarios will be simulated over the base scenario.

7.1 The Base Case Scenario

For the base case scenario an elderly couple in the Netherlands is assumed. The male being 68 years of age and the female 65 years. This implies that both are currently retired and eligible for equity release products. The initial house value is set equal to the average value for homeowner 65 years and over in 2012. This is equal to €257.600[11]. The value of the property and the value of the loan are projected on 1.000 different paths over a period of 35 years from the VAR(1) model. According to section 5.2 the mortgage rate is equal to the short term interest rate plus a fixed margin. This margin is assumed to be 2%. This rate is determined by looking at the current short term interest rate and the current variable mortgage rates in the Netherlands. For the base scenario no mortality improvements are assumed.

Loan to value ratio

The loan to value ratio is the percentage amount of the property that can be taken out as a reverse mortgage. The ratio strongly depends on the country of residence and the product that is chosen. In Australia a couple of age 65 has a LVR of approximately 20% [12] while in the United States this is 65% [13] for a reverse mortgage which pays a lump sum or line of credit. The difference in loan to value ratio is mostly due to the fact that in the United States the no negative equity guarantee is provided by the government and therefore the risk lies with the government and not with the provider, as is the case in Australia. The only reference the Dutch market has is the Florius Verzilverhypotheek, the above mentioned couple would be able to get a loan to value ratio of 16,4% at their current age. If they would take out a reverse mortgage 10 years later the loan to value ratio increases by approximately 10%. In 2013 Australia has implemented a new regulation regarding reverse mortgages. In the National Consumer Credit Protection Amendment Regulation 2013 (No.2) the maximum loan to value ratios have been increased to 25% for 65 year old and increasing with 1% with each year of age. Although this new regulation would give Australian providers the opportunity to offer higher loan to value ratios this is barely reflected in the currently offered products on the Australian market.

[11] Task Force Verzilveren, average home equity of elderly over 65 years
[12] `www.macquarie.com/au/personal/home-loans/reverse-mortgage`
[13] `www.reversemortgage.org`

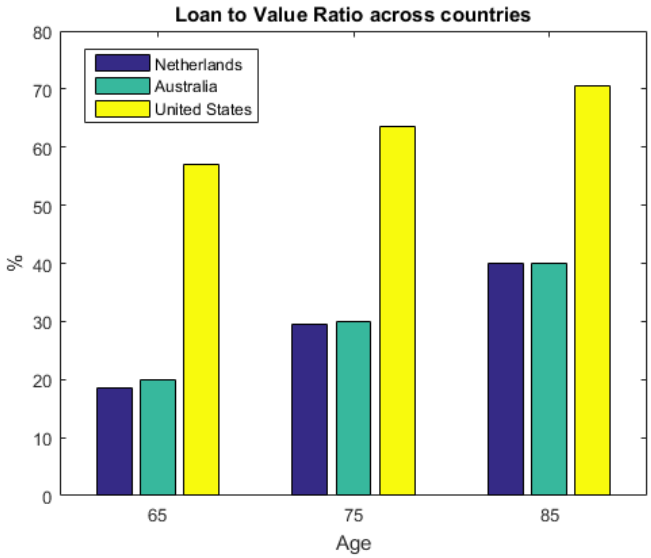

Figure 14: Loan to Value Ratio Across Countries

Mortgage rates

Just as in a regular mortgage the consumer can choose between a fixed mortgage rate or a variable mortgage rate when taking out a reverse mortgage. The mortgage rates are based on the short term interest rate plus a fixed margin. The fixed mortgage rates are usually higher than the variable mortgage rates, especially in the current economy where interest rates are really low. Looking at the average of mortgage rates offered in the Dutch market[14] the following mortgage rates can be assumed. However when looking at our only reference point, the Florius Verzilverhypotheek it is shown that their fixed rate is 1% higher than the average fixed mortgage rate [15].

Variable rates	Short term interest rate + 2%
Fixed rate	3,3%
Florius Verzilverhypotheek rate	4,3%

There are four components which determine the current mortgage rate; additions related to development capital markets and capital costs, individual risk additions, ongoing service fees, profit addition[16].

Mortgage rates and reverse mortgage rates are not equal. This is because the no negative equity guarantee is a risk for the provider and this risk needs to be paid through a premium by the consumer. In the Netherlands Florius asks for a premium of 1% on top of the fixed long term mortgage rate. In Australia there are mortgages with variable interest rates, the premium ranges from 3% to 4% [17]. In the United States there are also both contracts with fixed and variable interest rates. The current average fixed interest rate is 3,99% and the current variable interest rate is 2,7%. In the United States the no negative equity guarantee is provided by the government and therefore a one time premium between 0,5% and 2% needs to be paid [18].

[14] `www.independer.nl`
[15] `https://www.florius.nl/Pages/hypotheekvormen/verzilver-hypotheek.aspx`
[16] Webpage Nationale Nederlanden
[17] `www.macquarie.com`
[18] `www.mtgprofessor.com`

Rent rates

The two Dutch products which are currently in the market offering a lease and rent back construction both determine their rent rate as a percentage of the value of the property. These constructions are similar to the home reversion scheme which is offered in Australia. The rates Verzilvermijvast and Zilver Wonen Fonds ask are 6% and 5,5% of the market value of the property on an annual basis.

7.2 House value

The value of the property also changes over time. The house price at time t depends on the house price of the previous period and is increased/ decreased with the change in house price over that period.

$$H_t = H_{t-1} \times (1 + HPI_t) \tag{20}$$

The final house value at the termination date is thus

$$H_T = H_0 \prod_{t=0}^{T} (1 + HPI_t) \tag{21}$$

7.3 Lump Sum Reverse Mortgage

7.3.1 Loan value

When taking out a lump sum mortgage or line of credit this implies that the consumer will gain immediate access to the total amount available. This implies that interest is accumulated of the total amount from the start. The loan value is dependent on the loan to value ratio. The loan value $L(0)$ is equal to $L_0 = H_0 \times LVR$, where H_0 is the house value at the time the loan is taken out. $r_t^{(1)}$ is the variable interest rate and α is the addition which turn interest rates into mortgage rates and also a premium since this is a reverse mortgage and not a forward mortgage.

$$L_t = L_{t-1} \times (1 + r_t^{(1)} + \alpha) \tag{22}$$

$$L_T = L_0 \prod_{t=0}^{T} (1 + r_t^{(1)} + \alpha) \tag{23}$$

7.3.2 No Negative Equity Guarantee

The no negative equity guarantee is either paid by the provider or by an external party such as the government. Because there could be costs associated with selling the property (γ) the no negative equity guarantee looks as follows

$$NNEG_T = \max(L_T - H_T(1 - \gamma), 0) \tag{24}$$

The costs associated with selling the property, γ, is assumed to be equal to 0.5% of the value of the property.

The value of the no negative equity guarantee at time T is then equal to

$$NNEG_T = \max(L_T - H_T(1-\gamma), 0) \times \prod_{t=0}^{T} m_t \tag{25}$$

Where m_t is the stochastic discount factor.

To determine the present value of the no negative equity guarantee the probability of leaving the house should be incorporated. In this analysis it is assumed that the maximum age is equal to 100 years. This is reasonable since it is expected that after the age of 100 the home owners will have moved into long term care or deceased. Therefore this is the ultimate termination point of the loan.

$$NNEG = \sum_{t=0}^{100-min(x,y)-1} \mathbb{E}[{}_tq^*_{x:y} \max(L_T - H_T(1-\gamma), 0) \times \prod_{t=0}^{T} m_t] \tag{26}$$

The value of the reverse mortgage contract for the provider is the expected profit the provider will get from this investment. In case of a reverse mortgage this is equal to the expected payout when the contract is terminated minus the original payment (L_0) minus the no negative equity guarantee.

$$RM = \sum_{t=0}^{100-min(x,y)-1} \mathbb{E}[{}_tq^*_{x:y}(min(L_t, (1-\gamma)H_t) - L_0) \times \prod_{t=0}^{T} m_t] - NNEG \tag{27}$$

7.3.3 Risks for the consumer

The consumer receive guaranteed payment at the start of the contract which is equal to

$$Payment = H_0 \times LVR \tag{28}$$

The initial payment is thus risk free. However the total accumulated interest amount is uncertain if the consumer decides to take out a reverse mortgage with a variable interest rate. The total accumulated amount depends on the development of the interest rate and the number of years the couple is able to stay living at the property. Because it is assumed that a no negative equity guarantee is in place there is no risk that the total loan value will be larger than the property value. There is however risk for the consumer if they decide to leave the property early or want to make sure there is money left for their heirs. In that case there is a risk since the property value minus the loan value is uncertain.

7.4 Tenure Reverse Mortgage

7.4.1 Loan Value

Another reverse mortgage product is a tenure contract. Which implies that the home owners will receive a monthly (quarterly or yearly) payment until they leave the house. In order to correctly compare all products it is assumed that the total value of the lump sum payment is equal to the expected value of total number of tenure payments. The loan value is equal to

$$L_T = \sum_{t=0}^{T} (LT \times (1 + r_t^{(1)} + \alpha)^t) \tag{29}$$

Where LT are the tenure payments and $r_t^{(1)}$ the short term interest rate.

The tenure value per year is determined by taking the lump sum value and dividing this by the expected lifetime of the couple living at the property. The joint survivor annuity is defined as:

$$Y_{x:y} = \sum_{t=0}^{100-min(x,y)-1} ({}_tp^*_{x:y} \times (\frac{1}{1+r_t^{(1)}})^t) \tag{30}$$

Current Age Couple	Joint survivor annuity
y=68 and x=65	18.1 years
y=78 and x=75	9.2 years
y=83 and x=80	5.7 years

Table 6: Expected remaining lifetime at the property

The tenure payment for every year is thus equal to the total lump sum payment divided by the number of years.

$$LT = \frac{H_0 \times LVR}{Y_{x:y}} \tag{31}$$

7.4.2 No Negative Equity Guarantee

The value of the no negative equity guarantee becomes

$$NNEG = \sum_{t=0}^{100-min(x,y)-1} \mathbb{E}[{}_tq^*_{x:y} \max(L_t - H_t(1-\gamma), 0) \times \prod_{t=0}^{T} m_t] \tag{32}$$

The value of the reverse mortgage contract is similar to the lump sum reverse mortgage contract. The original loan value (L_0) is in a tenure reverse mortgage contract equal to the number of payments made by the provider ($LT \times t$).

$$RM = \sum_{t=0}^{100-min(x,y)-1} \mathbb{E}[{}_tq^*_{x:y}(min(L_t, (1-\gamma)H_t) - LT \times t) \times \prod_{t=0}^{T} m_t] - NNEG \tag{33}$$

7.4.3 Risk for the consumer

$$Payment = H_0 \times LVR / Y_{x:y} \tag{34}$$

Similarly to a lump sum reverse mortgage contract the payment to the consumer is constant. However instead of a lump sum payment these payments are now on a yearly (quarterly/ monthly) basis. This implies that the payout is different but the risks are the same. Because the total amount is not taken out at time t=0 this implies that interest is accumulated less rapidly.

7.5 Home Reversion

7.5.1 Loan value

In case of a home reversion the home owner sells (part) of the house to the provider and then rents the property back with the guarantee that the original owner can stay living in the property until

they decide to leave. The acquisition rate is assumed to be equal to the loan to value ratio [Alai et al., 2014]. The value of the rent agreement for the remaining lifetime living at the property can be expressed as the present value of the rental yield per time period multiplied by the proportion of the house which is sold.

$$RL = \sum_{t=0}^{100-min(x,y)-1} \mathbb{E}[{}_tp^*_{x:y} R_t H_t \times LVR \times \prod_{t=0}^{T} m_t] \tag{35}$$

R_t is the rental yield per time unit.

Rental Yield

It is assumed that the rental yield is equal to the short term interest rate plus a fixed premium of 2%. This is assumed to equivalently compare the lump sum home reversion contract with the lump sum reverse mortgage contract.

7.5.2 Contract Value

The present value of the home reversion contract is then equal to

$$HR = \sum_{t=0}^{100-min(x,y)-1} [{}_tq^*_{x:y} \times RL] \tag{36}$$

7.5.3 Net payment

The actual lump sum payment the provider has to make at the start of the contract is equal to

$$Net\ Payment = H_0 \times LVR - RL \tag{37}$$

7.5.4 Risk for the consumer

The consumer receives a fixed payment when part of the house is sold to the provider. From this point on the consumer will start paying rent for the part of house that is sold. The consumer does not face risk with respect to the value of the house when sold. Unlike a reverse mortgage the interest is not accumulated but the rent payments are paid monthly. It however depends on the type of contract what the rent payments will be. If the rent payments are for example indexed or related to the house value this might increase the rent payments.

7.6 Base Results

Using the base scenario a comparison can be created between the different products. The Florius Verzilverhypotheek is the only reference available regarding appropriate loan to value ratios. Using a loan to value ratio of 16,4% however would result in a no negative equity guarantee of zero. Such a low loan to value ratio has zero risk of reaching the cross-over point and thus is the NNEG zero. Concluding that there is no risk involved for either the consumer or the provider in this product. Therefore a loan to value ratio of 40% is assumed. Note that a large number of participants need to take out these products in order to pool longevity risk.

Reverse Mortgage

The no negative equity guarantee for a tenure reverse mortgage contract is higher than for a lump sum contract when incorporating a loan to value ratio of 40%. A tenure contract accumulates interest at a lower pace but has a higher risk since the payments are for life and not for a fixed period. Since the total value of the lump sum is equal to the expected number of years in good health multiplied by the tenure payments the risk of outliving this amount will result in a higher no negative equity guarantee.
The value of the reverse mortgage contract is the return the provider is expected to obtain for the initial investment. This value is equal to the average outcome using the 1.000 scenarios. The value of the contract is higher for a lump sum contract since the interest is accumulated faster and the no negative equity guarantee does not have such a large effect in case of a 40% loan to value ratio. In the sensitivity analysis also cases in which the tenure contract is more favorable will be presented. The payment is the amount the consumer will receive.

Reverse Mortgage	LVR	NNEG	Value RM Contract	Payment
Lump sum	40%	€3.433	€62.325	€103.040
		[€2.898 , €3.968]	[€61.089 , €63.561]	
Tenure	40%	€7.835	€23.321	€5.693*
		[€7.062 , €8.608]	[€22.583 , €24.059]	

Table 7: Base Case results Reverse Mortgage, 95% CI [...]

* Expressed in yearly amounts.

Home Reversion

In a home reversion contract the provider buys a share of the property. The present value of the agreement incorporates the rental yields and the probability of leaving the property. This value is again determined using the average over the 1.000 scenarios. At a 40% loan to value ratio a lump sum reverse mortgage contract is worth more than a lump sum home reversion contract. This is mainly due to the many years ahead in good health and thus large accumulation of interest in a reverse mortgage contract.

Note that the "Net Payment" is from a provider's perspective while the "Payment" for reverse mortgages is from a consumer's perspective.

Home Reversion	Acquisition %	RL	Value HR Contract	Net Payment
Lump sum	40%	€63.122	€54.718	€39.917
		[€62.366 , €63.878]	[€54.026 , €55.410]	[€40.674 , €39.162]

Table 8: Base Case results Home Reversion, 95% CI [...]

7.7 Sensitivity Analysis

A sensitivity analysis will be used to give insight in the effect the different parameters have. The age and loan to value ratio have a great influence on the results and are therefore discussed first. Since strong mortality increases have been seen in the past few years also these improvements will be incorporated.

7.7.1 Age increase

In the base scenario it was assumed that the couple would be 68 and 65 years of age. Because of this they still had an expected long period in good health ahead of them. The next table shows the value if the couple would wait 10 and 15 years with taking out these products. Because an older age implies a higher loan to value ratio it is also incorporated with the 1% per age year rule for lump sum reverse mortgages [19].

Reverse Mortgage	LVR	Age increase	NNEG	Value RM Contract	Payment
Lump sum	40%	y=68 x=65	€3.433	€62.325	€103.040
Lump sum	50%	y=78 x=75	€1.228	€52.790	€128.800
Lump sum	55%	7=83 x=80	€444	€39.212	€141.680

Table 9: Reverse Mortgage Lump Sum Age Increase

The age increase for the tenure contract also implies that the yearly tenure payments will increase. The lump sum payment is divided by the expected number of years in good health according to table 6. The loan to value ratio has not changed and is still fixed at 40%.

Reverse Mortgage	LVR	Age increase	NNEG	Value RM Contract	Payment
Tenure	40%	y=68 x=65	€7.835	€23.321	€5.692*
Tenure	40%	y=78 x=75	€23.178	€9.491	€11.200*
Tenure	40%	7=83 x=80	€49.554	−€24.689	€18.077*

Table 10: Reverse Mortgage Tenure Age Increase

* Expressed in yearly amounts.

Home Reversion	Acquisition	Age increase	RL	Value HR Contract	Net Payment
Lump sum	40%	y=68 x=65	€63.122	€54.718	€39.917
Lump sum	50%	y=78 x=75	€45.294	€33.652	€83.505
Lump sum	55%	y=83 x=80	€32.319	€20.014	€10.936

Table 11: Age increase Home Reversion

It can be seen that a higher initial age decreases the value of the no negative equity guarantee and the life long rent value for lump sum contracts. This is explained by the fact that the interest accumulation years for a lump sum reverse mortgage are less and therefore the chance diminishes that the cross-over point is reached. The same holds for the lump sum home reversion contract. The number of expected years is good health is now less which implies that the received rent payments will be less.

The tenure payments are already adjusted to the remaining life expectancy therefore the loan to value ratio is kept equal at 40%. The no negative equity guarantee increases when the contract is taken out at a later age. This is because the tenure payments have increased and because the chance of outliving the expected life expectancy has increased.

7.7.2 Loan to Value ratio

As discussed in the section 7.1, the loan to value ratio strongly depends on the country of residence and the age of the consumer. It is now assumed that the couple is of the same age as the base

[19] www.macquarie.com

scenario couple but the loan to value ratio (LVR) is increased. According to the US HECM program in the United States the average loan to value ratio at the age of 65 is 64%. In the sensitivity analysis therefore also a LVR of 65% is calculated. This gives a clear comparison if the same LVR ratios would be applied as in the US.

Reverse Mortgage	LVR	NNEG	Value RM Contract	Payment
Lump sum	16%	€0	€26.303	€41.216
Lump sum	30%	€49	€49.269	€77.280
Lump sum	35%	€491	€57.047	€90.160
Lump sum	40%	€3.433	€62.325	€103.040
Lump sum	45%	€13.879	€60.098	€115.920
Lump sum	50%	€39.343	€42.493	€128.800
Lump sum	65%	€280.115	−€183.550	€167.440

Table 12: LVR Sensitivity Lump Sum Reverse Mortgage Contract

Reverse Mortgage	LVR	NNEG	Value RM Contract	Payment
Tenure	16%	€0.0	€12.479	€2.277*
Tenure	30%	€.364	€23.034	€4.269*
Tenure	35%	€2.204	€25.094	€4.981*
Tenure	40%	€7.835	€23.321	€5.692*
Tenure	45%	€20.087	€14.678	€6.404*
Tenure	50%	€41.627	−€4.068	€7.116*
Tenure	65%	€175.427	−€133.055	€9.250*

Table 13: LVR Sensitivity Tenure Reverse Mortgage Contract

* Expressed in yearly amounts.

The figure below provides a comparison between the no negative equity guarantee of a lump sum reverse mortgage contract and a tenure reverse mortgage contract. As mentioned before the tenure reverse mortgage contract has a higher risk of reaching the cross-over point. However a lump sum reverse mortgage accumulates faster and therefore the loan value is higher when the loan to value ratio is larger.

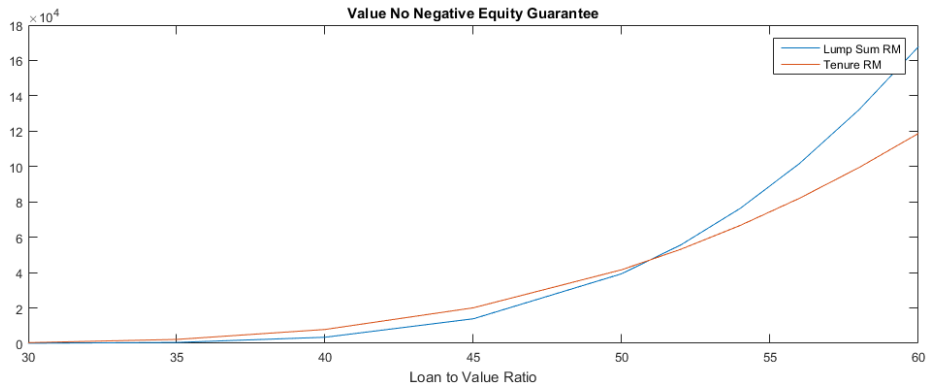

Figure 15: Comparison of the No Negative Equity Guarantee

Home Reversion	Acquisition %	RL	Value HR contract	Net Payment
Lump sum	16%	€25.249	€21.887	€15.966
Lump sum	30%	€47.342	€41.038	€29.937
Lump sum	35%	€55.232	€47.878	€34.927
Lump sum	40%	€63.122	€54.718	€39.917
Lump sum	45%	€71.013	€61.558	€44.906
Lump sum	50%	€78.903	€68.397	€49.896
Lump sum	65%	€102.574	€88.917	€64.865

Table 14: LVR sensitivity Home Reversion Contract

The figure below provides a comparison between the total value for all contracts. A lump sum reverse mortgage contract has a higher value until the loan to value ratio is approximately 45%. A reverse mortgage has a higher risk for the provider since the loan value might be larger than the house value. For high loan to value ratios this risk increases and the value starts declining once the value of the no negative equity guarantee increases. The value of a tenure reverse mortgage is under these assumptions always smaller than the value of a lump sum home reversion contract. This is because the provider will have larger risks and the interest accumulates less fast.

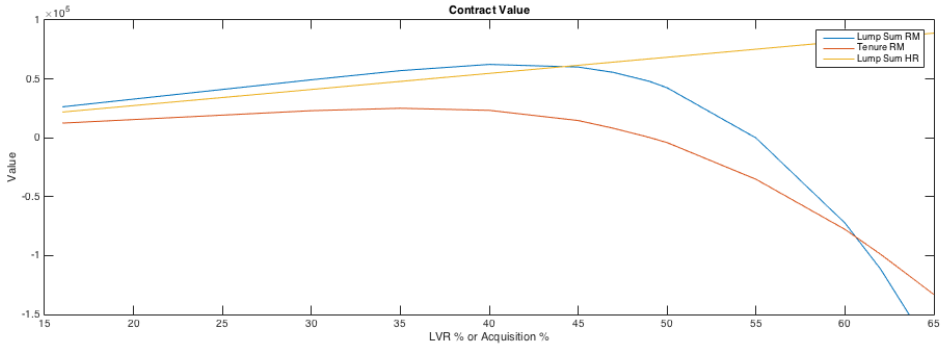

Figure 16: Comparison of the Value of the Contract

7.7.3 Mortality improvements

The Royal Actuarial Association present new life expectancy tables every few years. These tables are used for actuarial calculations in which life expectancy needs to be incorporated. The fluctuations in these tables have an influence. Therefore also mortality improvements will be incorporated.[20]

Reverse Mortgage	LVR	Mortality improvements	NNEG	Value RM Contract	Payment
Lump sum	40%	0%	€3.433	€62.325	€103.040
Lump sum	40%	2,5%	€3.519	€63.312	€103.040
Lump sum	40%	5%	€3.605	€63.865	€103.040
Lump sum	40%	10%	€3.776	€64.634	€103.040

Table 15: Mortality improvements Reverse Mortgage Lump Sum Contract

[20] www.towerswatson.com/nl-NL/Insights/IC-Types/Technical-Regulatory/2014/Premieverhogend-effect-nieuwe-Prognosetafel

Reverse Mortgage	LVR	Mortality improvements	NNEG	Value RM Contract	Payment
Tenure	40%	0%	€7.835	€23.321	€5.692*
Tenure	40%	2,5%	€8.031	€23.762	€5.692*
Tenure	40%	5%	€8.227	€24.038	€5.692*
Tenure	40%	10%	€8.619	€24.407	€5.692*

Table 16: Mortality improvements Reverse Mortgage Tenure Contract

* Expressed in yearly amounts.

Home Reversion	Acquisition %	Mortality improvements	RL	Value HR Contract	Net Payment
Lump sum	40%	0%	€63.122	€54.718	€39.917
Lump sum	40%	2,5%	€64.584	€56.866	€38.455
Lump sum	40%	5%	€65.881	€58.574	€37.158
Lump sum	40%	10%	€68.031	€61.277	€35.008

Table 17: Mortality improvements Home Reversion Contract

It is assumed that the mortality improvements are also health improvement of the same percentage and thus that the couple lives longer and in good health. It can be seen that the no negative equity guarantee and the life long rent contract both increase as the mortality improvements increase which makes sense since the accumulation period is assumed to be longer. However the difference is very small and it can be concluded that mortality improvements do not have a large impact.

7.7.4 Initial House Value

The initial house value is assumed to be equal to the average house price.

Reverse Mortgage	LVR	House Value	NNEG	Value RM Contract	Payment
Lump sum	40%	€150.000	€1.999	€36.292	€60.000
Lump sum	40%	€257.600	€3.433	€62.325	€103.040
Lump sum	40%	€350.000	€4.664	€84.680	€140.000

Table 18: House value Lump Sum Reverse Mortgage Contract

Reverse Mortgage	LVR	House Value	NNEG	Value RM Contract	Payment
Tenure	40%	€150.000	€4.562	€13.580	€3.315*
Tenure	40%	€257.600	€7.835	€23.321	€5.693*
Tenure	40%	€350.000	€10.646	€31.686	€7.735*

Table 19: House value Tenure Reverse Mortgage Contract

* Expressed in yearly amounts.

Home Reversion	Acquisition %	House Value	RL	Value HR Contract	Payment
Lump sum	40%	€150.000	€36.756	€31.862	€23.244
Lump sum	40%	€257.600	€63.122	€54.718	€39.917
Lump sum	40%	€350.000	€85.765	€74.346	€54.235

Table 20: House value Lump Sum Home Reversion Contract

The initial house value has an influence on the value of the contract. If the house value is higher the value is also higher in case of a 40% LVR or acquisition rate. The increase in NNEG and contract value is proportional to the increase in house value.

7.8 Consumer's perspective

An analysis for the provider's perspective has been conducted in the previous paragraphs. This section will therefore focus on the perspective of the consumer.

7.8.1 Reverse Mortgage

Taking out a reverse mortgage for the couple gives them the opportunity to take out a significant part of their house value without selling part of the property. However when they still have many years of good health ahead of them and they plan on staying in their property until they move into long term care or decease this implies that the expected loan value will accumulate very fast. Which products suits them best (lump sum or tenure) depends on whether the couple wants to have the total amount available at once or is satisfied with periodical payments. With a tenure contract the couple has the advantage that the interest is not accumulating as fast as with a lump sum contract and they also have the advantage that if they live longer than expected the total value of their payments will be larger than the lump sum payment. If the couple has a strong bequest motive and wants to use a reverse mortgage to avoid paying inheritance tax a lump sum would give them the opportunity to transfer a large amount to their children before they decease.

Lump Sum
+ Large upfront payment
+ Favorable when couple needs large amount
+ Favorable when couple leaves property early

If bequest motive or leave early
+ Avoid inheritance tax
− Quick accumulation of interest

Tenure
+ Payments until move out
+ Favorable when couple outlives average age
+ Less quick accumulation of interest
− No large payment upfront

7.8.2 Reverse Mortgage or Home Reversion

In a home reversion contract the consumer sells part of their property and starts paying rent for the sold part to the provider. It strongly depends on the rent amount which product is more favorable. In general it will hold that

Total rent > Total accumulated interest	Favor Reverse Mortgage
Total rent < Total accumulated interest	Favor Home Reversion

The main difference between the products is the fact that the rent needs to be paid monthly while the interest is added to the loan balance. The couple thus needs to be able to make the monthly rent payments in case of a home reversion contract. On the contrary this implies that when the property gets sold the remaining value of the property still belongs to the original home owners while in a reverse mortgage contract the interest could have accumulated such that to remaining value for the consumer is left.
Another psychological reason why a reverse mortgage might be more appealing is the fact that with this contract no part of the property is already sold to the provider.

Reverse Mortgage

+ Property still belongs to owners
+ Large upfront payment
− Interest payments
− No Negative Equity Guarantee

Home Reversion

+ Remaining value of the property
− Payment upfront is less
− Rent payments
− Partly sell ownership

8 Results and Comparison

In the previous section an overview has been provided of the different products; a reverse mortgage and a home reversion product. The conclusion which product would be favored strongly depends on the loan to value ratio and the other market assumptions such as the development of the house value, mortgage rate and longevity risk.

In Australia and The Netherlands currently very low loan to value ratios are applied for reverse mortgage products. We have seen that this implies that the value of the no negative equity guarantee is zero and therefore there is no risk for the provider when offering these products. On the contrary a premium is asked by the provider for these products while the actuarial fair premium would have been zero with such low loan to value ratios.

The currently offered products

There are a few products already available on the Dutch market. The next paragraphs provides an overview for the consumer's perspective how much these products would cost and what are the (dis)advantages of these products.

8.1 Florius verzilverhypotheek

The Florius verzilverhypotheek is the only pure reverse mortgage product currently offered on the Dutch market. Florius currently offers a mortgage rate of 4,3% [21] which is a fixed mortgage rate. This is higher than the current fixed interest rate for mortgages which is 3,3%.

The mortgage rate which is stated in the contract can be viewed as the costs for taking out the product. Florius also provides a no negative equity guarantee. In the previous chapter the no negative equity guarantee was priced and concluded that with the low loan to value ratio Florius offers, there should actually be no premium on top of the forward mortgage premium. It can be concluded that Florius is overpricing its product. It could be the case that Florius does not have enough participants yet and therefore creates a buffer to make up for the lack of pooling risks. Florius could also have a different view (more pessimistic) on the development of the interest rate, house prices etc over the next couple of decades and therefore is creating the extra buffer. The foremost and most likely reason is probably that Florius is the only provider in the Dutch market currently and can therefore increase his price.

The graph below shows the conservative attitude of Florius regarding the loan to value ratio they offer. As seen the interest rate of 4,3% results in a profit for Florius compared to 3,3% (the average fixed forward mortgage rate) while Florius does not bear any risk by offering this product since the no negative equity guarantee is zero in both cases.

Florius Verzilverhypotheek	Mortgage rate	LVR	Payment	Value NNEG
Lump Sum Reverse Mortgage	4,3%	16,4%	€42.246	0
Lump Sum Reverse Mortgage	3,3%	16,4%	€42.246	0

Table 21: Florius Verzilverhypotheek

[21] https://www.florius.nl/Documents/Rentetarieven/renteblad-florius-verzilver-hypotheek.pdf

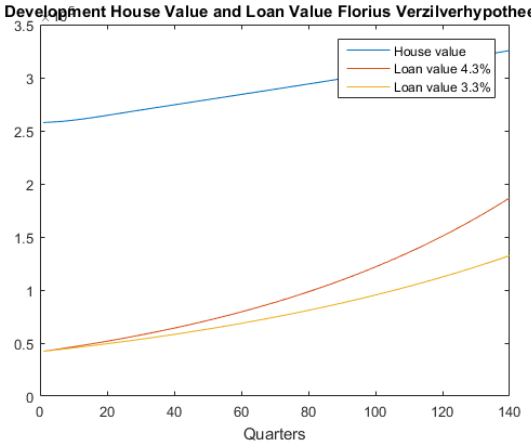

Figure 17: Florius Verzilverhypotheek

Changing the loan to value ratio

In comparison to providers abroad Florius' loan to value ratio is rather low. The next table shows an overview of the no negative equity guarantee if the loan to value ratio is increased for both a mortgage rate of 3,3% and 4,3%. The no negative equity guarantee is determined using the 1.000 scenarios of the VAR(1) model. The zero NNEG is the percentage the provider could increase the loan to value ratio to and still have a no negative equity guarantee of zero is all 1.000 scenarios. It can be concluded that the loan to value ratio can be increased from the provider's perspective without facing risk of reaching the cross-over point.

Florius	LVR	NNEG 4,3%	NNEG 3,3%
Lump sum	16%	€0	€0
Lump sum	20%	€0	€0
Lump sum	25%	€0,30	€0
Lump sum	30%	€18	€0
Lump sum	35%	€145	€0,38
Lump sum	35%	€626	€21
Zero NNEG		23%	33%

Table 22: Florius Verzilverhypotheek LVR sensitivity

8.2 Verzilvermijvast

During the course of writing this thesis Verzilvermijvast has changed their product offering. They now only offer one product. Verzilvermijvast offers a sale and rent back construction using two tranches. In the first tranche 50% of the market value of the house will be paid out to the couple. The second tranche will be paid out when the couple leaves the house and this will again be equal to 50% of the then current market value of the property. If the property has increased in value 50% of the profit will go to Verzilvermijvast and similarly 50% will be paid by Verzilvermijvast if the property has decreased in value. The first tranche is equal to €128.800. There are one time administration costs for taking out this product equal to €2.500. The costs for property valuation and building inspection need to be paid 50% upfront by the owners but will be paid back by Verzilvermijvast once the house is sold. The couple will start paying rent to Verzilvermijvast which is set equal to 6% of the market value on an annual basis. There is no mention of increasing rent costs since the terms and conditions are not publicly available. In order to compare this product with the

analysis from the previous chapter it is again assumed that the couple will only leave the house in case of decease or moving into long term care. The expected remaining years living in the property will be approximately 18.5 years. The biggest fluctuation can be found in the house price. A 70% confidence interval is created with lower bound "Min HP" and upper bound "Max HP". In order to properly evaluate the current value of the product a discount rate is used. Two discount rates are presented below 2,25% and 2,75% [22].

2,25%	Min HP	Mean HP	Max HP	2,75%	Min HP	Mean HP	Max HP
Payment 1	128.800	128.800	128.800	Payment 1	128.800	128.800	128.800
Payment 2	78.311	146.612	273.092	Payment 2	80.388	145.596	262.434
PV P2	51.886	97.140	180.941	PV P2	48.666	88.143	158.876
PV Rent	247.223	247.223	247.223	PV Rent	237.209	237.209	237.209
Admin Costs	2.500	2.500	2.500	Admin Costs	2.500	2.500	2.500
Present Value	**-69.037**	**-23.783**	**60.018**	**Present Value**	**-62.243**	**-22.767**	**47.966**

Table 23: Verzilvermijvast: Overview

Whether this product is favorable to take out strongly depends on the evaluation of the house price when the house is sold. From the VAR(1) model a projection of the house value into the future has been made. The expected house value is between €156.622 and €546.183 with an average of €293.223.

8.2.1 Leaving the property early

It can be argued that the home owners who take out this product are not planning to stay living in the property for their remaining lifetime in good health. Because the second tranche is paid after the property is sold this is an incentive to sell the property earlier. This benefits the home owner and their possible heirs since they can now use the possible tax advantage of giving money to their children before they decease. The following table gives an overview if the couple decides to stay 10 years living at the property after they have bought the Verzilvermijvast product.

2,25%	Min HP	Mean HP	Max HP	2,75%	Min HP	Mean HP	Max HP
Payment 1	128.800	128.800	128.800	Payment 1	128.800	128.800	128.800
Payment 2	97.802	138.188	194.710	Payment 2	97.802	138.188	194.710
PV P2	78.292	110.621	155.867	PV P2	74.564	105.354	148.446
PV Rent	152.492	152.492	152.492	PV Rent	148.997	148.997	148.997
Admin Costs	2.500	2.500	2.500	Admin Costs	2.500	2.500	2.500
Present Value	**52.099**	**84.428**	**129.675**	**Present Value**	**51.867**	**82.657**	**125.749**

Table 24: Verzilvermijvast: 10 Years

It can be seen that the present value is now positive in all cases. This make sense since the accumulated rent is less.

8.2.2 Risks

There are three main parties who face risks with this deal. The provider of the product (Verzilvermijvast), the home owners, the heirs of the home owners.

[22] `www.rente-tarieven.nl`

Home Owners The home owners only face a large risk with respect to the second tranche payment. However these risks are shared with the provider. In case of a decrease in house value 50% of the loss will be taken by the provider. However in the case of an increase in house value (which is expected) also 50% of the gain will go to the provider. There is no risk regarding the monthly rent since this amount is fixed. Fluctuations in the discount rate diminish partly because they are used for both the rent value and the present value of the second tranche.

Provider The main risk for the provider is the house price risk. If the house price goes down the provider will receive less in the second tranche. A lower payoff in the second tranche could be covered with the rent payments since the rent payments are fixed to the initial house value. If the house price goes up, which usually occurs in the market, the provider will benefit from this since the provider will receive extra profit when the house is sold. But since the rent is not indexed with inflation the provider will not benefit from this increase.

Heirs The heirs of the home owners will inherit the second tranche if the home owners leave the house because of decease. They therefore also face a lower/ higher payoff depending on the development of the house price.

8.3 Zilver Wonen Fonds

Just as Verzilvermijvast, Zilver Wonen Fonds provides a sale and rent back solution for our base couple. The Zilver Wonen Fonds will provide the couple with 80% of the current market value of the house which is equal to €206.080. They will receive this amount as a lump sum upfront and they can now spend it freely as they wish. But there are costs associated with this product. The first costs are the taxation and building inspection costs of which Zilver Wonen Fonds will pay 50%. This implies average costs for our couple of €350[23]. There are also administrative costs that need to be paid. These are set equal to 1,5% of the market value. The couple will now start paying rent to Zilver Wonen Fonds. The rent is set to 5,5% of the market value annually. The rent is indexed by the consumer price index each year[24]. The rent is on average 5,5% but depends on the region where the house is located. It is for this analysis assumed that it is 5,5%. The following overview of costs can now again be created if it is assume that the couple will only leave the house because they are moving into long term care or have deceased. The VAR(1) model is used to calculate the mean and the confidence interval of the development of the consumer price index. "Min Rent" captures the lower bound of the confidence interval and "Max Rent" the upper bound.

2,25%	Min Rent	Mean Rent	Max Rent	2,75%	Min Rent	Mean Rent	Max Rent
Payment	206.080	206.080	206.080	Payment	206.080	206.080	206.080
PV Rent	197.346	239.387	294.483	PV Rent	189.789	229.455	281.318
Admin Costs	4.214	4.214	4.214	Admin Costs	4.214	4.214	4.214
Present Value	**4.520**	**-37.521**	**-92.617**	**Present Value**	**12.077**	**-27.589**	**-79.452**

Table 25: Zilver Wonen Fonds: Overview

When the couple would take out this product at their current age the associated costs would be very high. There are some extra gains for the couple such as the maintenance costs and other costs associated with owning a house. Depending on how the couple decides to spend the lump sum amount, capital tax might be an extra cost which the couple needs to be taken into account.

[23] `www.taxatietarieven.com`
[24] CBS Statline Inflatie

8.3.1 Leaving the property early

Just as with Verzilvermijvast it can be argued that the product is not taken out with the intention to stay living at the property for the remaining lifetime in good health. Therefore also an analysis is created using a ten year horizon.

2,25%	Min Rent	Mean Rent	Max Rent	2,75%	Min Rent	Mean Rent	Max Rent
Payment	206.080	206.080	206.080	Payment	206.080	206.080	206.080
PV Rent	128.539	143.898	161.794	PV Rent	125.689	140.555	157.864
Admin Costs	4.214	4.214	4.214	Admin Costs	4.214	4.214	4.214
Present Value	**73.327**	**57.968**	**40.072**	**Present Value**	**76.177**	**61.311**	**44.002**

Table 26: Zilver Wonen Fonds: 10 Years

8.3.2 Risks

Compared to Verzilvermijvast the rent is indexed every year. Which results in extra risks for the home owners.

Home Owners The lump sum payout does not depend on the development of the house price when the property is sold. The only risk the original home owners have is the rent fluctuations. The rent is indexed every year with inflation and therefore since this variable is uncertain the outcome is uncertain. This product is less risky with respect to the second tranche payment but more risky with respect to rent costs.

Provider The provider pays the original home owners 80% of the market value of the property as a lump sum. This implies that the house price risk is fully absorbed by the provider. However the provider has a buffer of 20% since the property was not sold for a 100% market value. The rent revenues are indexed every year which implies that the revenues are kept to the same level every year and this is riskless for the provider.

Heirs Since there is no payment when the original home owners decease or move out of the property there is no extra risk for the heirs with respect to the original home owners.

8.4 Comparison Verzilvermijvast and Zilver Wonen Fonds

The two products discussed above are both products offering a sale and rent back construction but when looking at the costs a large difference can be seen. It does not necessary imply that Verzilvermijvast is always more favorable than Zilver Wonen Fonds. This strongly depends on the time the owners are planning to leave the house. It also depends on the amount of money the owners wish to receive upfront which of the product is more appealing to them. In general it can be concluded that if the couple does not need the 80% upfront but is satisfied with the 50% Verzilvermijvast is cheaper.

Still for both products it can be seen that more than the total value of the property will be paid in costs after 18,5 years. It has to be noticed that this is because the product is taken out at an age at which many years in good health are still ahead of the couple and it is assumed that they do not wish to leave the house for other reasons than long term care or decease.

There are many advantages associated with these products. One of the advantages is to avoid bequest tax if the couple wishes to leave most of the value of the property to their heirs. Another advantage is the freedom to spend their money as they choose, either on health care costs, travel or just more comfortable living conditions. These advantages need to be taken into account as well

but are difficult to express in terms of money value since everyone values them differently. This can ultimately result in the products not having a negative utility value but only a negative financial value.

8.5 No longer available products

During the course of this thesis Verzilvermijvast has changed their conditions. They now just offer one product but they used to offer three products.

1. Verzilvermijvast: Similar to the Verzilvermijvast contract in the previous section but the first tranche was equal to 60% of the market value of the property and the monthly rent was determined by the current market value divided by 225. The annual rent was thus less than the current case and the first tranche payment was also higher.

2,25%	Min HP	Mean HP	Max HP	2,75%	Min HP	Mean HP	Max HP
Payment 1	154.560	154.560	154.560	Payment 1	154.560	154.560	154.560
Payment 2	52.551	120.852	247.332	Payment 2	52.551	120.852	247.332
PV P2	34.818	80.072	163.873	PV P2	31.814	73.163	149.732
PV Rent	219.754	219.754	219.754	PV Rent	210.853	210.853	210.853
Admin Costs	2.500	2.500	2.500	Admin Costs	2.500	2.500	2.500
Present Value	**-32.875**	**12.378**	**96.180**	**Present Value**	**-26.979**	**14.370**	**90.940**

Table 27: Verzilvermijvast: Old Product

The next overview is for a 10 year horizon.

2,25%	Min HP	Mean HP	Max HP	2,75%	Min HP	Mean HP	Max HP
Payment 1	154.560	154.560	154.560	Payment 1	154.560	154.560	154.560
Payment 2	72.042	112.428	168.950	Payment 2	72.042	112.428	168.950
PV P2	57.670	90.000	135.246	PV P2	54.925	85.715	128.807
PV Rent	135.549	135.549	135.549	PV Rent	132.442	132.442	132.442
Admin Costs	2.500	2.500	2.500	Admin Costs	2.500	2.500	2.500
Present Value	**74.182**	**106.511**	**151.757**	**Present Value**	**74.543**	**105.333**	**148.425**

Table 28: Verzilvermijvast: Old Product 10 years

Comparison
When comparing this version of Verzilvermijvast to the version discussed in section 8.2 it can be concluded that this product has a higher present value and would have been more favorable. This product however is more risky for the provider since the rent is lower and the first tranche pays out higher.

2. Verzilvermijgarant: This product holds under the same conditions as the old Verzilvermijvast contract but the second tranche is no longer variable and is always equal to the first tranche. In this way no risk is involved for the consumer in case of a value decrease but also no gain can be made if the house increases in value.

Remaining Lifetime 2,25%		Remaining Lifetime 2,75%		10 Years 2,25%		10 Years 2,75%	
Payment 1	128.800	Payment 1	128.800	Payment 1	128.800	Payment 1	128.800
Payment 2	128.800	Payment 2	128.800	Payment 2	128.800	Payment 2	128.800
PV P2	85.338	PV P2	77.974	PV P2	85.338	PV P2	77.974
PV Rent	219.754	PV Rent	210.853	PV Rent	135.549	PV Rent	132.442
Admin Costs	2.500	Admin Costs	2.500	Admin Costs	2.500	Admin Costs	2.500
Present Value	**-8.115**	**Present Value**	**-6.578**	**Present Value**	**76.090**	**Present Value**	**71.833**

Table 29: Verzilvermijgarant

Comparison
Verzilvermijgarant is a product designed for people who do not want to have any risk at all. The product has zero risk for the consumer since the rent is fixed and both tranche payments are fixed. When comparing this product to the product from section 8.2 the present value is lower on average. This is because it is expected that the house value will increase with time and this upward potential is no longer a profit for the original home owners. On the other hand they also do not bear any risk if the house value might decline.

3. Verzilvermijnu: This product is different from previously described products since it automatically terminates after 10 years. It offers an immediate lump sum payment of 90% of the market value. Instead of paying rent on a monthly basis the rent now needs to be paid for the full 10 years at once. The rent is set equal to 50% of the paid out value. This results in an immediate lump sum cash of 45% and rent free living for the next 10 years.

Payment	231.840
Rent	115.920
Present Value	**115.920**

Table 30: Verzilvermijnu

Comparison
When comparing the 10 year values for all different products Verzilvermijnu has the highest present value. There are no risks for the home owners and they receive an immediate cash payment upfront and also do not have to make any rent payments for the next 10 years. If the couple was already planning to leave the property after 10 years this would have been the most favorable product on average. Only if the house price would have gone up tremendously or if the consumer price index fell a lot over the next decade this product would have a lower present value than some of the other products.

8.6 Conclusion

The question that now arises is; 'why are these products priced so unfairly?'. This can be explained by a few reasons. The first being the monopoly position of the provider. There are currently barely any providers in the Netherlands which results in no market competition and does not influence the incentive of the provider to lower the price. The second reasoning being the fact that since the products are not widely known among the Dutch public and therefore hardly taken out, pooling of risk is not possible. Especially micro longevity risk can be pooled by the provider if enough consumers take out the product. Lack of this causes the price of the product to rise if there is a no negative equity guarantee in place. The last reason why the products are so expensive is the fact that there is no governmental institution which provides the no negative equity guarantee but the provider has to take this risk for himself. This can then be related to the very low loan to value

ratio which the Dutch providers offer. If higher loan to value ratios would be used by the providers the risk would increase a lot and this would either result in a very risky product for the provider or significantly increasing costs for the consumer.

9 Conclusion

With the increasing uncertainty about the Dutch pension wealth and people becoming more aware of their financial situation when they retire, new products should be investigated. A possible interesting product could be an equity release product such as a reverse mortgage, a home reversion product or a variation.

9.1 Interest in equity release products

With the increasing uncertainty about the future of the Dutch pension system and the increasing longevity alternative products should be sought and evaluated. One of these product could be an equity release product such as a reverse mortgage or home reversion. Using the investigations by ING International Survey Home and Mortgages [2015] and Dillingh et al. [2015] it can be concluded that there is a prospective future market for these products in the Netherlands. The main reason why people in the Netherlands would be interested in these products would be for the purpose of living more comfortably or spend the extra money on traveling or making improvements to their house. Another important aspect why people would be interested in these products would be if they have a strong bequest motive. Because the inheritance tax is relatively high[25] in the Netherlands it could be favorable and also utility increasing if the money is transferred before decease. Dillingh et al. [2015] mainly concluded that the interest depends on the expectation of the housing wealth and future pension income.

With the uncertainty about future health care costs and the regulatory law change in 2015 people are encouraged to stay as long as possible in their own home before moving into long term care[26]. This could potentially drive up the market for equity release products. With the extra money improvements to the house can be afforded more easily and when moving into long term care the personal budget could be avoided by already transferring the money towards the (grand)children.

The current market for equity release products is still small. This is mainly due to unawareness of the existence of these products and the perception that your house can also be part of your pension wealth. [ING International Survey Home and Mortgages, 2015] [Dillingh et al., 2015]

In the United States and Australia, where these products are already widely known in the market, there are strict regulatory rules attached to these products. In order for the market in the Netherlands to increase such strict rules should be implemented. The government can play a large and substantial role in this by for example providing the no negative equity guarantee or lighten the burden for financial institutions to provide such products.

Looking at the supply side there are also some issues to address. The first being the issues banks would face if they choose to offer these kind of products. After the financial crisis the regulations have become much stricter for banks and insurance companies when it comes to mortgage products. This is again linked to the influence of the government and might therefore stimulate individual parties to gain access to this market.

9.2 Products and the Dutch Market

The currently offered products on the Dutch market are rather limited. The Florius Verzilverhypotheek is the only reverse mortgage products available. According to table 22 the loan to value

[25] Belastingdienst
[26] `www.zorgwijzer.nl`

ratio Florius applies could be increased. The difference between the reverse mortgage rate and forward mortgage rate should be to cover the risk of the no negative equity guarantee. However with the low loan to value ratio Florius does not face any risk in reaching the cross-over point. The other products on the Dutch market, Zilver wonen fonds and Verzilvermijvast, are both very expensive products from a consumer's perspective.

9.2.1 Provider's Perspective

If reverse mortgage products or home reversion products suit the Dutch market best depends on a lot of factors. The low loan to value ratios would suggest that reverse mortgage products give a higher return for the providers. Also depending on the loan to value ratio the risks between a lump sum reverse mortgage and tenure reverse mortgage can be analyzed. According to figure 15, for lower values of the loan to value ratio a tenure reverse mortgage is more risky for the provider than a lump sum reverse mortgage. This also intuitively makes sense since the risk of outliving the expected age has a more significant impact.

9.2.2 Consumer's Perspective

For the consumer a few aspects need to be considered. There are differences between the payout schemes, the (partial) ownership of the property and the way interest is accumulated. All these factors need to be taken into account when choosing the product that fits best. For the consumer it is also of beneficial to think about the duration of the contract. If the duration of a reverse mortgage contract is shorter the accumulated interest is less which implies that there might still be some remaining house value left when leaving the property.

A lump sum could be chosen when the couple would like to have a large amount of money available right away. They could for example transfer this to their children to avoid inheritance tax or spend it on luxury items. If a reverse mortgage is chosen they need to realize that interest will accumulate fast and they might not have any remaining house value left when they leave the property. If a home reversion is chosen they already sell part of their house. They need to be able to make the monthly rent payments afterwards which might not be beneficiary.

If the couple wants to use an equity release product to have some extra money on a monthly basis a tenure contract could be chosen. A tenure contract has the advantage for the consumer that the payments are paid out until they move out and interest is accumulated less rapidly in comparison to a lump sum reverse mortgage contract.

9.3 Further Research

In order to fully explore the possibilities for equity release products on the Dutch market a few aspects need to be explored further. One of these would be the interest in other products and not just reverse mortgages. Another would be whether active marketing would increase the potential demand because currently one of the major issues for equity release products is the fact that there is still a lot of unawareness about them in the market.

9.3.1 Critical evaluation of the data

The interest rate and development of the house prices are the two main variables that influence the analysis. Because of the large data fluctuations the last 20 years the development of these two

variables might be discussed further. In some scenarios the VAR model predicts the interest rate to develop to values below zero. One could argue if this is realistic. The house price development is on average below the historical average before the crisis.

10 Appendix

Probability of ending up in Long Term Care

Age	Male	Female
60	0,22%	0,19%
61	0,17%	0,16%
62	0,19%	0,16%
63	0,20%	0,19%
64	0,17%	0,20%
65	0,18%	0,17%
66	0,17%	0,19%
67	0,14%	0,16%
68	0,18%	0,17%
69	0,18%	0,24%
70	0,16%	0,28%
71	0,16%	0,30%
72	0,22%	0,42%
73	0,26%	0,53%
74	0,26%	0,48%
75	0,31%	0,54%
76	0,49%	0,77%
77	0,53%	0,97%
78	0,72%	1,13%
79	0,77%	1,39%
80	1,05%	1,68%
81	1,09%	2,14%
82	1,14%	2,50%
83	1,72%	2,90%
84	1,96%	3,24%
85	1,72%	3,91%
86	2,62%	4,05%
87	2,80%	4,82%
88	3,26%	5,08%
89	5,00%	5,28%
90	5,20%	6,30%
91	3,94%	6,03%
92	5,51%	6,34%
93	5,38%	6,83%

Table 31: Probability of ending up in long term care

Methodology
In order to determine the probability of ending up in long term care per year data from the CBS is used. Data from 2013 and 2014 is used to determine the number of entrants into long term care per age group. Next these probabilities are adjusted with the probability of dying while in long term care.

VAR(1) Model

Covariance Matrix

	CPI	GDP	HPI	$r^{(1)}$	$r^{(40)} - r^{(1)}$
CPI	1,19E-05	5,27E-07	-3,50E-07	7,74E-07	1,91E-06
GDP	5,27E-07	6,35E-06	6,23E-07	-2,63E-06	2,18E-06
HPI	-3,50E-07	6,23E-07	1,51E-05	-7,92E-07	-9,85E-07
$r^{(1)}$	7,74E-07	-2,63E-06	-7,92E-07	1,22E-05	-1,15E-05
$r^{(40)} - r^{(1)}$	1,91E-06	2,18E-06	-9,85E-07	-1,15E-05	2,19E-05

Table 32: Covariance Matrix of the VAR(1) Model

Cholesky Decomposition of the Covariance Matrix

	CPI	GDP	HPI	$r^{(1)}$	$r^{(40)} - r^{(1)}$
CPI	0,00345	0,00015	-0,00010	0,00022	0,00055
GDP	0	0,00252	0,00025	-0,00106	0,00083
HPI	0	0	0,00388	-0,00013	-0,00029
$r^{(1)}$	0	0	0	0,00332	-0,00325
$r^{(40)} - r^{(1)}$	0	0	0	0	0,00320

Table 33: Cholesky Decomposition of the Covariance Matrix

Correlation Matrix

	CPI	GDP	HPI	$r^{(1)}$	$r^{(40)} - r^{(1)}$
CPI	1	0,0607	-0,0261	0,0643	0,1184
GDP	0,0607	1	0,0636	-0,2994	0,1845
HPI	-0,0261	0,0636	1	-0,0584	-0,0542
$r^{(1)}$	0,0643	-0,2994	-0,0584	1	-0,7028
$r^{(40)} - r^{(1)}$	0,1184	0,1845	-0,0542	-0,7028	1

Table 34: Correlation Matrix of the VAR(1) Model

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List of Tables

List of Figures