Reverse mortgages in the Dutch market

Master Thesis for the Executive Master of Actuarial Science

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1. WORD OF GRATEFULNESS

After years of study next to my job as actuarial analyst this is the end of my EMAS trajectory. To finish this I of course had help of a lot of people. Therefore I want to thank a selection of them. Firstly, thanks to all other students of EMAS 4, with whom I have worked together intensively. Furthermore thanks to the teachers, who made this study possible. A special thanks for Dirk Brounen, for being my supervisor while I was writing this thesis, for supporting and giving good advice whenever I was having trouble writing it. Thanks to the people at Nationale-Nederlanden who made it possible for me to complete this study.

And finally thanks to my good friend Helena, for proofreading, for giving advice whenever needed and for all moral support throughout the last years.

2. EXECUTIVE SUMMARY

In this thesis reverse mortgages in the Netherlands are discussed. More specific, the reasons for the fact that reverse mortgages are not a popular product in the Netherlands are elaborated upon. Since the Dutch population is ageing, and pension is getting more expensive, a reverse mortgage product could be the solution for the pension problem, so you would expect it will become popular.

In the theory of household finance, it is discussed that a house should be part of the wealth of a household, and a reverse mortgage is a product that can be used to do so. In this way the household can keep on living in the house, instead of having to sell it to acquire the wealth that is in it.

Experiences in other countries are discussed, and it is seen that a reverse mortgage product might not work if it is the tradition to give your house to your children as in some Asian countries, or if the idea behind a reverse mortgage is that it is used as a last resort as in Italy.

The most important barrier for reverse mortgages is that the product is unknown in the Netherlands. In a questionnaire only 10% of the people knew the meaning of a reverse mortgage, while more than 25% would be interested in such a product when they are told what it is.

The pricing of a reverse mortgage is also discussed and it is seen that the most important factors for this are house prices, interest and longevity. It is also seen that it can be a lucrative product for both the borrowers as financial institutions, and advantages for both are described. The borrower can get a better standard of living, while the financial institution can get a fixed mortgage interest and diversification advantages.

The conclusion is that as soon as a big financial institution starts selling reverse mortgage products and combines that with a good marketing campaign, I think reverse mortgages should take on in the Netherlands, and I definitely think reverse mortgages will be a product of the future.

3. Table of contents

4. INTRODUCTION

This thesis is about reverse mortgages. I will investigate why reverse mortgages are unpopular in the Netherlands, while in my opinion it just should be a popular product. This will be my main research question:

- **Why are reverse mortgages unpopular in the Netherlands, while it should be a popular product, based on its characteristics and what are the factors that can trigger reverse mortgages within the future of Dutch household finance?**

I will start by explaining why I think reverse mortgages should be popular. The pension problem which will be described in the first chapter is the motivation for this investigation. This chapter concerns how we can solve the issue of funding pensions caused by the ageing of the population in the Netherlands. This is a problem for the complete Dutch society, so it is quite an interesting subject. This raises the following sub question:

- **How are reverse mortgages a possible solution for the Dutch pension crisis that will be upon us?**

After outlining the problem, I will give an extensive explanation of the reverse mortgage product. A reverse mortgage is a financial product, where home owners can sell their house, while they keep on living in it. This product can thus help elderly with financial issues, such as pension gaps. I will also zoom in on the advantages and disadvantages for both the financial institutions and the borrowers.

Subsequently, I will write about the history of household finance. I will describe how households cope with their finances, and how they should cope with their finances based on household finance theory. I will also clarify how reverse mortgages fit in this picture, and why I think they should be embedded in household finance. A related research sub question:

- **Why should reverse mortgages be embedded in household finance?**

In the next chapter lessons learned from reverse mortgages in other countries will be discussed. I will give an insight into the reverse mortgage market in the USA, the U.K, Singapore, Korea and China. The idea is to learn from how reverse mortgages in this countries became popular as in the USA or how they flopped as in Singapore. This leads to the sub question:

- **What can we learn from other countries at the start-up of the reverse mortgage market in the Netherlands?**

Thereafter, I will summarize on why reverse mortgages are unpopular in the Netherlands from a psychological point of view. We will see that the main reason for the unpopularity of reverse mortgages in the Netherlands is the simple fact that most possible users of this product do simply not know it exists. I will also discuss the effects of moral hazard and selection in this area. My next sub question therefore is:

- **What can be done to take away the psychological barriers for the Dutch society to get involved in the reverse mortgage market?**

Finally I will look upon reverse mortgages from a pricing perspective. I will describe the assumptions on which the price of a reverse mortgage should be based. The main drivers are the interest rate, the house prices in the Netherlands and longevity.

I will calculate the prices for an example couple of Kees and Bep. Furthermore, I will establish a model for the pricing of reverse mortgages. At this moment I am not aware of any available model that looks at the consequences of longevity on this product. My next sub question therefore is:

- **What should be the price of a reverse mortgage, and to which extent should this be dependent on the rising life expectations?**

I will also zoom in on the Florius Verzilverhypotheek, the only reverse mortgage currently available in the Netherlands, and the reasons for its unpopularity.

Finally, I will conclude that there is a good opportunity for financial institutions to get into the market of reverse mortgages, and I will give an example of how they could do that. My final sub question will be:

- **How should a modern financial institution start its activities to become a key player in the (start-up of the) reverse mortgage market in the Netherlands?**

5. MOTIVATION FOR THE INVESTIGATION

As we are all aware, in the Netherlands increasingly many people are getting retired as a consequence of the ageing of the inhabitants of our country. And since the life expectation of everyone is increasing, more and more money is needed to be able to pay for all the pensions. Furthermore the working population is decreasing. Pension funds noticed this already from the start of this century, and therefore pension funds are switching from defined benefit to defined contribution programs (Ponds & Riel, 2007). One could wonder if this will be enough to let the pension insurance system survive, and it is an absolute necessity to look out for other options to finance pensions in the future.

The house as a source for the retirement income is investigated (Roon, Eichholtz, & Koedijk, 2010). Since more and more people own the house they live in, and the house is a large part of the wealth of those people at the moment they retire, the house should be a logical starting point to look at, when trying to find funding for the pension of the retiree.

The three most important disadvantages for the use of the house as a funding source for retirement are (Roon, Eichholtz, & Koedijk, 2010):

A. "Through the dominant position of housing in the average wealth portfolio, and because of the high leverage the mortgage market allows, home owners are easily to much exposed to housing market risk."
B. "The overwhelming majority of home owners own only one home, and are therefore exposed to unrewarded specific risk."
C. "It is far more difficult to gradually consume the built-up housing wealth than the wealth that has been accumulated in financial assets (..)"

This has the following consequences and inferences for reverse mortgages:

Ad A. An 'investors' house should be taken as a part of the financial wealth, as it reduces the risk to which he is exposed to a great extent, while the expected return only decreases by a small amount. Furthermore for older investors, the portion of their wealth that should optimally be in housing decreases, which means they can use their house for financing their retirement, for example by using a reverse mortgage (Roon, Eichholtz, & Koedijk, 2010).

Ad B. Of course home owners that own just one home are exposed to specific risk, and if the value of their house decreases suddenly and unexpectedly, this will have a great impact on the wealth of the home owner. As can be seen in the next chapter, as soon as the home owner has a reverse mortgage with a no negative equity guarantee, sudden decreases in the price of his house will not affect him (as long as it was not his fault that his house price dropped). This seems a good reason for retirees to get a reverse mortgage.

Ad C. As we will see in the next chapter reverse mortgages are the solution to make it possible to gradually consume the wealth that is built up in the housing. It makes it possible to even use the value of the house in a lifetime annuity for the retiree.

Three reasons why they reverse mortgages are not popular yet, which I will further consider in the later chapters are (Roon, Eichholtz, & Koedijk, 2010):

- There might be cultural reasons. Houses might be inherited by children to live in. In that case it is not realistic to sell a house for a reverse mortgage. Another cultural reason might be that houses are not owned, but leased. We will see that this is the case in Singapore (See chapter 0).
- The reverse mortgage might be a too difficult product to understand for the home owner. Although the financial institutions will of course do the calculations for the borrowers a lack of understanding the product can easily lead to a lack of trust. (Roon, Eichholtz, & Koedijk, 2010) also state that investigations in Australia reported that younger generations (with a higher financial education level) are planning to use products like reverse mortgages more than older generations.
- Not enough government involvement. As we will see, in the USA the government has been active in setting up reverse mortgage schemes, and we will see that they are quite more popular over there than in the Netherlands. This might have to do with a lack of trust in financial institutions (especially after the crises in the last decade).

I think reverse mortgages might be a good solution to ensure that there will not occur a pension crisis in the near future. There is a lot of wealth in housing, and retirees do not have the possibilities to use that wealth at this moment yet, which can be changed by the use of reverse mortgages.

6. AN INTRODUCTION OF THE REVERSE MORTGAGE PRODUCT

In this chapter I will introduce the concept of the reverse mortgage product, and I will discuss the No negative equity guarantee (NNEG) before treating the advantages and disadvantages of such a product. Finally I will discuss household finance and the place reverse mortgages could take therein.

1. Reverse mortgage product

Before we get into the modelling of a reverse mortgage, all the advantages and disadvantages and the possibilities for reverse mortgages to solve the pension problems, we have to know what a reverse mortgage exactly is, and why someone might want to buy such a product.

Suppose you have bought a house about forty years ago and currently you are around the retirement age of 67. Furthermore, suppose your house's mortgage is completely paid off. After your retirement, you want to have the same standards of living as before your retirement. At this moment, 40% of the retired population cannot keep up the same standards of living just after retirement, as can be seen in an investigation of Multiscope (Multiscope, 2015). Of course you have the option is to sell your house and find some cheaper housing, but I am sure you would like to stay in the house you are currently living in. In that case, a reverse mortgage can offer a solution.

Other reasons for getting a reverse mortgage might be to help cushion shocks in pension income, or help in the optimal timing of bequests (Dillingh, Prast, Rossi, & Brancati, 2013).I will get further into these reasons in chapter 2. For now, let's have a look at what a reverse mortgage exactly is.

A REVERSE MORTGAGE is a financial structure in which a homeowner borrows against the equity in his house and does not have to pay back the loan until either the borrower dies or sells his house (Eschtruth, 2001). When this happens, the money earned by selling the house can be used for repaying the loan of the reverse mortgage. The money borrowed in the reverse mortgage construction can be either a lump sum, a line of credit or a monthly tenure or term (CFPB, 2014). The mortgage interest is added to the debt while the reverse mortgage is still outstanding.

No negative equity guarantee (NNEG)

One problem with a reverse mortgage for the borrower is that you cannot know the selling price of your house in advance like in an interest-only mortgage. That means that you might not be able to completely pay off your loan by using the money you get from selling the house.

Therefore usually a 'No Negative Equity Guarantee' (NNEG) is given with such a product. This means that if the value of the house while selling it is not enough to cover the complete loan, the difference will not be recovered from the borrower. If, on the other hand, the selling price of the house is higher than the loan, the borrower (or his heirs) will get the difference (Rawlinson, 2006). Of course this no negative equity guarantee is not free, and this is included in the price of the product.

The point where the value of the loan equals the value of the house is called the cross-over point, and the risk that this point will be passed is called the cross-over risk. It is the risk that the loan will

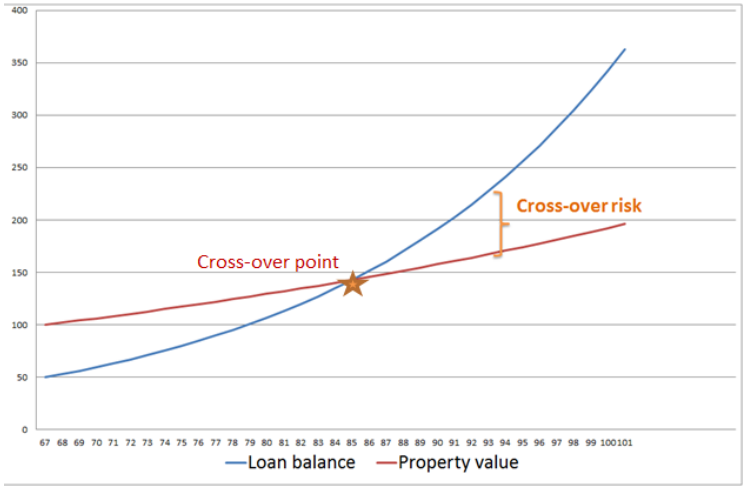

FIGURE 1 CROSS OVER RISK

not be fully paid back to the lender, which is illustrated in **Fout! Verwijzingsbron niet gevonden.** from (Werner-Huibers, 2013).

In this thesis we will only consider reverse mortgages with NNEG.

Available reverse mortgages in The Netherlands

In the Netherlands the only available reverse mortgage product is the Florius Verzilverhypotheek and this product is seldom sold (Florius, 2016). The reasons for this are explored extensively throughout this thesis.

2. Advantages and disadvantages of reverse mortgages

In this section I will consider the advantages and disadvantages of reverse mortgages both from the point of view of the borrower as well as from the point of view of a financial institution.

View of the Borrower

The following advantages for the borrower of a reverse mortgage are self-evident :

- The borrower can borrow money to get a better standard of living. As stated before, 40% of the people just retired cannot keep up the standards of living they are used too (Multiscope, 2015) without extra money;
- The borrower can borrow money to do a big purchase or to finally travel around the world just after retirement; or
- The borrower can borrow money can from a bequest motive. In this way the borrower can give his money to his heirs without having to sell the house already. In this way the heirs can get this money at a moment that they can certainly use it, instead of at the moment of death of the borrower, which is at an uncertain moment, where the heirs might be retirees themselves, and have no need for any extra money.

The biggest disadvantage of a reversed mortgage for the borrower is that if the borrower decides to leave his property, the reverse mortgage will cost the borrower more than he gets out of it (Farrell, 2011).

Furthermore, the borrower of course has to pay interest on the reverse mortgage loan which means that a part of the value of the house will go to the financial institution in this way anyway. In case of the bequest motive, one can see this interest as a compensation that has to be paid to the financial institution for the fact that the heirs get their money earlier.

View of the Financial Institution

The financial institution which agrees to a reverse mortgage can lend money against an interest rate and be sure the money will be returned, since there is a house as collateral, i.e. as long as the value of the house is higher than the value of the loan as is explained in “No negative equity guarantee (NNEG)”. This immediately makes clear one of the risks for the institution: It might not get all its money back, because of the NNEG. That is a reason why the financial institution might only loan an amount of money which is a percentage of the value of the collateral. The institution has to do some good pricing for the reverse mortgage. They have to take into account:

- A possible decreasing of house prices, house prices are volatile in the long run as we have seen in the crises in the last decade; so this should be priced in.
- The interest rates may rise. The interest rate on the reverse mortgage will be fixed (as it is for usual mortgages), but it is definitely possible that the interest in the market will become higher than the interest rate on the reverse mortgage. The financial institution has to take counter measures against that (Which is why the interest on a reverse mortgage might be a bit higher).
- The longevity of borrowers: It is uncertain how long the borrowers will keep living in their houses. Since people live longer and longer, the financial institution definitely has to account for that in the prices of their reverse mortgage products.
- Costs: Startup costs commercial costs, administration costs, costs of staff. In one way or another this has to get back to the financial institution.

The first three of these risks will be taken into account when we will try to calculate a fair price for a reverse mortgage later in this thesis.

Until now it looks like there are only disadvantages for the financial institution, but of course that cannot be the case. Advantages are:

- The institution can make a profit on the loan via the interest.
- Furthermore the addition of reverse mortgages to a financial institutions portfolio leads to more diversification. More diversification means that less capital for other products must be maintained.
- Finally there might be profit on other parts of the price: the people may live shorter than expected, or interest rates in the market may decrease, in which case still a higher interest on the reverse mortgage product is paid.

Of course house prices may increase also, but if that is the case the additional value of the house at the moment of selling is for the heirs of the borrower (in case of death) and not for the financial institution.

3. Household finance in conjunction with reverse mortgages

In this section I will start by giving a short introduction in household finance and how this is looked at from a scientific point of view. I will state what households should do optimally based on household finance science, and compare that to what households do in practice. Thereafter I will look at reverse mortgages and what the influence of our earlier results on these products might be. The arguments and text in this chapter is highly based on the views of John Campbell.

Firstly, household finance is quite different from corporate finance. Of course one can state that "by analogy with corporate finance, household finance asks how households use financial instruments to attain their objectives", but thereafter one finds a very different set of problems. For example, households must plan over a long - but finite - horizon, while in corporate finance that usually is not necessary. Furthermore households have non-traded assets like their human capital and they hold illiquid assets like their house. In contrast to corporates they have much more strict constraints on their ability to borrow money and finally they have to deal with complex taxation (Campbell, 2006).

On the other hand, there is a big difference between corporate finance and household finance. From corporates you can expect that the things economic agents should do from a scientific financial perspective and the things they do coincide. For households, this is definitely not guaranteed at all. It is definitely possible that a household should invest in stocks from a financial viewpoint, and that might even be advised to the household by a financial planner, but the household might still not do this. You will not see this behaviour in corporates. Reasons for this might be mental accounting and loss aversion, two concepts that were introduced by Daniel Kahneman and Adam Tzversky (Kahneman, 2014).

Loss accounting is the fact that people try harder to avoid loss then to make profit. Everyone knows the feeling of buying something from a bonus instead of buying something from the normal salary. In the first case, it feels like it is easier to spend money, because it does not feel like a loss. Instead it is feeling like less profit. People try to avoid loss, but do not maximize profit in these cases.

Mental accounting is the process in which humans use different accounts in their mind for different purposes, which sometimes lead to foolish results. An example is about two sports fans, that want to

go to a match 50 miles away. One of them has paid for his entrance ticket, while the other got his ticket for free from a friend of his family. On the day of the match there is a heavy snow storm. Which of the fans will try harder to get to the game? You will say that this is the one that has paid for his ticket, and that is what happens in reality. But from a purely economic point of view the entrance ticket has already been paid for and cannot be exchanged. The cost of not going should be the same for both sports fans, and therefore they should be equally likely not to go (Kahneman, 2014).

One of the reasons household finance is this difficult is that you cannot really model this kind of behavior.

Another example is based on regret aversion:
Suppose Paul has stocks in company A and considers changing to company B. He decides not to change and at the end of the year he discovers that he might have earned 1200 dollar more if he had changed. Suppose furthermore that George has stocks in company B and does change to company A at the same moment. At the end of the year he discovers that he would have earned 1200 dollar more if he had not changed. Kahneman asks whether Paul or George will regret his actions more. 92% of the respondents say George, while from an economical perspective you should expect 50/50. Thus it is economically totally incomprehensible, which leads to the conclusion that actions like this in household finance will be very difficult to model, based solely on economic parameters (Kahneman, 2014).

Another problem in household finance is the fact that it is extremely difficult to measure the wealth of households. The data is not public, and it will be very difficult to get good data from respondents on something as private as their financial situation. The best thing that can be done is make use of tax return statements and maybe some data from financial institutions via which the households participate in stock markets et cetera. Thereafter this data also has to be combined to get correct data which can be used for studying the finance of households (Campbell, 2006).

For now let's consider the problem of (reverse) mortgages in household finance. For stock markets, it is possible that households do not own stocks, because they think they have not enough financial knowledge to make the right decisions, which may or may not be true. You do not see this phenomenon as it comes down to mortgages. This presumably follows from the lack of a simpler alternative. Although there are usually different kinds of mortgages available and it is possible to refinance them on various moments, in most cases households do not refinance their mortgages as often as they should from a pure economical point of view (Campbell, 2006). The reason that they refinance not often enough might easily be as a result from status quo bias. This is the bias of people to prefer to keep the known instead of changing to something uncertain (Kahneman, 2014). This might also be the reason that in different countries there are different mortgage products, but within a country you usually see very much of the same mortgage contracts.

Finally also consider the problem that when introducing a new product there has to be a large enough market for it to get profitable. If a new complex financial product will come into the market, it has to be adapted by financial well-educated individuals at first, who think it is in their best interest to get such a product. Then it has to get to the more average person too. In that case the product might benefit from scale and diversification benefits. As long as only the well-educated individuals own the product, these advantages will not be completely there yet. This can prevent the entry to

the market of new products, since the well-educated will not want to buy the product until there is a large market for it. Otherwise they do not have the scaling or diversification benefits. The average person will not buy something the well-educated do not buy and in this way we are at the starting point again (Campbell, 2006).

For reverse mortgages this means that for the best way to get introduced into the market, it has to be considered a clear advantageous product not only by the highly financial educated individuals, but also by the average person. To do this, good marketing and good financial advising will be necessary. As Keynes already wrote in 1932 that he looked forward to a “distant future when economists will be thought of as humble, competent people, on level with dentists”, this is still something to aim for in the near future to get the reverse mortgages in the market (Campbell, 2006).

7. REVERSE MORTGAGES, LESSONS, EXPERIENCES AND OTHER FACTORS

In this chapter I will describe which lessons on introducing reverse mortgages can be learned from experiences in other countries. Furthermore, the psychological factors in the market of reverse mortgages are described, and I will describe moral hazard and adverse selection in depth.

1. Comparison: Reverse mortgages in other countries

This section concerns reverse mortgages in various other countries. I will discuss the most relevant features of them and their popularity. I will look at the USA, the United Kingdom, and various countries in Asia.

Reverse Mortgages in the USA

In the USA homeowners can have a loan on their equity in various ways, one of them being the traditional mortgage in which future monthly payments are required. Since the older retired population usually does not meet the criteria for those loans, the elderly have reverse mortgages. By far most of these reverse mortgages are in the Home Equity's Conversion Mortgage (HECM) program insured by the federal housing administration (FHA) (Cocco & Lopes, 2015).This is a typical reverse mortgage product which enables Americans from 62 years and older to use their homes equity for a loan (Castro, 2016). The following payment plans can be used (Castro, 2016):

Payment plan	Explanation
Tenure	Equal monthly payments as long as at least one borrower lives and continues to occupy the property as a principal residence
Term	Equal monthly payments for a fixed period of months selected
Line of credit	Unscheduled payments or in installments, at times and in an amount of your choosing until the line of credit is exhausted
Modified tenure	Combination of line of credit and scheduled monthly payments for as long as you remain in the home
Modified term	Combination of line of credit plus monthly payments for a fixed period of months selected by the borrower

TABEL 1: PAYMENT PLANS

As we can see, there is plenty of choice for the person that wants to have a reverse mortgage in the USA.

Similar to the setup with the no negative equity guarantee (NNEG) in the Netherlands, in this program if at the time of selling the house (either because the borrower moves out or dies), the borrower does not have to pay any difference if the value of the house is lower than the outstanding loan. This difference is covered by the FHA insurance, and thus the lender will get his money back (Cocco & Lopes, 2015). This is not regulated in this way in the Netherlands. Of course, the borrower has to pay some small amount for this FHA insurance (Castro, 2016). This construction stimulates the use of reverse mortgages.

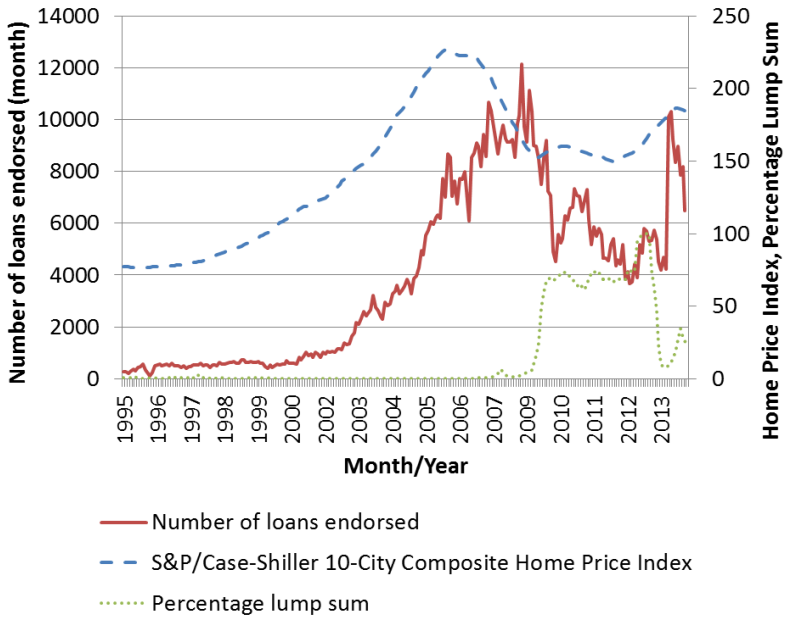

FIGURE 2 REVERSE MORTGAGES IN THE USA

Still not many eligible persons take a reverse mortgage in the USA (2-3%) as can be seen in Figure 2 from (Cocco & Lopes, 2015). In 2013 there were some changes in the reverse mortgage product in the HECM program, which meant that the borrowing limits became tighter but they are still higher than in for example the United Kingdom. Also the initial costs are higher than in the U.K. (Cocco & Lopes, 2015).

Reverse Mortgages in the United Kingdom (U.K.)

In this section I will compare reverse mortgages in the USA with those in the U.K. The reverse mortgage products in the U.K. are pretty similar to the one sold by Florius in the Netherlands, so the conclusions here to a certain extent also hold for the Netherlands. As in the USA in the U.K. there are also reverse mortgages that end as soon as the borrower dies or moves to another house. Both lump sum and line of credit reverse mortgages are possible (Cocco & Lopes, 2015).

By far the most important difference is that in the U.K. there are no guarantees on the product for the lender as with the FHA in the USA, thus the lender has to pay for NNEG himself. For that reason, the interest rates in the U.K. are higher and the borrowing limits are lower (Cocco & Lopes, 2015).

Reverse Mortgages in Asia

As a final comparison we will look into reverse mortgages in various Asian countries. In some of those countries reverse mortgages have taken on, while in others they are not even available.

In Singapore most of the value of housing was owned by their households, and Singapore has an aging population (Phang, 2015). Therefore it seems a good idea to sell reverse mortgages in Singapore. Two providers have done so in the past: NTUC Income in 1997 and OCBC Bank in 2006. Both stopped offering those reverse mortgages in 2009 because there were not enough borrowers. The reasons for this were (Phang, 2015):

- The schemes were complicated for the borrowers, i.e. either the borrowers had not enough financial education, or the lenders did not give a sufficient explanation of the product. Of course there can be done something about that.
- The lenders wanted properties with long remaining leases as collateral, so far from everyone could make use of the products. For this it is necessary to know that most housing in Singapore is public housing where buyers can buy 99-year leases of their house from the Housing and Development Board in Singapore.

Since in the Netherlands we do not have house leases, this should be no reason for reverse mortgages not being popular in the Netherlands.

In Korea in 2007 as part of a social safety network, a housing pension system started, which is a reverse mortgage product with a guarantee from the Korea Housing Finance Corporation (Wang & Kim, 2014). This housing pension system is a financial product, guaranteed by the government, in which elderly (60+ years) get a loan with their houses as collateral from a bank. If the value of the house at time of death (or moving) is lower than the value of the loan, the government pays the difference. This is a bit like the USA construction, although the difference is paid by the government and not by an insurance (So it is paid by taxes, and not by an insurance fee). For our investigation on reverse mortgages in the Netherlands, it seems wise to keep the possibility of such a construction in mind.

As a last Asian country, I will have a look at China. This seems logical, since it is the country with the most elderly persons in the world, and is an aging country. A country is an aging country if at least 10% of its population is over 60 years old or 7% of its population is over 65 years old, which makes China an aging country since 1999 (Wang & Kim, 2014). Also the standards of living are becoming better and better in China for the last couple of decades.

Therefore it should be no surprise that four cities in China started a reverse mortgage pilot program (CCTV, 2014). It was not received popular, and the reasons stated in interviews on the Chinese television were:

- If using your house for a reverse mortgage, what would the children inherit? Of course this seems not quite such in issue in the Netherlands.
- Will the insurance company compensate the family if the person dies shortly after signing such an agreement? Of course, as long as the person has not borrowed much, the repayment after selling the house will be small and the rest of the value of the house could go to the family.

Yao Yu from the China Insurance Regulatory Commission even stated that:

“For old people who don’t have children, have property but lack cash, we offer them a choice to turn their fixed assets into current assets, to live more comfortably in their own home in their old age” (CCTV, 2014).

In the Netherlands of course, usually children have their own houses, so the utilization of reverse mortgages would be expected to be higher.

2. Psychological background

In this section I will consider why reverse mortgages are a lot less popular than one would expect based on their advantages described in chapter 2. For this I will use results from investigations in the Netherlands. The results are based on a questionnaire held in the Netherlands (Dillingh, Prast, Rossi, & Brancati, 2013). Later in this chapter, I will also consider moral hazard and adverse selection.

As stated earlier, reasons for getting a reverse mortgage are to "facilitate consumption smoothing for the elderly, to cushion shocks in retirement income and to optimally time bequests" (Dillingh, Prast, Rossi, & Brancati, 2013). With the optimal timing of bequests we mean that it is far more efficient to get your heirs a bequest at the time they need it the most (which means: a time you can specify) then after your death, which might be either next year or in 40 years (Merton, 2007). Usually it would be better for the heirs to get there bequest earlier, since at that moment in time they are still paying for their own housing mortgage.

Since there is no good supply of reverse mortgages in the Netherlands the results are based on a questionnaire. Results of this questionnaire are (Dillingh, Prast, Rossi, & Brancati, 2013):

- Less than 10% of the respondents in the questionnaire had heard of reverse mortgages.
- More than 25% of the homeowners aged 45 or more is interested or moderately interested in the product.

Since there is almost no supply of reverse mortgages the unfamiliarity is not a surprising result. The second result certainly points at a possibility to sell reverse mortgages in the Netherlands, although being interested is not exactly the same as saying that one would take a reverse mortgage in the future. Of course the fact that more people are interested than have heard of reverse mortgages suggests that there are opportunities for financial institutions in this area.

Other results of the questionnaire were:

- Interest (as in popularity) in reverse mortgages is higher among people who fear pension cuts than among others.
- People for which the ratio of housing wealth over income is greater are more interested in reverse mortgages than others.

Both of these observations lead to the idea that reverse mortgages in the Netherlands could be used extremely well as a product to keep consumption of pensioners up to their standards and to cushion shocks in their pensions.

Furthermore a reverse mortgage might be used for a single large purchase such as for travelling shortly after retirement.

All of these results are completely based on observations in the Netherlands, and are therefore not necessarily valid for other countries. In Italy for example, the reverse mortgage is better known, but it is not popular, since it is seen as a last resort against poor consumption and not as an instrument to gain a better standard of living (Fornero, Rossi, & Brancati, 2015).

Other factors that might account for the small supply of reverse mortgages in the Netherlands are moral hazard and adverse selection.

Moral hazard

One of the dangers in selling reverse mortgages is moral hazard. There are two possibilities of moral hazard that can occur in a reverse mortgage setting (Davidoff & Welke, 2005):

1. Since a mortgagor does not stay in the house that is used as the collateral of the mortgage at the end of the mortgage period, the mortgagor has no incentive to maintain the house and keep the value of the property the same. This is one of the reasons financial institutions might give for high fees with reverse mortgages. A contractual obligation to maintain the house would be another solution to ensure that this won't happen.
2. Since elderly with a reverse mortgage have more money to spend than the elderly without a reverse mortgage, it is relatively more attractive to stay in their houses for a longer period of time. This means that, in the process of pricing reverse mortgages, a financial institution should take this into account. As soon as reverse mortgages become more popular, this should be investigated, and included as part of the pricing process.
   In the USA this kind of moral hazard does not take place. In fact, people with a reverse mortgage on average move out of their houses sooner than other elderly (Davidoff & Welke, 2005). Therefore, we can ignore this issue in the Netherlands for now (although it should be investigated at a later time).

Adverse selection

Adverse selection in the context of reverse mortgages is the phenomenon that people that expect to stay in their houses longer probably are more interested in a reverse mortgage than people that intend to move (or expect to die) sooner. The most well-known example of this is the reverse mortgage of Jeanne Calment. When she was 90 years of age, the French attorney Andre-Francois Raffrey offered her to pay her the equivalent of 500 British pounds a month until her death in return for her apartment (Crisalli, 2010). This turned out to be a total miscalculation as Jeanne Calment lived until she was 122 years old, at which time Raffrey already was dead. This example directly illustrates why reverse mortgages should be offered by financial institutions and not by individuals, since financial institutions are able to overcome these kind of exceptions.

In reverse mortgages there is no adverse selection but selection instead. Elderly with reverse mortgages are expected to stay in their houses shorter than elderly without reverse mortgages. This follows from the following argumentation (Davidoff & Welke, 2005):

- Elderly with a reverse mortgage are more aware of their marginal utility (the money they want to spend) than elderly without a reverse mortgage, since that probably is the reason that they have a reverse mortgage.
- Therefore they are more aware of the gap between their marginal utility before and after moving out of their property.
- But then, if the price of their house is rising, they will be more inclined to sell their house increase their marginal utility even further.
- Therefore there should be selection instead of adverse selection.

Of course this reasoning was stated in 2005, at which time the house prices were rising and rising as can be seen in Figure 3 (Rohit, 2011). One would expect that this reasoning does not hold when

house prices are decreasing, since selling a house on which a reverse mortgage is taken, will not result in an increased marginal utility in this case. To show that there will also not be selection in the Netherlands, also house prices in the Netherlands are shown in Figure 4 **Ongeldige bron opgegeven.**.

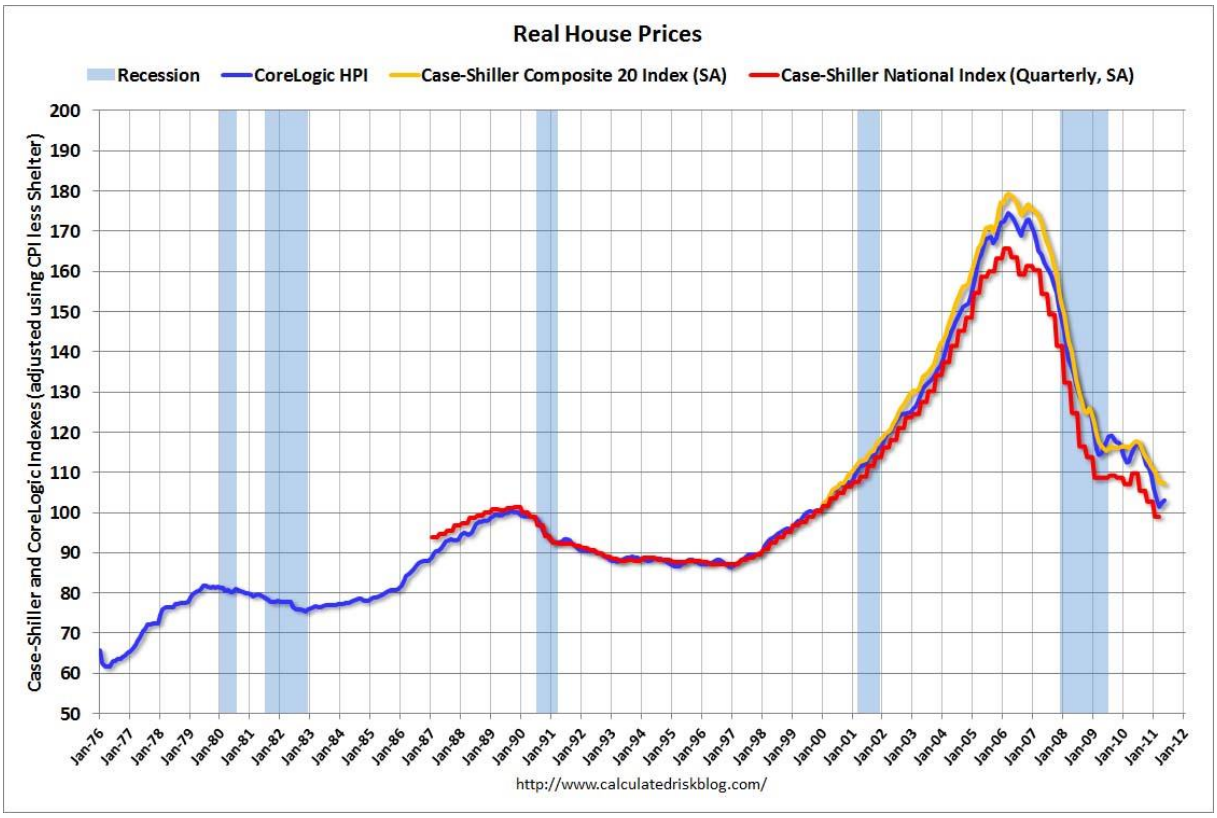

FIGURE 3: HOUSE PRICES IN THE USA

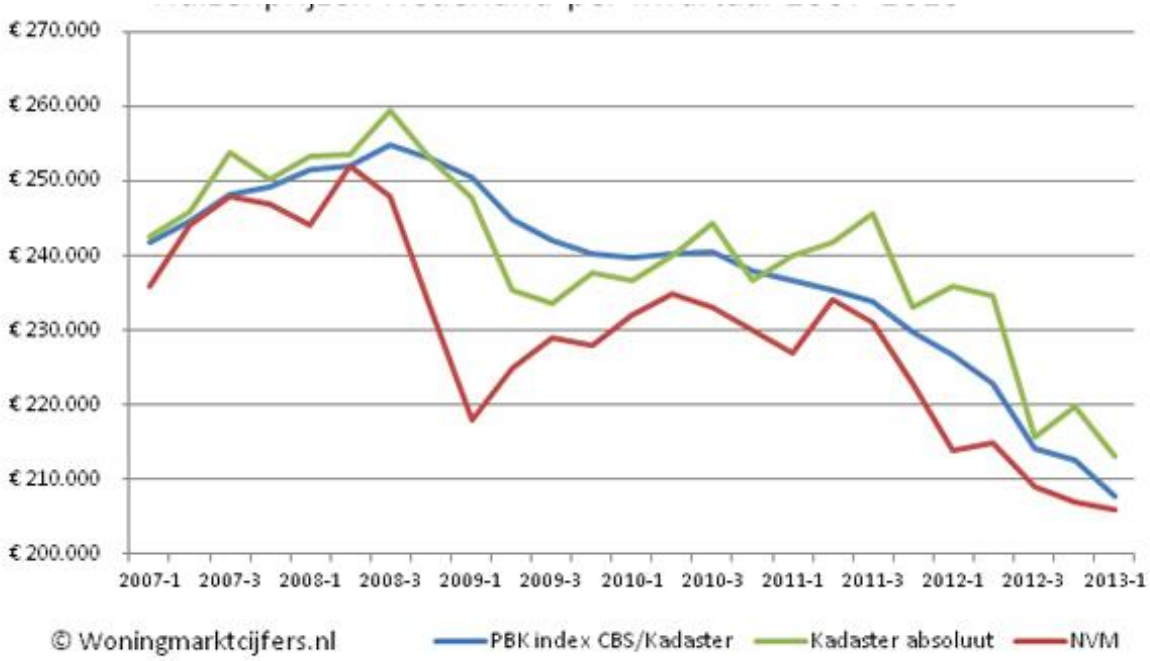

FIGURE 4: HOUSE PRICES IN THE NETHERLANDS

One can conclude that it might be necessary to take moral hazard and adverse selection into account in the pricing of reverse mortgages. I will not do this, since the effects rate to be quite low in comparison with the effects of interest, longevity and house prices. Furthermore one can conclude that the most important thing to do to get reverse mortgages on the market is to get them known by the people and to get people more financially educated.

8. Reverse Mortgage – Anatomy, modelling and framing

In this chapter I will follow the fictional characters of Kees and Bep, a typical Dutch couple, I will state my assumptions and give an overview of the framing of my model.

1. Example

Suppose Bep is just retired (67 years) and Kees is three years older (70)[1]. They own a house of 250.000 Euro, which is completely mortgage-free. They are interested in a reverse mortgage in the Netherlands. Their goal is to keep up their standards of living after retirement. Since currently the only product of that type is the Florius Verzilverhypotheek, I will have a look at their possibilities for that product. Thereafter the product I will model will be described.

Florius Verzilverhypotheek

For the Florius Verzilverhypotheek the minimum age is 60 years, and the amount that can be borrowed depends on the age of the borrowers and the value of the collateral. At maximum 55% of the value of the collateral can be borrowed. This percentage is also known as loan-to-value or LTV in the field of mortgages. As long as you fulfill some conditions, such as maintaining your house in a proper way, there will be no remaining debt. Independent of the duration of the loan, one can live in his house until death with this mortgage.

Now, let's consider the amount of money Kees and Bep can borrow with this mortgage, to achieve their goal.[2] The loan to value is 18.3%, i.e. 45.750 Euro. In the Florius Verzilverhypotheek the loan to value increases as the age at the start of borrowing increases. One of the reasons for this is the fact that the financial institution will run the various risks on the product for a shorter time, as the borrower will have a shorter life expectancy at the moment of closing the product.

The requested interest rate by Florius is 4.1%. In the Florius Verzilverhypotheek it is necessary to start with a one-time withdrawal of at least 4.500 Euro. In this way Florius can be sure to get at least the interest over that amount for the duration of the loan. Kees and Bep want to have this minimum amount, since they prefer to have a small amount each month, and do not need money to spend immediately.

Another property of the Florius Verzilverhypotheek is that you have to state a maximum number of months in which you want to make use of the loan, i.e. borrow money. In other words, it is impossible to choose for a duration 'until death'. In the table below, one can see the maximum amount Kees and Bep can borrow per month if they choose to let the duration be x months:

Duration in months (years)	Maximum amount / month (Euros)
60 (5)	688
120 (10)	344
180 (15)	229

[1] $X - y = 3$

[2] Calculations based on https://www.florius.nl/Pages/handig/bereken-verzilver-hypotheek.aspx These calculations are indications, and might not be completely accurate.

240 (20)	172
360 (30)	115

TABEL 2: FLORIUS VERZILVERHYPOTHEEK

As you can see, when the duration doubles, the maximum amount that can be borrowed is halved. This definitely implies that to calculate these amounts no mortality rates are used. To check this, one can try to calculate the amounts a 100-year old can borrow. This is halved if the duration doubles from 300 to 600 months, although no one gets to the age of 125 at this moment, let alone 150 years

Suppose Kees and Bep choose a duration of 15 years. Then the cashflows will be as follows:

- At the start of the reverse mortgage Kees and Bep get 4500 Euro.
- Thereafter they get 229 Euro each month for the next 15 years as long as they are still alive.
- The moment Kees and Bep are both dead, their house will be sold, and from the money earned the loan will be repaid to the financial institution.

Reasons why I think the Florius Verzilverhypotheek is not popular are:

- It is relatively unknown. If you ask your financial advisor about a reverse mortgage, it is definitely possible, that he will not know what it is.
- There is an obligation to start with a loan of 4500 Euro, which might turn possible customers off.

2. Assumptions

In this section I will state the assumptions and data for the product that I will model. They are split up in product assumptions, mortality assumptions, interest assumptions and assumptions on house prices.

Product assumptions

The product I will model will be based on monthly payments to the borrower until death. I will not model a certain number of months as in the Florius Verzilverhypotheek, but the reverse mortgage will always finish at death of the insured (couple).

At the end of each year there will be added a mortgage interest of 4% to the outstanding loan. The mortgage interest percentage is a parameter of the model and can therefore be changed for simulation purposes.

I assume that the reverse mortgage loan will be repaid at the moment that the insured person dies or, in case the mortgage is closed by a couple, at the moment of death of the longest surviving partner. In this way the possibility of moving to a nursing home before death is excluded. I have chosen to do so, since I do not have any data on this kind of moving. The effect of this assumption is that the maximum amount of the loan will decrease.

Furthermore, I will assume a Non Negative Equity Guarantee (NNEG), which means that if the value of the collateral is insufficient at time of death, the loss is for the financial institution, that offered the products.

Mortality assumptions

For mortality in the model I will start with the generation tables of the AG 2012-2062.[3] More information on this can be found in (Genootschap, 2012). For years after 2062 I will assume the same mortality probabilities as for the year 2062, since no better assumptions are available. Furthermore, I will assume that in case of couples the mortality rates of both persons of the couple are independent of each other. Of course this assumption is not realistic, but there are no mortality tables available in which such dependencies are processed. I will assume this will not have any relevant effect on the results of the model. Based on this mortality tables, the model calculates in each year:

- The probability loans have to be paid to the borrower in this year, i.e. the probability that at least one of the insureds is still alive in this year. The probability an amount has to be paid in year x equals:
  1 - $(1-{}_tp_x) * (1-{}_tp_y)$
  where ${}_tp_x$ is the possibility that a male of age x is still alive x years from now, and ${}_tp_y$ is the same possibility for a female of age y.
- The probability that year x is the last year of the reverse mortgage, since the longest surviving of the couple dies in year x equals:
  $(1-{}_tp_x) * q_y + (1-{}_tp_y) * q_x - q_x * q_y$
  Note that the last term is a correction factor, to make sure we do not count the possibility of both partners dying in the same year twice.

To look at longevity, these mortality rates can be changed in the model.

Interest rate assumptions

In the model I will discount all cash flows to t = 0, which I will assume to be January 1st 2016. I will use the risk free rate that can be found on the EIPOA web site without any adjustments and which is plotted in the graph below. The structure for 31-12-2015 can be found in Appendix A. I will discount all cash flows, i.e. all expected loans and the expected repayment of the loan at time of death to t = 0 based on this curve. The profit on interest of the product for the financial institution is the difference between the mortgage interest paid and the risk free rate.

[3] Prognosetafel AG 2012-2062

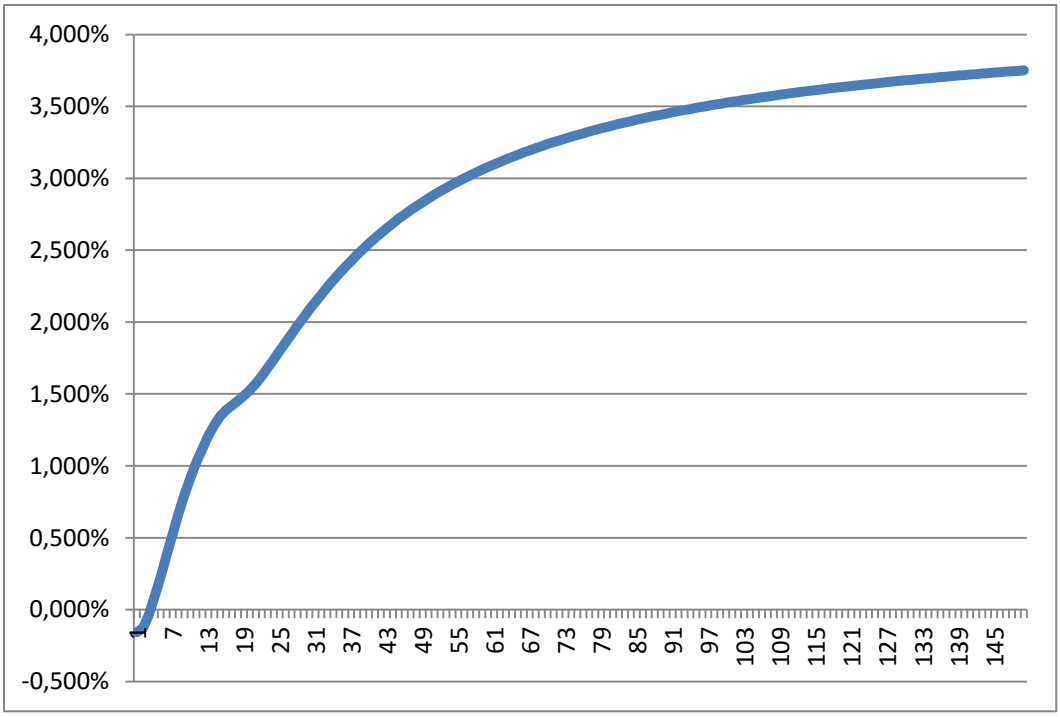

FIGURE 5 RISK FREE RATE 31-12-2015

House prices

For housing prices I assume them to stay constant in the future. This is a unrealistic view, since various sources seem to think they will at least increase with inflation. Furthermore I have included a variable in my model that states which percentage of the current house price should be used for the calculation of the possible amount that can be borrowed. I will set this LTV-variable at 80% and vary this in the next chapter. I will also add inflation to these prices.

3. Framing of the model

The model I used for this thesis calculates the following:

- the present value of the expected loans;
- the profit that a financial institution will make on interest by calculating the difference between the mortgage interest and the risk free interest;
- the present value of the expected amount the financial institution will lose as a consequence of the NNEG condition of the product, based on a collateral value of 80% of the current housing price; and
- The present value of all expected future cash flows as a difference between the previous two numbers.

Thereafter the model will search for the maximum amount of the loan per month for the reverse mortgage, on which the present value of the total cash flows is zero. This is the amount, the borrower can lend in the product, and as long as the value of the collateral will be at least 80% of the current housing price, there is an expected profit for the financial institution.

A best estimate for the expected profit can be calculated by recalculating the present value of the expected cash flows with the real estimation for the collateral value and taking the difference.

9. MODEL: RESULTS AND SCENARIOS

In this chapter I will elaborate on the results of my pricing model for the reverse mortgage of Kees and Bep in different scenarios. First the starting point is given. Thereafter I will vary expected housing prices, including inflation in the house prices, mortgage interest, interest and mortality.

My starting assumptions are as discussed in the previous chapter:

- Kees (male), 67 years and Bep (female), 70 years take a reverse mortgage product for the rest of their lives on January 1st 2016
- The collateral is their house with a current value of 250.000 Euro.
- Mortality is based on AG 2012-2062
- Interest curve for discounting is the risk free rate of EIOPA without adjustments on 31-12-2015.
- Expected housing prices are a constant equal to 80% of the current housing price.

Based on these assumptions and requiring a total present value of 0 for the sum of all future cash flows (i.e. a fair product) the model finds a reverse mortgage of 320 Euro / month for Kees and Bep for the rest of their lives. In this result administration costs and startup costs are not taken into account.

Different expected housing prices

By updating the expected collateral to be equal to the current housing price (instead of 80% of the housing price), you can find a present value of all future cash flows for this reverse mortgage of 15054 Euro. In this result administration costs and startup costs are not taken into account.

You can also model the housing price to increase with an inflation of various inflation percentages as in the table below.

%Collateral/Inflation%	0%	1%	2%
80%	0	18.254	32.118
100%	15.054	29.478	37.068
120%	24.844	34.777	38.489

TABEL 3: PRESENT VALUE OF EXPECTED CASH FLOWS OF KEES AND BEP BASED ON DIFFERENT EXPECTED HOUSE PRICES

It is clear from the model that the expected cash flow for the financial institution is higher if the house price is higher. This is because in those cases the price of the NNEG guarantee for the financial institution decreases.

Different mortgage interest rates

Until now all calculations were done with a mortgage interest rate of 4,0%. In the Florius Verzilverhypotheek the mortgage interest is 4,1%. In the following table the maximum possible amount Kees and Bep can borrow based on different mortgage interest rates is stated:

Mortgage interest percentage	Monthly amount for Kees and Bep (in Euros)
3,5%	328

4,0%	320
4,1%	318
4,5%	310

TABEL 4: MONTHLY AMOUNT OF THE REVERSE MORTGAGE BASED ON DIFFERENT MORTGAGE INTEREST RATES

As expected a higher mortgage interest rate leads to a lower possible monthly amount that Kees and Bep van borrow. Note that these are monthly differences, which leads to great differences in the present value of all future cash flows.

Different interest rates

Before we have each time assumed the risk free interest rate for discounting. If you shock the interest rates for discounting purposes you get the following results for the present value of the future cash flows:

Shock (basis points)	Present value expected cash flows (Euros)
-50	14355
-10	2777
0	0
+10	-2884
+50	-13780

TABEL 5: PRESENT VALUE OF EXPECTED CASH FLOWS BASED ON PARALLEL SHOCKED INTEREST CURVES

As you can see, if the risk free rate interest percentage increases, the present value of the future cash flows of the reverse mortgage decreases. This is a logical consequence, as a higher risk free interest rate implies less profit on interest for the financial institution and therefore a lower expected income.

Different mortality rates

The results until now are based on the mortality rates of the AG 2012-2062 generation table. If we instead use the more recent mortality table AG 2014, we find a present value of the expected cash flows of Kees and Bep of -1927 Euro. This means that the financial institution that starts selling reverse mortgages has to take changing mortality rates into account.

Conclusions

Based on the model I have calculated the present value of the expected cash flows of the reverse mortgage of Kees and Bep. As one would expect they are dependent on mortality, interest and housing prices. I have given some possible scenarios, and shown what the effects on the present value of the reverse mortgage would be. Higher life expectancies, higher risk free interest rates and a lower expected house price all lead to a lower present value, as one would expect.

To really implement such a product in the market a financial institution should make various decisions on its assumptions, where the results in this chapter and the accompanying model can be used as a guide.

10. INTRODUCING REVERSE MORTGAGES INTO THE DUTCH MARKET

In earlier chapters we have seen the reasons why reverse mortgages are unpopular in the Netherlands, such as the fact that they are relatively unknown. That should not be a reason not to add this product to the product range of a financial institution. We have seen all advantages and disadvantages of the product in chapter 2, and various aspects of the pricing of such a product in chapter 9. Finally there are a few other advantages of being one of the first institutions to offer this product. Some first mover advantages are:

- As long as you are the only one in the market, persons that want to close a reverse mortgage will come to you. In this way you get a higher market share, and it is not to be expected that persons that have a reverse mortgage will frequently change to another provider of those products.
- By being one of the first to offer reverse mortgages, you can be the first to collect data on such products, which leads to more information for future decisions. In this case this will lead to more knowledge, which can be used to develop the product and enlarge the market share.
- As long as there are no other players in the reverse mortgage market, a financial institution can implement a higher profit margin. As long as there are no competitors with lower prices, one can make more profit here.

Of course being a first mover also has a few disadvantages:

- If the product contains risks that are not seen and cannot yet be predicted, a completely new product may lead to unpredicted losses. In this case this seems to be unlikely, since Florius already has a similar product, although longevity might be an issue here.
- To be a first mover a financial institution has to do research to set the assumptions. Later movers into the market might be able to make use of already obtained knowledge. To obtain this knowledge involves some startup costs.

With this advantages and disadvantages considered together with the advantages and disadvantages in chapter 6, I think it would be a good idea to introduce reverse mortgages to the Dutch market.

11. CONCLUSION

In this conclusion I will answer the research questions I stated in the introduction.

Why are reverse mortgages unpopular in the Netherlands, while it should be a popular product, based on its characteristics and what are the factors that can trigger reverse mortgages within the future of Dutch household finance?

The most important reason for this is the fact that people are not familiar with the product. As was stated in chapter 7, only 10% of the Dutch population knows what a reverse mortgage product is. Furthermore all characteristics of the product seem to have the potential for the reverse mortgage product to become popular. Reverse mortgages in the Netherlands might be triggered by a big financial player getting a reverse mortgage product in the market and marketing.

How are reverse mortgages a possible solution for the Dutch pension crisis that will be upon us?

Since most retirees own a house, and for 40% of them their pensions are inadequate to keep their standard of living the same as they are used to from the moment they retire, the selling of their house while keep living in it helps them get more cash. In this way it reduces the impact of the pension crisis for the retired persons.

Why should reverse mortgages be embedded in household finance?

One should use the value of the house as part of the wealth of a household (Campbell, 2006). The only way this can be done after a house is completely financed and without moving to a smaller house is by getting a reverse mortgage on that house. In chapter 3 it is concluded that good marketing and good financial advising will be necessary to get reverse mortgages into the Dutch market.

What can we learn from other countries at the start-up of the reverse mortgage market in the Netherlands?

In some other countries reverse mortgages are already being sold, and in some countries it has been tried, but they are flopped. Reasons for these flops were that houses were leased or that it was tradition in the country that children of the retired would go and live in their house, so it could not be sold. It is also seen that the government sometimes guarantee the NNEG via insurances, which leads to a lower mortgage interest rates and higher borrowing limits, as can be seen in chapter 7.

What can be done to take away the psychological barriers for the Dutch society to get involved in the reverse mortgage market?

First of all the reverse mortgage product should be made much more popular by advertising, leading to more popularity in the Netherlands. Furthermore it would help if the government would insure the NNEG as in the USA, since then financial institutions might be more inclined to offer the product.

What should be the price of a reverse mortgage, and to which extent should this be dependent on the rising life expectations?

A model to price reverse mortgages is elaborated upon in chapter 8. We have seen for an example that the present value of the expected cash flows depends more on the house prices than on the life expectancies. Of course this might change for bigger portfolios. To be more specific, a financial institution might model what will happen with a complete portfolio of reverse mortgages.

How should a modern financial institution start its activities to become a key player in the (start-up of the) reverse mortgage market in the Netherlands?

I think a modern financial institution that wants to make use of the benefits of selling reverse mortgages should start by making the product more known in society. Besides it is also of importance to investigate what they want to assume and price the reverse mortgage product accordingly.

12. "ADVERTORIAL"

A financial institution might start to get reverse mortgages more popular by starting an advertorial like the following one:

Do you own a house?

Have you (almost) reached your retirement age and:

- ***Will you get a lower pension than you would have hoped? Or:***
- ***Do you want to make that trip around the world now, which you've always dreamed about? Or:***
- ***Do you want to give your children something extra now they can still make good use of it?***

In that case our reverse mortgage might be something for you!

Contact us at …

Or in Dutch:

Bezit u een eigen huis?

Gaat u (bijna) met pensioen?

- ***Heeft u een lager pensioen dan u gehoopt had in het verschiet? Of:***
- ***Wilt u nu eindelijk die wereldreis gaan maken waar u altijd van gedroomd hebt? Of:***
- ***Wilt u uw kinderen nu alvast een extraatje geven, nu ze het nog kunnen gebruiken?***

In dat geval is onze omkeerhypotheek misschien wel wat voor u!

Neem contact met ons op, via…

13. SUGGESTIONS FOR FURTHER RESEARCH

After reading this thesis, if the subject of reverse mortgages interests you, and you want to do further research, there are various possibilities still open. A not exhaustive list:

- More in-depth analysis of the assumptions of the product can be done. Especially more investigations can be done on expected house prices, selection and adverse selection in different house price markets, or the influence of the mortgage interest rate on the risk free interest rate and vice versa;
- Other products, such as reverse mortgages without NNEG can be investigated;
- Reverse mortgages for other persons than “Kees” and “Bep” might be investigated;
- Other product features can be investigated, such as products that do not pay the same amount each year.

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15. APPENDIX A

Risk free interest rate at 31-12-2015 (EIOPA):

Year	Interest rate						
1	-0,157%	41	2,584%	81	3,368%	121	3,642%
2	-0,129%	42	2,619%	82	3,378%	122	3,647%
3	-0,038%	43	2,654%	83	3,388%	123	3,651%
4	0,096%	44	2,687%	84	3,397%	124	3,656%
5	0,232%	45	2,719%	85	3,407%	125	3,660%
6	0,381%	46	2,749%	86	3,416%	126	3,664%
7	0,526%	47	2,779%	87	3,425%	127	3,668%
8	0,667%	48	2,807%	88	3,434%	128	3,672%
9	0,801%	49	2,834%	89	3,442%	129	3,677%
10	0,921%	50	2,861%	90	3,451%	130	3,681%
11	1,026%	51	2,886%	91	3,459%	131	3,685%
12	1,120%	52	2,911%	92	3,467%	132	3,688%
13	1,208%	53	2,934%	93	3,475%	133	3,692%
14	1,284%	54	2,957%	94	3,482%	134	3,696%
15	1,344%	55	2,979%	95	3,490%	135	3,700%
16	1,388%	56	3,001%	96	3,497%	136	3,703%
17	1,422%	57	3,021%	97	3,504%	137	3,707%
18	1,454%	58	3,041%	98	3,512%	138	3,711%
19	1,488%	59	3,061%	99	3,518%	139	3,714%
20	1,527%	60	3,079%	100	3,525%	140	3,718%
21	1,574%	61	3,097%	101	3,532%	141	3,721%
22	1,627%	62	3,115%	102	3,538%	142	3,724%
23	1,683%	63	3,132%	103	3,545%	143	3,728%
24	1,741%	64	3,148%	104	3,551%	144	3,731%
25	1,800%	65	3,164%	105	3,557%	145	3,734%
26	1,859%	66	3,180%	106	3,563%	146	3,737%
27	1,918%	67	3,195%	107	3,569%	147	3,741%
28	1,976%	68	3,210%	108	3,575%	148	3,744%
29	2,033%	69	3,224%	109	3,581%	149	3,747%
30	2,088%	70	3,238%	110	3,586%	150	3,750%
31	2,141%	71	3,251%	111	3,592%		
32	2,193%	72	3,264%	112	3,597%		
33	2,243%	73	3,277%	113	3,603%		
34	2,292%	74	3,289%	114	3,608%		
35	2,338%	75	3,301%	115	3,613%		
36	2,383%	76	3,313%	116	3,618%		
37	2,426%	77	3,325%	117	3,623%		
38	2,468%	78	3,336%	118	3,628%		
39	2,508%	79	3,347%	119	3,633%		
40	2,547%	80	3,357%	120	3,637%		