Netspar

Network for Studies on Pensions, Aging and Retirement

Netspar THESES

Marc de Graaf

The Elderly Home Equity Puzzle

The Demand for Mortgage Debt

MSc Thesis 2011-005

The elderly home equity puzzle: the demand for mortgage debt

This thesis focuses on the question whether the elderly home equity puzzle can be explained by passive saving behavior in the Netherlands. It is shown that homeownership and home equity increased gradually in the past decades. Among the elderly the market share of interest-only mortgages increased to over 80% in 20 years. This suggests that households stop accumulating capital by paying off mortgage debt. Instead, they let their capital accumulation depend on house price developments. This is a signal for (indirect) capital decumulation among the old by using mortgage debt as instrument. The model of Brueckner (1994) for mortgage demand is presented and empirical (instrumented variable and tobit) estimations are done. The results show a negative effect of age on mortgage demand. Therefore it seems that elderly tend to not using home equity for nonhousing consumption at old age. This suggests a contradiction to the standard lifecycle theorem, even in a country where the precautionary savings motive is expected to be small (due to small expected health costs and a generous pension scheme). Additionally, a panel study based on synthetic age cohorts is done (Deaton, 1985) in order to assess activity (or refinancing) in the demand for mortgage debt. It appears that elderly do not actively increase mortgage debt, but prefer to (indirectly) decumulate home equity by changing the type of mortgage to a cheaper or interest-only mortgage.

Name: MSc. Marcus A. de Graaf

Supervisors: Prof. dr. Rob J.M. Alessie

Prof. dr. Eduard H.M. Ponds

Tilburg University

May 2011

“Who is wise and

understanding among you?

Let him show by good conduct

that his deeds are done

in gentleness of wisdom.”

(James 3: 13)

Table of contents

1. Introduction

The introduction is divided in 5 sub-paragraphs. First, the motivation for the research topic is given. Second, a literature overview is provided. Third, the extensions to current literature are discussed. Fourth, the main findings are summarized and fifth, the outline of this thesis is given. The main research question is whether the elderly home equity puzzle can be explained by passive behavior of Dutch households on the mortgage market.

1.1 Why this topic?

The elderly home equity puzzle comes forth from the observation that elderly maintain large amounts of home equity, while the lifecycle theory suggests that elderly should decumulate home equity. This implies that elderly should liquidize their home equity by either moving to a cheaper owned house, moving to a rented house, or by taking up mortgage debt. The first two ways of liquidizing home equity have the major disadvantage that moving is required. According to Artle and Varaiya (1978), this barrier could be the reason for the high amount of home equity held among the old. The third way however, offers a way to liquefy capital without the requirement to move.

Mortgage debt has a substantial advantage compared to the other types of liquefying home equity, which is that mortgage debt brings relatively small transaction costs. One could (partly) refinance his property, and use the liquefied capital for consumption purposes. Nowadays (over 30 years after the article of Artle and Varaiya), the types of mortgages developed and it became even easier to change the type or size of mortgage debt. Therefore the demand for mortgage debt is the instrument with small transaction costs which offers a way to actively determine the net home equity holdings of a household. The question why the elderly home equity puzzle exists automatically focuses on how households behave on the mortgage market and on what drives mortgage debt.

In the average household portfolio, home equity is the largest asset for homeowners (Spoor, 2008). Spoor investigated the opportunity to use home equity as supplementary source of income which could be used for health costs. Several scenarios in which the government would cut health benefits were considered. The main conclusions stated that the risks could be substantial (especially interest risk and house market risks), implying that the best time to decumulate home equity is when it is really necessary at the final stage of life (when amenities are most needed, while standard annuities and individual savings are not sufficient to cover all costs). However, this way of decumulation of home equity assumes that there will be a moment in which elderly

cannot pay for the costs anymore (and will need their accumulated home equity to cover these costs). This assumption is questionable, given that health costs are usually covered by mandatory insurance (or government).

Additionally, the older households get, the smaller the house market and interest risks become (due to the shorter remaining time horizon). Therefore the household could start decumulating home equity earlier. The household could exploit home equity as additional source of pension income and use it for consumption purposes (as implied by the lifecycle theory). However, the elderly home equity puzzle points out that elderly don't do this.

Especially now, during an era of aging, this phenomenon requires academic interest. Pension schemes and collective health care schemes will be cut when there are insufficient employees to bear the costs. At this point the availability of additional resources will become important. Given that home equity is the largest asset in the average household portfolio, understanding behavior of elderly on the house market is crucial. In case that elderly are unable or restricted in using home equity as additional source of pension income, home equity could offer a way out. However, before one can think of constructions that make it easier to decumulate home equity, it should be clear whether elderly are actually trying to use home equity as additional source of pension income. This is reflected in the main research question: can the elderly home equity puzzle be explained by passive behavior of Dutch households on the mortgage market? Passive behavior implies that there are no signs of households trying to decumulate their home equity.

1.2 Literature overview

In literature there are several views on the elderly home equity puzzle. Extensive research on aging and home equity in the US is performed by Venti and Wise (2004). They show that in the US the house is the largest asset for the average household and that elderly are not likely to move. Homeownership rates decline slightly among the oldest old, but the level remains substantial. They also show that the amount of home equity is increasing among most age cohorts. The oldest old do have slight decreases in home equity, but the decreases are rather small. Except for cases of catastrophic events such as the death of a spouse, the capital decumulation among the old is small. In addition Venti and Wise show that elderly who do move during their retirement period are just as likely to buy a larger (more expensive) house as to buy a smaller (less expensive) house. The main conclusion is that elderly do not use home equity for non-housing consumption at old age. They suggest to consider home equity as a buffer for unfortunate news (in line with a precautionary savings motive), while it remains questionable

why the old maintain the large amounts of home equity. These conclusion strongly support the existence of the elderly home equity puzzle in the US.

Skinner (2004) offers some comments on the home equity puzzle as shown by Venti and Wise (2004). He suggests that psychological factors (the attachment to the house) causes that elderly don't want to move. Another reason is that the elderly cannot insure against rent hikes. However, these rent hikes should be small compared to the benefits from liquefying ones house. If the elderly decide to move, the motive to liquefy home equity is only indicated by roughly 21% of the movers (Choi, 1996). The majority moves due to health problems, to live closer to family, or because of amenities. This suggests that the economic incentives may play only a modest role in the use of home equity. The final suggestion Skinner provides is that home equity can function as a safe haven for asset-based tests such as Medicaid.

All these suggestions may be relevant for the existence of the home equity puzzle and point at possible passive economic behavior among the elderly. However, the analyses of Venti and Wise (2004) departs from the idea that elderly can decumulate home equity in two ways. Either they move to a smaller owned house, or they move and start renting a house. Implicitly they also suggest the availability of reverse mortgages, but because of the small revealed interest in reverse mortgages, they focus on decumulation of home equity by moving. This is in line with Artle and Varaiya (1978), who stated that even when owning is cheaper than renting, households may still prefer to rent because of illiquidity of home equity. Both ignore the possibility to refinance mortgage debt to specific mortgage types or to specific levels of mortgage debt, while this is likely to be the most convenient way to liquefy home equity.

In several studies (Skinner, 1996 and Leviton, 2001) reverse mortgages have been considered. The conclusions point at the importance of precautionary savings (especially since the studies focus on the US), which explains the small demand for reverse mortgages. However, when applying this conclusion to countries with a small precautionary savings motive (i.e. collective health insurance and public pension schemes) it implies that elderly should demand reverse mortgages.

An important issue is that mortgage debt as instrument for decumulating home equity is assumed to result in demand for reverse mortgages. If this is not the case, then mortgage debt apparently is not used for decumulating capital and therefore it is ignored (as is the case in Artle and Varaiya, 1978 and Venti and Wise, 2004). Even in studies like Skinner (1996) and Leviton

(2001) the conclusion that the demand for reverse mortgages is small is assumed to imply that mortgage debt is not used as instrument for capital decumulation among the old. To some extent this conclusion is correct (since home equity is not reduced when households do not take a reverse mortgage). However, one could also argue that in fact there is indirect capital decumulation when households change the type of mortgage to a cheaper, or an interest-only type of mortgage. This trend is very large in the Netherlands (Rouwendal, 2007), implying that households stop accumulating home equity. This way of indirect capital decumulation brings the smallest transaction costs (no movement or change in the size of mortgage debt is required) and the smallest risk (i.e. modest house market and interest risk).

Since home equity is the largest asset in the average household portfolio (Spoor, 2008), one could focus on home equity when investigating wealth dynamics. The standard lifecycle models (Modigliani and Brumber, 1954) departs from the idea that households will engage in borrowing and lending in order to obtain more uniform consumption levels over life (Fisher, 1930). Therefore households are expected to save during their working life and spend their savings during retirement. The older elderly get, the larger mortality risk becomes and the shorter the remaining expected lifetime is. Therefore households are expected to spend their savings while they age. In literature there are several studies which show that this is not observed (Venti and Wise, 1989, 1990, 2004 and Feinstein and McFadden, 1989), which result in the home equity puzzle. In fact, households might even reduce their consumption when they get older (Banks, Blundell and Tanner, 1998 and Bernheim, Skinner and Weinberg, 2001). Several extensions to the standard lifecycle model, such as a bequest motive (Kotlikoff and Summer, 1981 and Hurd, 1987), a precautionary savings motive (Kimball, 1990), consumption constraints (Börsch-Supan and Stahl, 1992) or illiquidity of accumulated capital (Artle and Varaiya, 1978) have been put forward as possible explanations for the large amount of capital held at old age.

In the US, the precautionary savings motive received empirical support (Skinner, 1988 and Kimball, 1990), especially when considering a joint precautionary savings motive and an operational bequest motive (Dynan, Skinner and Zeldes, 2002). The precautionary savings motive takes a possibly bad (costly) scenario into account and prepares for if this scenario occurs (even while the probability is very small). This motive is driven by uncertainty about future expenses (Palumbo, 1999). On average households are likely to save more than they require, but they do know that the savings they leave on the table will be bequeathed. Therefore savings have two purposes, they either deal with unexpected high costs, or (in case these costs do not occur) they will be bequeathed (and therefore they are not considered as a waste).

When applying these motives to the Netherlands, the precautionary savings motive should be smaller (Hubbard, Skinner and Zeldes, 1995), given that the expected health costs are small, while in the US these costs are rather large (Doorslaer and Masseria, 2004). This implies that in the Netherlands, capital decumulation among the old should be more in line with the expectations of standard lifecycle theory (one can see the effect of the introduction of a social security scheme on wealth holdings in Kapteyn et al., 2005), and therefore the home equity puzzle should be non-existent or small. According to Rouwendal (2009), the home equity puzzle is rather large in the Netherlands as well. This raises doubts about the validity of the implications of lifecycle theory when considering the elderly home equity puzzle.

A different approach to the elderly home equity puzzle should consider whether there are signs of the willingness to decumulate capital among the old (as is assumed in the lifecycle theory). These signs (such as the refinancing of mortgage debt or increasing Loan-to-Value ratios) are a measure for activity or passivity in saving behavior. If increasing mortgage debt offers a convenient way for capital decumulation, then why does the elderly home equity puzzle still exist? Psychological research (Schwartz et al., 2002, Kliger and Schwartz, 2005 and Iyengar et al., 2006) states that maximizing behavior results in lower satisfaction levels than satisfying behavior. They also show that there is a learning curve in life, causing that the older people get, the more they will pursue satisfaction rather than maximization. This change in behavior would result in passive saving behavior among the old, which offers a theoretical background for the main research question.

1.3 New in this thesis

The most important feature of this thesis is that a model for mortgage demand is empirically estimated and compared between age groups. This allows for a comparison between the determinants of mortgage debt for young and old households. The setup of the model departs from the model as proposed by Brueckner (1994) and includes the current value of the house. This shows how the current value of the house affects mortgage demand among age groups and that this effect is significantly positive at old age, while it is insignificant or negative among young and middle-aged age groups. This implies that mortgage debt is used as instrument to decumulate home equity (while Artle and Varaiya, 1978 and Venti and Wise, 2004 ignore this instrument and only consider movements in their analyses).

Additionally, refinancing of mortgage debt is tested in a panel study based on synthetic age cohorts (Deaton, 1985). This analysis considers the effect of the change in the current value of

the house on the change in mortgage debt. This estimation offers a way to assess activity at the Dutch mortgage market. In several studies (which focus on the US), reverse mortgages are considered (i.e. Skinner, 1996 and Leviton, 2001), but all conclusions point at the lack of demand for reverse mortgages due to the precautionary savings motive. When applying these conclusions to the Netherlands (with a small precautionary savings motive), the demand for reserve mortgages should be large.

It will be shown that Dutch households do not increase mortgage debt for decumulation of home equity. But it is also shown that the current value of the house has a significantly positive effect on mortgage debt at old age. This implies that household use different methods than the reverse mortgages for (indirect) capital decumulation (i.e. by changing the type of mortgage to a cheaper or interest-only mortgage). The results show that on the contrary of what is often assumed, mortgage debt must be taken into account when considering capital decumulation among the old.

The descriptive analysis provides an update of several key characteristics of the Dutch house market such as the development of homeownership rates, net home equity and mortgage debt. Rouwendal (2007 and 2009) also presented some characteristics of the Dutch house market, but this thesis includes more recent data (up to 2009 rather than up to 2002 and 2006 respectively). The wave of 2009 brings a larger time horizon to test the panel study on (and test its robustness), since the required information about mortgage debt became available since the wave of 2002.

Another important feature is that the country considered is the Netherlands, while most research uses US data. The reason why the Netherlands is important for this research, is that Dutch households do not face large uncertain health costs, due to a mandatory health insurance scheme. Hubbard, Skinner and Zeldes (1995) and Kapteyn et al. (2005) showed that in case of social insurance, the savings at old age would decrease. When comparing the income-related inequality in the use of medical care, the Netherlands take up a position with low inequality and a collective health insurance system while the US takes up a position with high inequality and a private health insurance system (Doorslaer and Masseria, 2004 and Wagstaff and Doorslaer, 2000). In addition, the public pension scheme offers insurance against the costs associated with longevity risk. This implies that the precautionary savings motive should be very small in the Netherlands and therefore the wealth pattern is expected to be more in line with the standard lifecycle model. The elderly home equity puzzle should therefore be small or nonexistent in the Netherlands.

1.4 Main findings

First, it is shown that the elderly home equity puzzle exists in the Netherlands. This is contradicting the expectations according to lifecycle theory, given that the precautionary savings motive is supposed to be small (due to small uncertain health costs and a public pension scheme). However, in the past decades the share of homeowners with interest-only mortgages increased to over 50% of the entire mortgage market. This can be interpreted as an indirect way of capital decumulation (which is supported by all empirical estimations in this thesis), since households stop paying off mortgage debt. This trend points at active behavior among the old.

Second, the theoretical model for mortgage debt (Brueckner, 1994) is estimated by using instrumented variable estimations (two-stage least squares and tobit). Age dummy variables are included in these estimations and it is shown that the older the age cohort is, the smaller demand for mortgage debt is.

Third, in order to have a better understanding of the determinants of mortgage debt for specific age cohorts, the estimations are applied to all 10-year age cohorts (ranging from 20-29 to 80-89). This shows the development of the coefficients and the significance between age cohorts. One of the most interesting findings is that the current value of the house starts being significantly positive around retirement. This implies that retired households do take home equity into account for setting mortgage debt (and thus use mortgage debt as instrument to decumulate capital at old age).

Fourth, even though elderly use mortgage debt as instrument to decumulate capital, the effect remains rather small. Among the oldest old (80-89), homeowners liquefy at most 9% of the current value of the house as reflected in mortgage debt.

Fifth, although the effect of the current value of the house on mortgage demand is significant among the old, this could also imply that households change their type of mortgages, rather than refinancing the level of mortgage debt. Therefore a final estimation is performed which regresses the change in mortgage debt (between several waves) on the change in the current value of the house. The results show that the old are not actively increasing mortgage debt when the current value of the house increases. This implies that the observed activity in the previous estimations is due to the change in mortgage types (the movement towards interest-only mortgages), rather than increases in mortgage debt.

The overall conclusion is that elderly do reveal signs of active behavior, but the effect remains small. Elderly do not actively increase mortgage debt, but may change the mortgage type to an interest-only type of mortgage (resulting in relatively larger sizes of mortgage debt). The hypothesis that the home equity puzzle can be explained by passive saving behavior cannot be rejected.

1.5 Outline of this thesis

The outline of this thesis is as follows. In section 2 the data is described and some key descriptives are given. Section 3 provides a descriptive analysis on the Dutch house market. The main research question assumes that the elderly home equity puzzle exists in the Netherlands. Before being able to answer this question, it should be clear whether this assumption is correct and how the elderly home equity puzzle develops over time. Therefore the developments of homeownership, the share of mortgageholders among homeowners, the Loan-to-Value ratios, the market shares of all mortgage-types (especially interest-only mortgages), net home equity and mortgage debt will be considered. Finally conclusions about the elderly home equity puzzle are drawn.

Section 4 introduces a theoretical model for mortgage demand (as proposed by Brueckner, 1994). This theoretical framework can be empirically tested. Brueckner provided some suggestions for the application of the theoretical model to an instrumented variable estimation, which are summarized in paragraph 4.2 and applied to available variables in the dataset.

Section 5 contains instrumented variable estimations (both two stage least squares and tobit) for mortgage debt. The results show that the size of mortgage debt is negatively correlated with age. In order to draw better conclusions about the development of the effect and the significance of the variables between age groups, the estimations are estimated for each ten-year age cohort (ranging from 20-29 to 80-89 years old).

Section 6 provides a model based on synthetic age cohorts (Deaton, 1985) and aims to explain the change in mortgage debt by the change in the current value of the house. This model is in line with the theory provided by Brueckner (1994), but it differs from the estimation as suggested by him. This section focuses on the question whether households are actively increasing mortgage debt at old age. Section 7 provides a conclusion and suggestions for further research, while section 8 provides the literature list.

2. The Data

The data used in this thesis are the WBO/WoON datasets (Housing Needs Survey in the Netherlands). These datasets contain information about housing-related topics, such as the current house value, mortgage size and housing demands, as well as information about household characteristics.

The data consist of multiple cross-sectional waves, which are held about every 4 years since 1981. The most recent wave is from 2009. The questionnaires are modified and extended most of the times when a new wave is launched (especially when the WBO changed to the WoON research in 2002 many variables were added). Questions that focus on mortgage size have been included since 2002, while questions on the type of mortgage were included in earlier waves as well. The waves that are used and the time span will differ among the graphs in this thesis depending on the availability of the variables in the datawaves. Some descriptives of the data are given in table 1.

Wave	Median mortgage debt	Average mortgage debt	Median current value of the house	Share of home-owners (%)	Share of mortgage-holders among home-owners (%)	Number of respondents
1985	--	--	--	41.87	74.00	46095
1989	--	--	--	44.18	76.82	46851
1993	--	--	--	45.77	79.67	63049
1998	--	--	--	49.14	84.09	117569
2002	74874	98087	205000	52.23	86.38	75043
2006	102000	126970	250000	53.70	86.59	55958
2009	130000	147989	250000	56.80	86.32	69149

Table 1: Some descriptives

In table 1 it is shown that the median and average mortgage debt strongly increased between 2002 and 2009. The median current value of the house increased as well, but remained constant between 2006 and 2009. The share of homeowners and the share of mortgage-holders were somewhat constant. When analyzing the data, weights are applied to ensure that the dataset is representative for the society. These weights were created on basis of the probability of being selected into the survey (i.e. a married couple is twice as likely to be selected compared to a

single-person household). By applying these weights, the data is assumed to be representative for the Dutch society.

Rouwendal (2007) used the same dataset up to the wave of 2002 in order to show a.o. the developments in homeownership and mortgages. In section 3 similar graphs about the development on the house and mortgage markets will be shown, but the data up to 2009 will be used.

Throughout this thesis, all developments illustrated are based on synthetic age cohorts. These synthetic age cohorts are created in order to track households with the same year-of-birth in the waves of the cross-section dataset. In case longitudinal data would have been available, individuals could have been followed over time, but since this is not the case, synthetic age cohorts are created. This approach is widely used in literature.

3. A descriptive analysis

In the Netherlands there is a generous mortgage interest deductibility (most generous of Europe). This provides mortgageholders with tax benefits. Therefore the costs of a mortgage (the interest payment) are reduced. This can imply that the net interest rate on a mortgage is smaller than the returns on savings. In this case households can actively exploit tax benefits. According to Brueckner (1994), this is the optimal case in a situation with certain (non-stochastic) returns on savings. Therefore households are stimulated to take up the maximum allowed amount of mortgage debt. In this setup the home equity puzzle should not exist (i.e. if the value of the house increases, the household refinances the mortgage to the new maximum allowed mortgage debt). In the Netherlands the certain savings rate (offered by banks) is not larger than the tax deducted interest rate on savings. However, when investing in the stock market, the returns are expected to be larger. Investing in stocks includes uncertainty, but the trend, as expected by the model, will remain the same. This thesis continuously connects to this idea.

3.1 Homeownership and the elderly home equity puzzle

Rouwendal (2007) illustrated the development of homeownership and the demand for mortgages in the Netherlands over the period 1981-2002. He illustrated a substantial increase in the share of households that has a mortgage outstanding. This suggests that the amount of home equity saved by households gets smaller, implying that the home equity puzzle gets smaller as well. He also shows an increase in the share of homeowners that has a mortgage as well as an increasing market share of interest-only mortgages. The development towards interest-only mortgages can be explained by the generous mortgage interest deductibility and the related tax benefits. In this section, the focus will be on the development of homeownership and the demand for mortgages up to 2009 (by tracking 5-year synthetic age cohorts through the waves in the dataset). These developments show the behavior of households on the house and mortgage market and whether there is an elderly home equity puzzle or not.

In the past years, homeownership gradually increased in the Netherlands. Van der Schors, Alessie and Mastrogiacomo (2007) showed an increase of 10%-points in homeownership during the period 1990-2002 and provided insights into the Dutch house market. Within this increase there is a specific trend. It appears that the homeownership rates among young age cohorts increase by up to 6.4%-point a year, while the 65+ age cohorts show a change of around -0.6%-point a year.

To start with the analyses, the development of homeownership will be shown in figure 1. In this graph synthetic age cohorts will be tracked in order to take cohort effects into account. These cohort effects have often been emphasized in existing literature such as Rouwendal (2007) and Venti and Wise (1990). One could argue that the increase in homeownership is caused by higher living standards and immobility at the house market. In order to consider the cohort effects, ideally one should follow the same households over a long period of time. However, the available datasets (WBO and WoON) do not track the same households over time. The datasets consist of multiple cross-sectional observations. Therefore synthetic cohort effects will be considered, by tracking the heads of the households with the same years of birth. This will result in the best estimate for the cohort effects of the age groups. The development of homeownership among synthetic age cohorts are shown in figure 1. Note that differential mortality (Attanasio and Hoynes, 2000), implying that the rich live longer, will affect the implications of any study that focuses on optimal wealth paths (or planning horizons) among different age groups.

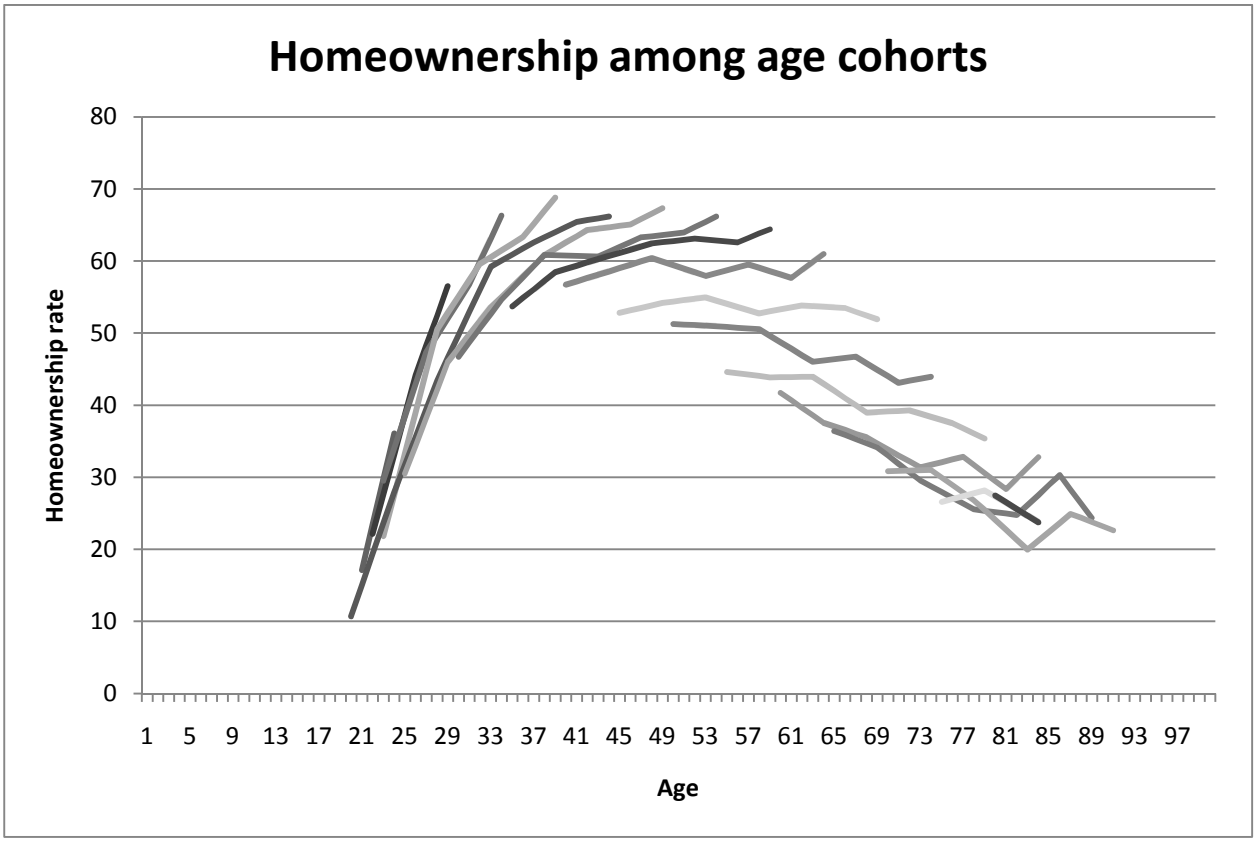

Figure 1: Homeownership in synthetic age cohorts (fixed year of birth)

Figure 1 clearly shows a specific pattern. It appears that the relatively young age cohorts have increasing homeownership rates. The middle-aged age cohorts have more constant homeownership rates, while the old age cohorts have somewhat decreasing homeownership rates. These results are in line with the results shown in Van der Schors, Alessie and Mastrogiacomo (2007), although the magnitude of the increase in homeownership rates among the young is somewhat smaller than 6.4%-points a year. The -0.6%-point decrease a year among the old (which they find for the period 1990-2002) matches with the synthetic age cohort starting with age 65. The decreasing homeownership rates roughly start around the retirement age (between 60 and 65) and continue to decrease until advanced ages. The decreases themselves however are not very large. The younger cohorts continue to stay at higher levels compared to the older age cohorts. This supports the existence of cohort effects. The movement within the cohorts however illustrates that not all of the trend (of increasing homeownership rates during the past decades) can be addressed to cohort effects.

3.2 Active saving behavior?

Figure 1 could imply an increase in savings, since an increasing amount of households owns a house (and saves through home equity). However, one should consider the share of mortgageholders among homeowners in order to get insights on the validity of this supposed increase in savings. If the share of mortgageholders among homeowners increased a lot, then the amount of savings may be smaller than expected when considering only the development of homeownership. The development of mortgageholders among homeowners is shown in figure 2.

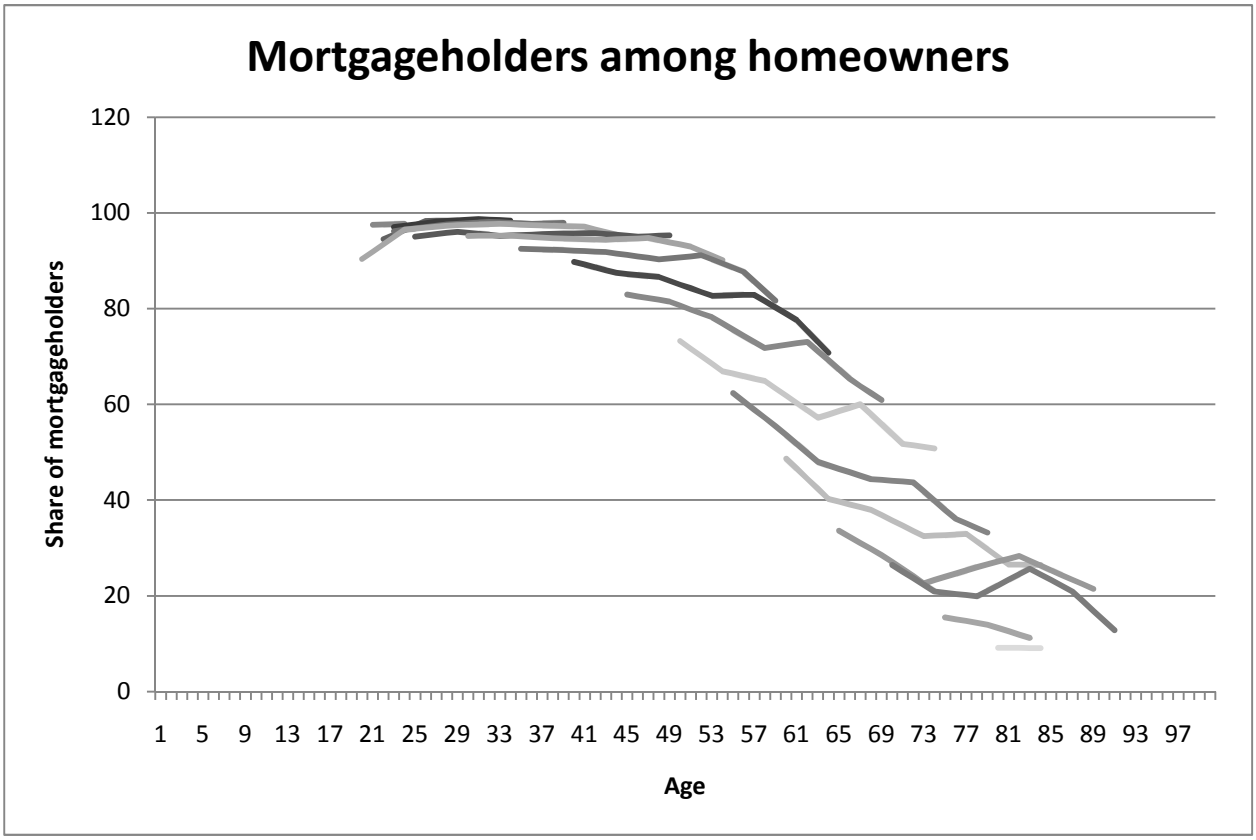

Figure 2: Development of mortgageholders among homeowners for synthetic age cohorts

Figure 2 shows that the share of mortgageholders decreases among most synthetic age cohorts. This trend could have been expected (Rouwendal, 2007), given that households simply pay off specific types of mortgages (implying a decrease). However, an interesting observation is that the rate of most of the middle-aged and older cohorts (i.e. starting with the cohort of 35 – 59) increases among all these cohorts around the same point in time. These increases occur between the waves of 1998 and 2002. In the Netherlands there was a tax reform (introducing a tax system in which mortgage interest payments could be deducted at a higher rate than before) during this time and the euro currency was introduced. These factors stimulated households to take a mortgage.

Additionally, one can compare the developments of the different age cohorts with each other. It appears that the younger the age cohort is, the higher the mortgage ratio at all ages is. This implies that the younger age cohorts pay off their mortgages less often. The overall mortgage rate increases from around 72% (in 1985) up to 87% in 2002 and remains constant until 2009.

3.3 LTV-ratios

The results of figure 1 and 2 shed some light on the elderly home equity puzzle. Even when the homeownership rates appear to be somewhat decreasing at old age, the homeownership rates remain considerably high (and the levels at the same age increase among younger age cohorts). Therefore it seems that elderly continue to own a house, even when they reach advanced ages, which supports the elderly home equity puzzle. Figure 2 showed that the share of mortgageholders among homeowners decreases within the age cohorts, but increases when the age cohort is younger. This shows that while there are more homeowners, the relative share of homeowners which holds a mortgage increased as well. This implies that at this point we cannot draw conclusions about the magnitude of home equity (and the importance of the home equity puzzle), although for the oldest old with still a substantial homeownership rate and a very small mortgageholders among homeowners rate, the home equity puzzle is very substantial.

It could be the case that households wish to borrow a maximum amount of mortgage debt and therefore prefer to own a house rather than renting a house. The development of the Loan-to-Value (LTV) ratio should be considered in order to see whether the increase in homeownership can be interpreted as support for the home equity puzzle. The LTV-ratios for synthetic age cohorts in the period 2002 to 2009 is shown in figure 3. In figure 3 the mean values are used and the cohorts are shown when the sample size of the cohort is larger than 40. The variables for the size of mortgage debt (and the LTV-ratios) have been included in the dataset since the wave of 2002. Therefore the graphs about these variables cover a smaller period of time (2002-2009).

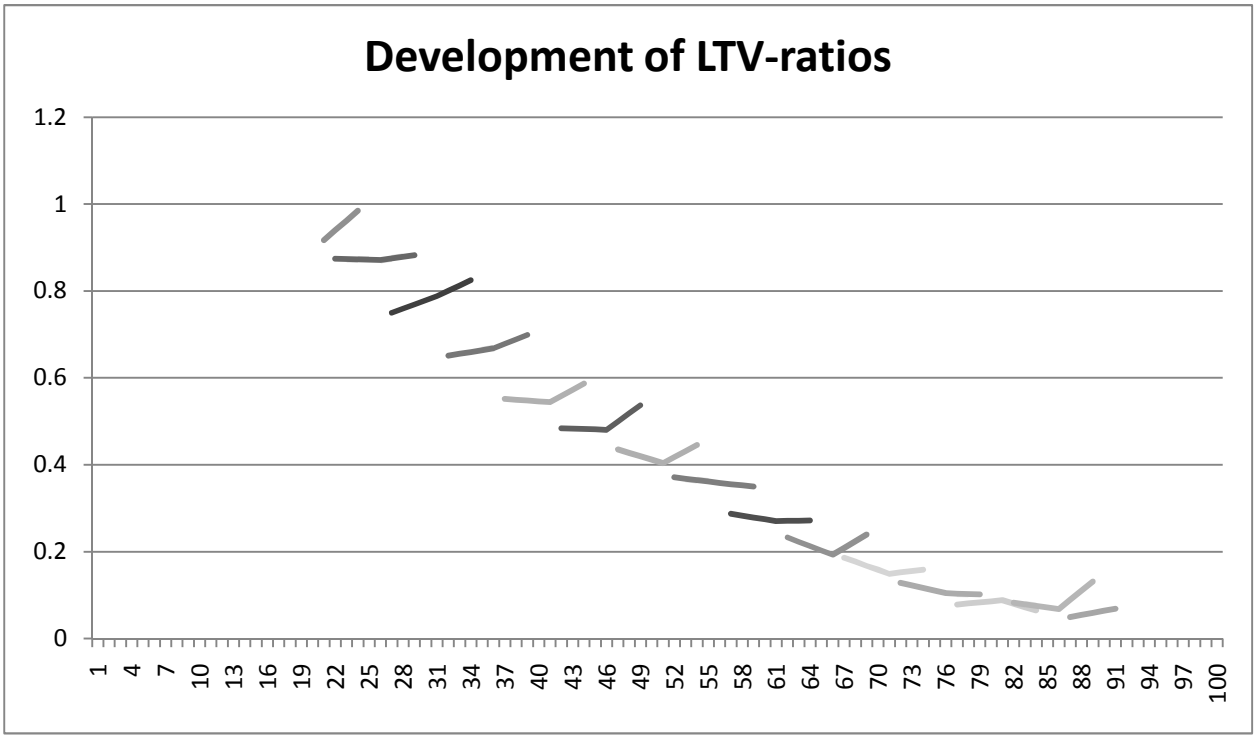

Figure 3: Development of LTV-ratio for synthetic age cohorts in the period 2002-2009

As one can see, the LTV-ratios remain quite constant among all age cohorts. However, the younger the age cohort is, the higher the LTV-ratio is. Three conclusions can be drawn from figure 3. The first conclusion is that the LTV-ratios of the older age cohorts do not increase. This implies that elderly homeowners do not increase the size of their mortgage debt in order to consume home equity. This supports the elderly home equity puzzle, given that elderly are expected to use home equity for consumption purposes late in life. On the other hand, one can argue that the constant LTV-ratios imply that households already are increasing mortgage debt. The house prices increased, (according to 'het kadaster', by 29.2% on average) implying that mortgage debt increased by roughly 29.2% as well. However, the finding that the LTV-ratios are constant, shows that the decumulation of home equity at old age could be far more substantial. Between the ages of 75 and 91, the LTV-ratios for all homeowners is below 10%. This shows that the elderly home equity puzzle exists, since roughly 90% of home equity is not liquefied among the oldest old.

The second conclusion is that the households are definitely not borrowing the maximum mortgage size. The LTV-ratios among the elderly are very small, especially when comparing the LTV-ratios of the old with the ratios of the young. This implies that the benefits of the generous mortgage interest tax deductibility are not maximally exploited.

The third conclusion which can be drawn is that the level of the LTV-ratios increases between the different age cohorts (the younger the age cohort is, the higher the LTV-ratio is). This difference remains constant in time, suggesting a passive saving behavior of the households. One might argue that the cohorts reflect different stages of the house market instead of saving behavior. Given that house prices increased, younger households pay relatively smaller downpayments, resulting in higher LTV-ratios. This argument holds when mortgage debt depends solely on the purchase price of the house. However, when households get older, other factors become more important and active behavior on the house market could be beneficial in a consumption-smoothing sense. Later in this thesis, a model for mortgage demand will be estimated. The results will show that the impact of the purchase price gets less important among the older age cohorts, while the current value of the house only becomes significant for the older cohorts. In case that the current value of the house becomes relevant for mortgage demand, it suggests that elderly are actively planning their consumption path. The result of figure 3 that all age cohorts of 59 years and older have LTV-ratios around or below 25%, just doesn't add up with an active optimizing economic behavior. However, it should be noted that on the other hand, the average increase in mortgage debt of roughly 29.2% does point at active saving behavior among the elderly. The impact of this behavior remains rather small.

In line with the third conclusion, the finding that the young age cohorts have relatively very high LTV-ratios, could also reveal specific expectations about the future. The house prices in the Netherlands increased rapidly in the past decades. In the period 1995-2009 house prices more than doubled (according to 'het kadaster' house prices increased by roughly 170%). Therefore home equity is perceived as a very good investment opportunity. In this way, a household could simply buy a house without paying off mortgage debt, and expect the LTV-ratio to drop automatically. In the Netherlands, a constant return on the house investment is almost guaranteed by the generous mortgage interest deductibility. Because of the generous mortgage interest deductibility, households may prefer to buy a house (and expect the house value to go up) and finance it by an interest-only mortgage instead of renting a house (Rouwendal, 2007). This motivation could also explain the increase in mortgageholders among homeowners in figure 2.

3.4 Development of the mortgage market

Before starting with the estimation of home equity and the development of mortgage debt, the developments of the composition of the mortgage market will be illustrated. In 1989 the interest-only mortgage entered the market. The interest-only mortgage offered an opportunity to partially own and partially "rent" the house, by keeping the size of mortgage debt constant. One could adjust the size to his preferences for relatively small transaction costs. This mortgage type removed the illiquidity of home equity. Additionally, this type of mortgage was strongly supported by a generous system of mortgage interest tax deductibility. In case that elderly households take an interest-only mortgage, the household stops paying off mortgage debt, resulting in a relatively larger size of mortgage debt and a larger LTV-ratio. The size of mortgage debt could also be increased when refinancing, resulting in even larger LTV-ratios.

When elderly do not change their mortgage size, the value of the house increased during the past decades, while mortgage debt did not increase and resulted in a decreasing LTV-ratio during the final stage of life (resulting in the elderly home equity puzzle). However, in case that the young cohorts choose the interest-only mortgage, they will maintain higher LTV-ratios. The behavior of both the young and old age cohorts could explain the LTV-trends. Therefore, the market share of the interest-only mortgage should be significant and increasing during the period 2002-2009. Table 2 denotes the market shares of each type of mortgage for the period 1989-2009. The market shares are based on mortgageholders which hold only one type of mortgage (they can hold multiple mortgages, but it will only be included when all are of the same type). When considering the market shares among mortgageholders which hold multiple types of mortgages, it appears that the market shares are in line with the market shares of mortgageholders with one type of mortgage. This is the same approach as used in Rouwendal (2007).

	1989	**1993**	**1998**	**2002**	**2006**	**2009**
Linear	19.80	16.30	7.68	3.79	2.54	2.07
Annuity	48.79	38.38	18.44	11.11	7.56	5.64
Life insurance	22.43	38.57	49.70	38.31	34.19	31.81
Investment	0.00	0.00	0.00	10.09	8.93	7.81
Interest-only	0.00	3.37	17.66	33.51	44.39	50.74
Other	2.49	3.38	6.52	3.19	2.39	1.93
Don't know	6.49	0.00	0.00	0.00	0.00	0.00

Table 2: Mortgage development in the Netherlands during the period 1989-2009

Table 2 illustrates that the share of interest-only mortgages rapidly increased and is now covering just over 50% of the entire mortgage market. This might explain the increasing level of the LTV-ratios when the age cohorts are younger. The question now is how the interest-only mortgage is spread over the age groups. If the increase in interest-only mortgages among the old is smaller compared to the increase among the young, it supports the idea that the increase in interest-only mortgages resulted in the high LTV-ratios among the young. The development of interest-only mortgages in synthetic age cohorts is given in figure 4. In figure 4 the horizontal axis does not show the age, but the year of the wave of the dataset. This is done in order to focus on the spike starting in 1993.

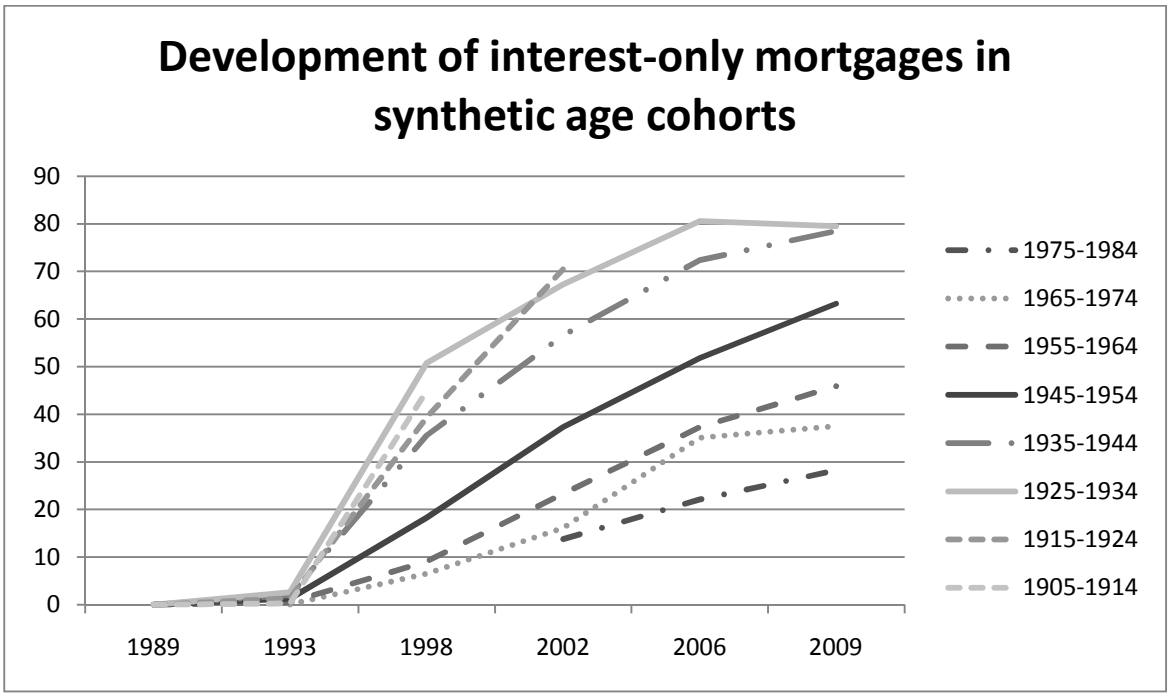

Figure 4: Development of interest-only mortgages in synthetic age cohorts

Figure 4 clearly shows the rapid increase in all age cohorts in the past decades. It appears that for every cohort, the market share of interest-only mortgages increased. However, the increase among the oldest cohorts is largest. This observation suggests active behavior among the old, since most of the elderly mortgage holders take up or refinance to an interest-only mortgage. When considering the development of the LTV-ratios and the increase in house prices, one would expect a decreasing LTV-ratio in case of entirely passive behavior (note that this is not the expectation of the lifecycle model, which expects the LTV-ratio to increase among the old). However, this is not the case since the LTV-ratio is roughly constant. So there is relatively much

active behavior towards the interest-only type of mortgage among the old. The effect on home equity is rather low since the LTV-ratio is not increasing, but under entirely passive behavior there would be a decrease in the LTV-ratio.

3.5 Net home equity

In the last part of the descriptive analyses, the development of net home equity of households which hold interest-only mortgages will be measured. The interest-only mortgage offers a good opportunity to estimate net home equity, since mortgage debt remains constant. Therefore net home equity can be estimated by subtracting total mortgage debt from the value of the house. The possibility to use the total mortgage debt is very convenient, since the measurement of other types of mortgage debt strongly depends on timing. The measurement of net home equity is expected to illustrate a high value for the old (given the low LTV-ratios). Information on total mortgage debt has been included in the dataset since the survey in 2002. Therefore the development of net home equity in the period 2002-2009 is shown in figure 5 for synthetic age cohorts.

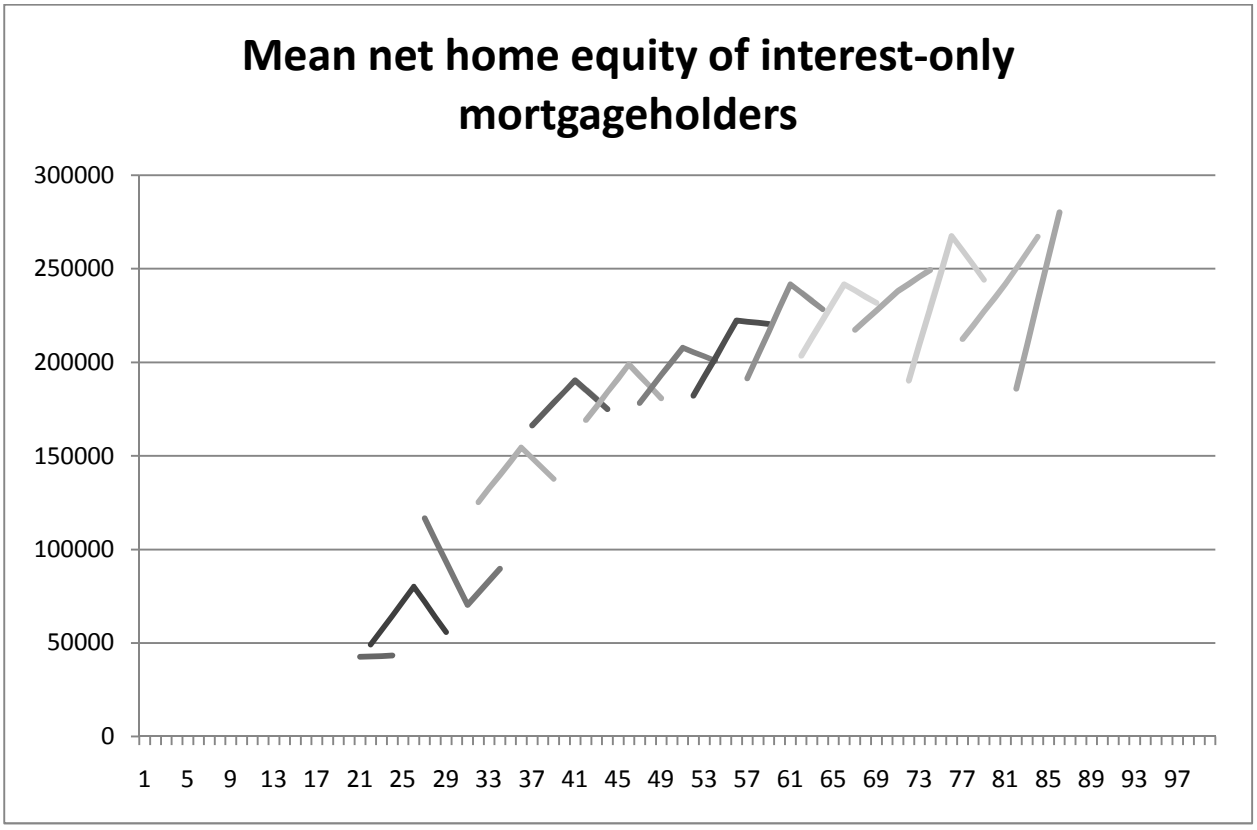

Figure 5: Development of mean net home equity for synthetic age cohorts of households which hold interest-only mortgages

Figure 5 clearly illustrates the elderly home equity puzzle. The value of net home equity is larger when the age cohort is older. The value for the old is extremely high (at some points over 250.000 euro), while on average there are no large expenses to be expected. Even when net home equity of the age groups is affected by the strong increase in house prices, it still holds that the amount of net home equity at old age is much larger than expected given the standard lifecycle theory.

The figure also illustrates a specific development between the age groups. Among the relatively young, net home equity remains constant or decreases. Among the older age groups net home equity increases in the period from 2002 to 2006 and decreases slightly from 2006 to 2009. There is not that much of a movement in net home equity (the overall development in net home equity during the period 2002-2009 is 2.5%), which is surprising given that house prices increased by 29.2% from 2002 to 2009 (according to 'het kadaster').

However, this might be explained by either new homeowners entering the age cohort (given the increasing homeownership rate as was illustrated in figure 2), or by households refinancing their mortgage to an interest-only mortgage (given the increasing share of homeowners that has a mortgage). By refinancing a mortgage, a household can increase total mortgage debt (given that house prices increased rapidly and added value to the house, allowing for a higher mortgage debt when refinancing). This offers a tax deductible way of borrowing additional money and results in a smaller amount of net home equity.

According to table 2, the share of households which has an interest-only mortgage increased by over 17% during this period. This transition on the mortgage market affects the illustrated development of net home equity. In order to get more insight in the reason why net home equity is not increasing as much as would be expected conditional on the price increases, figure 6 provides the development of mortgage debt (of households with an interest-only mortgage) for synthetic age cohorts.

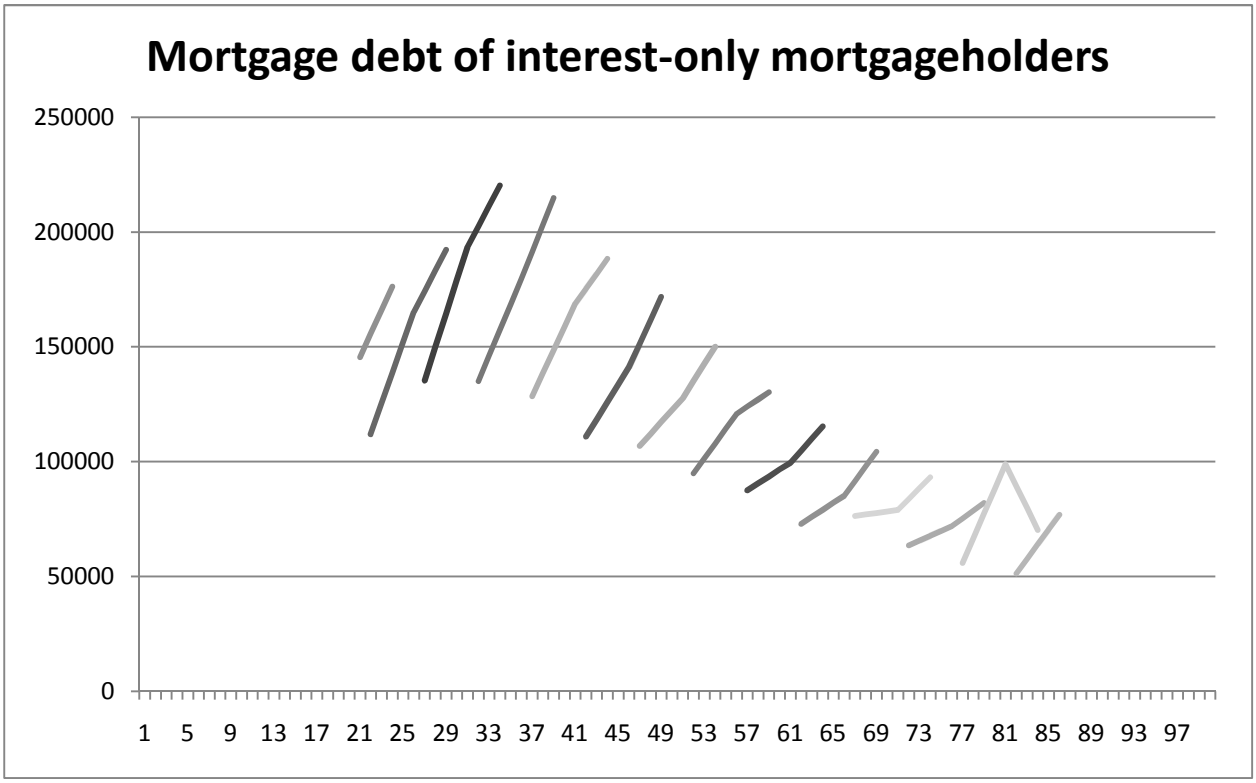

Figure 6: Development of mean mortgage debt for synthetic age cohorts of households with interest-only mortgages

The mortgage debt of interest-only mortgages was expected to remain constant (given that the mortgage debt is not reduced, since only the interest is paid). However, it appears that mortgage debt increased among all age groups (the overall increase is over 60%). This increase suggests active behavior of households and it causes that the increase in net home equity is small (as was illustrated in figure 5). Interesting to note is that the increase in mortgage debt is smallest among the oldest age cohorts (while they were expected to be largest, since the old are assumed to have stronger incentives to spend). When considering the increasing mortgage debt, one could argue that this is caused by the increased house prices. Higher house prices cause new homebuyers to require higher mortgages (ceteris paribus). This can be tested by removing all new homebuyers from the sample (i.e. by only considering households which bought their house before 2002). If the proposition that the increase in net home equity is small because of new homebuyers holds, a sample without the new homebuyers should show a smaller (or no) increase in mortgage debt and a larger increase in net home equity. The development of net home equity and of mortgage debt for this sample follows the same overall trend as in figure 6.

However, the increase in mortgage debt is smaller compared to figure 6. The increase in (overall) debt is reduced from over 60% to 31%. In This difference in mortgage debt causes an increase in net home equity. Net home equity increases by 21%. This is still lower than the expected 29.2% (according to 'het kadaster'), but the difference is smaller. The difference of roughly 8% may be caused by households borrowing additional money by taking a higher mortgage debt, suggesting active optimizing behavior as well. However, again the optimizing behavior that takes on additional mortgage debt is expected to occur among the old, but it appears that the young might refinance their mortgages while the old don't do this (the increase in net home equity is largest among the oldest old). So there is active behavior among the young, while there is passive behavior among the old. The passive behavior among the old again points at the elderly home equity puzzle.

The overall increase in mortgage debt among the synthetic age cohorts of households with other types of mortgages (which bought their house before 2002 as well) is 20% (these graphs are not shown, but the trends are similar to the trends in figure 5). This supports the argument that households with interest-only mortgages borrowed additional money, since the difference in the increase in mortgage debt is over 11%. Additionally, one could also consider the difference in the development of net home equity. For interest-only mortgageholders (which bought the house before 2002) the increase is 21%, while for all mortgage types (which bought the house before 2002) this is 41%. The difference is 20%, implying that in 7 years 20% of total house value is paid off. This implies that on average the house is paid off in 34 years. Given that the standard mortgage duration in the Netherlands is 30 years (and the mortgage duration of interest-only can be lifelong), this estimate appears to be quite accurate.

When considering the current market share of the interest-only mortgage on the mortgage market (as was shown in table 2), it appears that more than half of the mortgage-holders chooses to let the capital accumulation of home equity (which on average is by far the largest asset in the households' wealth portfolio) depend on the development of house prices. This half chooses to maintain mortgage debt and to benefit maximally from current mortgage interest tax deduction possibilities (by not paying off, or by increasing mortgage debt). This follows the track which was expected by Brueckner (1994) for the US. In the next section his theoretical model (which he used to compare the demand for mortgage debt in the US and Canada) will be described. It will be applied to the Netherlands.

3.6 Concluding remarks for the descriptive analysis

In this section two main questions have been investigated and answered. The first question addressed the elderly home equity puzzle. Does this puzzle exist in the Netherlands? It was shown that homeownership among the old is somewhat decreasing, but still substantial at old age. The older the cohort got, the smaller the share of mortgageholders among homeowners was. However, among the old that did maintain mortgage debt, the vast majority had an interest-only mortgage. It was shown that the market share of the interest-only mortgage increased by 17% during the sample period. Then the LTV-ratios were considered and shown to be roughly constant in a period in which house prices increased by 29.2% on average. Because of these observations it can be concluded that there has been quite some movement, suggesting active behavior of households.

The movement towards interest-only mortgages suggests indirect decumulation of home equity among the old by not paying off mortgage debt. However, the LTV-ratios were very small for the old. Additionally, the size of mortgage debt was smallest among the oldest and net home equity was largest among the oldest. The movement to interest-only mortgages points at somewhat active behavior among the old, but the impact is too small to be in line with the expectations of the lifecycle model. Therefore one could argue that even though there is some active behavior among the old, the largest part of home equity is not decumulated. This can be interpreted as passivity of the old. This passivity is not in line with the optimal consumption-smoothed path, and can therefore be called the elderly home equity puzzle. In short, the puzzle exists in the Netherlands!

The other question was whether households appear to behave actively. Here a distinction should be made between the young and the old. In all graphs it was shown that the old might act somewhat in line with capital decumulation, such as a move towards interest-only mortgages. However, the effect of this behavior is rather small compared to the behavior that aims to achieve a maximum consumption level. This is remarkable, especially in the Netherlands, since there are no high costs which can be expected at the final stage of life. Therefore motives such as uncertain medical expenses cannot explain this passive behavior. For the old the answer should be that even though there are some signs of active behavior, the effect of this behavior is very small when considering LTV-ratios, the size of mortgage debt and net home equity.

The young however reveal much faster increases in the size of mortgage debt (while this would have been expected to be the other way around according to the lifecycle model, since the young are expected to accumulate capital and thus decrease mortgage debt). This could be caused by refinancing or by moving to more expensive houses. The share of mortgage-holders also increases rapidly among the young. The share is larger compared to older age cohorts and the development over time reveals a stronger increase as well. Therefore the young appear to behave very actively, while the old are less active.

4. Theory

In this section a theoretical model will be discussed. The model was proposed by Brueckner in 1994 and aims to explain mortgage demand. Age groups can be included in the model, such that the effect of age on mortgage demand can be shown. The model will be used to empirically test the previous observations about the activity of elderly on the mortgage market. The estimations will be performed in section 5.

4.1 Theoretical model

The model is a two-period model, which lets current-period utility depend on housing consumption (h) and non-housing consumption (x). The utility function U(h, x) is assumed to be strictly concave. The choices made in the current period affect future wealth (z) (note that future wealth represents the entire future and not necessarily one period). The utility of future wealth is denoted as V(z), where the utility function (V) again is assumed to be strictly concave. V is discounted by a discount factor (δ), which is smaller than 1. In case that the agent dies after the current period, V represents the value of the bequest (which is in line with the 'indirect' bequest motive of Dynan, Skinner and Zeldes, 2002). The lifetime utility function therefore is:

$$U(h,x) + \delta V(z)$$

The consumer starts the current period with initial wealth (w), which consists of the sum of current income and assets. The consumer can spend his wealth on housing consumption (p*h), non-housing consumption (x) and he can choose to save (s). He is not allowed to borrow without collateral (i.e. mortgage debt (m) is allowed, but a negative s is not). This results in the current-period budget constraint:

$$x = w - s - (ph - m)$$

The maximum mortgage loan to value ratio (LTV) is indicated by α and must be smaller than 1. This provides a maximum value of mortgage debt. Instead of a maximum loan to value ratio, one could also use a maximum payment to income ratio (PI). For usage in the Dutch situation, one should apply the PI ratio, given that this is the criterion used when applying for a mortgage in the Netherlands. However, in the past decades the house prices increased rapidly (see the development of net home equity in figure 5, given the increasing mortgage debt in figure 6, or 'het kadaster'). Therefore the refinancing to higher levels of mortgage debt may be more relevant. The LTV ratio is a better facilitator for this phenomenon compared to the PI ratio, given that the changes in income do not behave in the same way as the house prices do and that the changes in house prices dominated the developments on the house and mortgage market (however, both restrictions, and even when including both restriction in the same optimization problem, lead to the same implications of the model). The constraints on the size of mortgage

debt and savings are given by $s \geq 0$, $\alpha ph \geq m$ and $m \geq 0$. Therefore savings and mortgage debt are nonnegative and there is a maximum size of mortgage debt, which equals the maximum LTV ratio (α) times housing consumption (p*h).

Brueckner (1994) treats the mortgage interest rate (r_m) and the interest rate on savings (r_s) first as non-stochastic (i.e. as certain). Later on he treats (r_s) as stochastic (i.e. he includes uncertain returns on savings). The relative magnitude of r_m and r_s is not restricted. Brueckner considers two cases. The US case, in which $r_m < r_s$ due to mortgage interest tax deductions. And the Canadian case, where the relative magnitude is the other way around, due to no mortgage interest tax deductions. The Dutch case is similar to the US case, since the mortgage interest tax deductibility is very generous (more generous compared to the US) in the Netherlands. Future income is denoted as y, resulting in the following expression for future wealth:

$$z = y + (1 + r_s)s + ph - (1 + r_m)m$$

Substituting both budget constraints in the lifetime utility function results in the following maximization problem:

$$\max_{s,h,m} U[w - s - (ph - m), h] + \delta V[y + (1 + r_s)s + ph - (1 + r_m)m]$$

Subject to:

$$s \geq 0$$

$$\alpha ph \geq m$$

$$m \geq 0$$

Plus the additional constraints:

$$\lambda \geq 0 \text{ and } \lambda s = 0$$

$$\mu \geq 0 \text{ and } \mu(\alpha ph - m) = 0$$

$$\theta \geq 0 \text{ and } \theta m = 0$$

Solving the maximization problem and combining the first order conditions with respect to s and m yield the following equation:

$$(1 + r_s)\delta V' + \lambda = (1 + r_m)\delta V' + \mu - \theta$$

Where λ, μ and θ respectively are the Lagrange multipliers for the constraints on s, h and m and must be nonnegative. In case that $r_m < r_s$, solving yields $\lambda < \mu - \theta$. Implying that: $m = \alpha ph$ and $s \geq 0$ ($\mu > \lambda \geq 0$ and $\theta = 0$).

It implies that if current mortgage debt is smaller than the maximum allowed level of mortgage debt (given the LTV ratio), the additional allowed mortgage debt could be borrowed against rate r_m. This additional money could be saved for a higher rate r_s, implying a higher utility level in case that the consumer can borrow additional money up to the maximum allowed mortgage debt. Therefore, under complete certainty of the savings rate, the consumer is expected to choose the maximum amount of mortgage debt.

However, it appears that in the US, consumers often pay large down-payments and don't choose the maximum allowed mortgage size. This contradicts the implications of the model without uncertainty. In the Netherlands, mortgage debt gradually increased over the past decades (see figure 6), but the maximum allowed mortgage size is depending on income rather than on house value. Therefore in the Dutch case, the maximum allowed mortgage size is smaller compared to the LTV constraints in the US. This is especially important for the young (with a relatively small income) and after the increased house prices during the past decades. However, when including uncertainty (i.e. treating the savings rate as stochastic), the optimal mortgage size changes and Brueckner shows that the optimal mortgage size lies anywhere between 0 and the maximum allowed mortgage debt. The mortgage rate is still treated as non-stochastic, given that fixed-rate mortgages are widely used to finance mortgage debt (this ignores the relatively new possibility to choose a flexible-rate mortgage).

Since the future utility function V is strictly concave, it must be the case that the certain value of r_s yields a higher utility compared to the uncertain (stochastic) value of r_s. This implies that (even when the expected r_s is larger than r_m) the uncertain utility of r_s can be smaller than the utility of r_m. Therefore the previous key equation (which is slightly modified by replacing future utility by expected future utility) is not binding for the relative magnitudes of the Lagrange multipliers anymore. Therefore it's optimal to choose a mortgage which lies between 0 and the maximum allowed mortgage, rather than choosing the maximum allowed mortgage. This implication is in line with the real US and Dutch situation at the house markets. In case that $r_s < r_m$, time preference will determine the optimal amount of mortgage debt. This optimum can be anywhere between zero and the maximum mortgage debt, but households cannot exploit tax benefits by increasing mortgage debt.

An important issue which is shown in the paper by Brueckner (1994) is the independence of optimal mortgage choice of an uncertain (or stochastic) p and y. Thus if the development of the house price or income is uncertain, it does not affect mortgage demand. In the Netherlands there are several issues that might threaten future increases of house prices. For example the aging problem, the sustainability of the welfare state and the increasing burden of mortgage interest tax deductibility (caused by the increase in (interest-only) mortgages, see table 2 and figure 4) are likely to dampen house price increases in the near future. Therefore the movement towards interest-only mortgages (which implies that households stop paying off their mortgage debt and let their accumulation of home equity depend on increases in the house price) can well cause problems in the future.

4.2 Towards the empirical estimation

The next step is to estimate this model empirically. Brueckner provided a framework for this. He suggests to estimate mortgage size depending on initial wealth, future income, the discount rate and (as instrumented variable) house size. In order to perform this estimation, some modifications will be made. The initial wealth variable will be the current value of the house. I chose the current value of the house as measure for initial wealth, because the house on average is by far the largest asset in a household's wealth stock. Future wealth will be replaced by the current income and the current value of the house. The current income is a measure for future income and the current value of the house includes the house price development. Information about the discount rate is not available. Therefore this variable will be ignored. The house size is replaced by the purchase price of the house (which is basically the house size times the price, as was shown in the theoretical model), which will be instrumented. For the instrumentation the surface of the living room and the year in which the house was bought (this is in line with Brueckner's suggestion to use house characteristics as instruments) are chosen. The surface of the living room gives an indication for the house size, while the year in which the house was bought gives an indication for the situation on the house market. Additionally, dummy variables for age groups and for types of mortgages are included.

One could interpret the estimation as follows: mortgage demand is explained by current income, the purchase price of the house, the current value of the house, age and the type of mortgage. Income explains mortgage demand, given that a higher income allows households to take a larger mortgage debt (the constraint on the maximum mortgage size is relaxed). The purchase price of the house affects the amount of money required to buy the house. A part of this amount could be paid as a downpayment, but a mortgage should cover the rest. Therefore the purchase

price of the house obviously affects mortgage demand. The current value of the house is an important indicator for the possibility to increase mortgage debt. When the current value of the house is larger than the purchase price, a household could use the additional value for consumption purposes, by converting this value to mortgage debt (i.e. liquefying home equity). Age and the type of mortgage are group characteristics that illustrate the differences among different groups. Age is relevant given that the remaining life expectancies differ among age groups. Therefore the time over which the household can spread its capital is different and affects the demand to invest, maintain or spend home equity (and thus the demand for mortgage debt). Alternatively, the type of mortgage also affects mortgage demand, given the different payoff schemes. For example a lifesavings mortgage is likely to reflect a larger mortgage demand compared to a linear mortgage type.

5. The demand for mortgage debt: an empirical analysis on cross-section data

In this section the model will be estimated in order to explain demand for mortgage debt. The estimating equation which will be estimated is:

$$MD = \alpha_0 + \alpha_1 Y + \alpha_2 H + \alpha_3 Z + \beta_1 age_{30} + \beta_2 age_{40} + \beta_3 age_{50} + \beta_4 age_{60} + \beta_5 age_{70} + \beta_6 age_{80} + \gamma_1 life + \gamma_2 save + \gamma_3 invest + \gamma_4 interest + \gamma_5 annuity + \gamma_6 linear + \gamma_7 other + \varepsilon$$

MD denotes mortgage demand. The alphas denote the constant and the coefficients for gross income (Y), the current value of the house (H) and the instrumented variable purchase price (Z). The betas denote the coefficients of the dummy variables for age groups. Age30 for example denotes the age group in the range of 30-39 years old, age40 denotes the group from 40-49, and so on. The gammas denote the coefficients of the dummy variables for different types of mortgages. The dummy trap for the age dummies is avoided by excluding the youngest age group age20. Therefore the age20-group will be the reference group. Because of the large differences in payoff schemes among the types of mortgages, the type of mortgage gas been included as dummy variable as well. These dummy variables are not subject to a dummy trap, because households can own multiple types of mortgages. This implies that a household can have multiple 'ones' and therefore the households can be included in multiple dummy variables and not only in a single dummy variable.

This equation will be estimated by using instrumented variable (IV) methods, where the variables 'surface of the living room' and 'year the house was bought' serve as instruments for Z. Z denotes the purchase price of the house when the house was bought. The purchase price is assumed to be endogenous (following the suggestions by Brueckner, 1994). The IV methods are used for estimating this model because of the assumed endogeneity of the purchase price.

The instruments chosen are the surface of the living room and the year in which the house was bought. Well-chosen instruments should not be correlated with the error term of the second stage regression and it should be relevant (i.e. the correlation between the instrumented variable and the instrument should be nonzero). The surface of the living room is chosen as instrument because it is predetermined and cannot (or hardly) be changed when owning or buying a house. When a household is looking for a house in a specific area, the surface is fixed. However, it is a relevant characteristic of the house. Therefore the surface of the living room does not endogenously affect mortgage demand, but it is a characteristic of the house. The second instrument, the year in which the house was bought, does not affect mortgage demand either. The year in which the house is bought captures many external factors (such as the state of the

economy, house price developments etc), which affects the current value of the house. The most recent wave (from 2009) of the dataset will be used for the estimation.

The estimations will follow the approach as used in Barth et al. (1983), in which the sample used for the IV estimation contained only the households who have values that are different from zero. For this estimation a two stage least squares (2SLS) method is used. However, when ignoring the zero-values, the implications of the model only focus on households which hold a mortgage (in this case). One can draw conclusions about mortgage demand among mortgageholders. However, conclusions about mortgage demand among homeowners cannot be drawn this easily. Therefore the zero-values (the homeowners without a mortgage) are included in the second estimation. Including the homeowners without a mortgage will result in censoring from below, given that especially among the old a substantial share of homeowners does not hold a mortgage (see figure 2). This share of zero's affects the distribution and therefore an IV tobit model will be applied to estimate the same model (but this time including the zero values).

When performing the first stage (2SLS) regression, it appears that the F-statistics are over 30 for both instruments. Therefore the instruments can be considered as strong. Additionally, testing for overidentifying restrictions (by Sargan test, or Amemiya-Lee-Newey test) does not reject the null hypothesis (that the instruments are not overidentified). Thus the used instruments are valid and relevant. The results of the IV estimations are shown in table 3.

	IV 2SLS	Std. Err.	IV Tobit	Std. Err.
Purchase price	0.51***	0.010	0.56***	0.011
Gross income	0.18***	0.014	0.11***	0.014
Current value	0.08***	0.005	0.04***	0.005
age30	3011.62	2418.88	7637.53***	2644.31
age40	-16014.8***	2421.60	-6135.46**	2634.17
age50	-31178.97***	2587.14	-21379.82***	2801.58
age60	-48751.92***	2810.71	-52998.28***	3002.74
age70	-60691.92***	3484.81	-85761.35***	3513.36
age80	-73598.8***	6351.55	-138414.8***	5408.03
Life insurance	17891.22***	1447.07	73752.06***	1472.05
Investments	38273.3***	1689.97	75669.6***	1818.11
Interest-only	17567.91***	1409.36	88742.64***	1347.90
Annuity	6538.11***	2448.66	72743.26***	2607.72
Linear	3498.18	4062.81	79139.62***	4414.24

Other	11324.86**	4756.45	94344.15***	5176.94
Constant	39385.14***	2838.54	-44523.38***	2980.06
First stage F	1048.46			
Sargan test (p-value)	0.26			
ALN test (p-value)			0.11	
Number of observations	32301		37111	

Table 3: Results of both IV estimations of mortgage debt. *, ** and *** respectively indicate a 10%, 5% and 1% confidence interval.

Both estimations yield significant results. The most important result for this analysis is the significant positive effect of the current value of the house on mortgage demand (even though the coefficient is small). This is a sign for active saving behavior, given that the current value of the house is a determinant for the size of mortgage debt. The effect of this active saving behavior is small, since an increase of 1 euro in the current value of the house on average results in a 0.08 euro larger mortgage debt. The marginal effect is 0.04 in the tobit estimation, which also implies that the effect is small.

Another result is the decreasing coefficient among the age dummy variables. The older the age group is, the smaller the coefficient is. This implies that the older the household is, the smaller mortgage demand is. This trend persists even among retired age cohorts. It implies that home equity is not liquefied among the old by actively increasing mortgage debt, since the opposite is observed. However, in the descriptive analysis it was suggested that the old reveal some active behavior, but that the effect is relatively small. Therefore the empirical results can point at passive behavior, while in fact there is some activity among the old. In order to test for this idea, the IV estimations can also be done for specific age groups (in order to see how the significance and coefficients change among these groups). This will illustrate whether there seems to be activity among the old on the mortgage market or not. The results are provided in table 4 (2SLS) and 5 (tobit).

IV 2SLS	Age20	Age30	Age40	Age50	Age60	Age70	Age80
Purchase price	1.24***	0.82***	0.65***	0.55***	0.40***	0.28***	0.20***
Gross income	0.02	0.1	0.18***	0.21***	0.12***	0.1	0.24
Current value	-0.30*	-0.05	0.03	0.05***	0.10***	0.10***	0.09**
Life insurance	29824.49***	11888.69***	14575.79***	21817.18***	32209.17***	36588.28**	2996.17

Investments	26799.91***	22867.27***	41034.54***	49749.19***	64824.28***	66700.59***	171724.7
Interest-only	13780.19***	8902.74***	14554.08***	23583.13***	33957.19***	45991.86***	-49392.75
Annuity	32712.28***	14526.84**	922.53	7128.13*	23927.17***	38008.27**	-33275.77
Linear	-34606.83	-41614.8**	8369.39	16462.41	15514.03**	20247.46	-14718.69
Other	-7590.96	-4332.25	12436.77	5129.56	37159.47***	33344.98	-20966.2
Constant	-8296.07	33081.45***	15585.21***	4744.81	-12764.22	-19486.76	62942.71
First stage F	34.22	153.31	624.13	405.2	359.19	214.33	47.91
Sargan test (p-value)	0.06	0.01	0.44	0.86	0.40	0.85	0.33
Number of observations	2350	7140	8603	7233	4928	1748	299

Table 4: IV (2SLS) estimations among different age groups. *, ** and *** respectively indicate a 10%, 5% and 1% confidence interval.

IV Tobit	Age20	Age30	Age40	Age50	Age60	Age70	Age80
Purchase price	4.88***	0.86***	0.67***	0.56***	0.39***	0.29***	0.24***
Gross income	-1.01**	0.09***	0.15***	0.17***	0.05*	0.05	0.12
Current value	-2.95***	-0.10***	0.004	0.03**	0.07***	0.08***	0.05**
Life insurance	84553.7***	27138.55***	45486.2***	78529.8***	147916.0***	211351.6***	304520.2***
Investments	70809.98***	33952.94***	64202.12***	88981.66***	143002.1***	135904.0***	464089.6***
Interest-only	39811.25***	21175.92***	44846.37***	89109.93***	190769.7***	275394.8***	289409.5***
Annuity	138584.8***	27268.62***	30385.62***	67387.74***	146824.0***	248143.1***	249310.9***
Linear	-116668.4	-25837.16**	45136.55***	79553.26***	152267.1***	227641.4***	331406.6***
Other	-30157.78	13383.79	49337.71***	73935.08***	193739.1***	248762.9***	326797.9***
Constant	-146251.6***	14689.41***	-23504.68***	-69836.63***	-170205.7***	-247777.8***	-272208.2***
ALN test (p-value)	0.25	0.02	0.69	0.46	0.22	0.76	0.14
Number of observations	2422	7242	8910	7879	6499	3161	998

Table 5: IV (tobit) estimations among different age groups. *, ** and *** respectively indicate a 10%, 5% and 1% confidence interval.

The most interesting observation that can be made here is that the current value of the house is not significant at young age, but it is significant at old age in table 4. It starts being significant in the age group of 50-59 and remains significant up to the oldest age group of 80-89. The coefficient doubles between the age group in 50-59 and 60-69 and remains constant after. This shows that old households do take the current value of the house into account when making a decision about the size of the mortgage. The current value of the house positively affects the size of the mortgage. Thus at old age, the current house capital is taken into account when deciding whether or not to take on mortgage debt. By taking on mortgage debt, a household decumulates

capital. The finding that this happens around the age of 50-59 and that the coefficient of the current value of the house is larger for the mortgage size decision among the older age groups, shows that elderly do behave actively in order to decumulate capital. This conclusion is supported by the tobit estimation as well, given that around retirement the coefficient turns positive and doubles between 60-69 and 70-79.

However, it should also be noted that the size of the coefficient of the current value variable is relatively small (compared to the purchase price variable). Therefore it may not be entirely supporting the implications of the lifecycle theory. Nonetheless, it is in line with the previously suggested movement of the elderly: attempts towards active behavior with a relatively small effect on maintained home equity.

Table 4 and 5 show that the purchase price is significant among all age groups. The coefficients however are relatively large among the youngest, while they decreases gradually and are smallest among the oldest. This suggests that the magnitude of the impact of the purchase price on the demand for mortgage debt is decreasing along with age. So it seems that mortgage demand at older ages is driven by other factors (such as the wish to decumulate capital). This finding suggests that households behave actively when determining the amount of mortgage debt. Otherwise, in the case that households are passive mortgage-holders, the effect of the purchase price on mortgage debt would remain more or less constant among the age groups.

Gross income is significant for specific age groups. It turns significant from the age groups 40-49 (in the 2SLS estimation) and remains significant until the age of 60-69. In the tobit estimation gross income is significant among all young age groups and remains significant until the age of 60-69 as well. This suggests that income is important for the demand for mortgage debt during the entire working phase of life. During retirement income is not significant anymore. Interestingly, the coefficient drops in the group age group of 60-69 years old. This can well be caused by the joint composition of employees and retirees in this group. The coefficient is positive among all age groups. Therefore the mortgage debt increases along with a higher income. This supports the observation that Dutch households do not pay off their mortgage, but when they can afford a larger monthly interest-payment, they increase mortgage size (and may move to a more expensive house).

A final comment should be made about the tests for the overdentifying restrictions. For the 20-29 years old there is overidentification at a 10% significance level, while for the 30-39 years old

there is overidentification at a 5% significance level. For the other age groups there is no overidentification. However, this does not affect the interpretation of the results, given that the trends persist when excluding the two youngest age groups.

6. Panel study based on synthetic age cohorts

As final part of this thesis, the active behavior will be investigated more closely. In order to consider active behavior, one should focus on the change in mortgage demand over time rather than the level of mortgage demand. In the IV-estimations in section 6, it was not possible to include changes in either mortgage debt or the current value of the house due to a matching problem (given that the data consists of multiple cross-sectional waves). If it would be possible to observe the changes in mortgage debt and the changes in the current value of the house, the implications of the model of Brueckner (1994) can be tested.

The WoON datasets offer the opportunity to set up synthetic age cohorts and use the cross-sectional waves for a panel study. This method was introduced by Deaton (1985). For this method synthetic age cohorts are created and the mean values are used as data. In this way one can follow synthetic age cohorts through the cross-sectional waves. However, the number of observations is substantially reduced, because mean values of age cohorts are used rather than individual observations (on a micro-level). A panel study based on synthetic cohort analyses therefore requires a large dataset, which allows for cohorts which consist of a small range of years per cohort. In this section multiple regression analyses will be performed.

According to Brueckner, households are expected to behave actively by adapting mortgage debt to changes in the current value of the house in an optimal way. In case that $r_m < r_s$ (and a certain return on savings), the mortgage size should be increased to the maximum allowed size. When the current value of the house increases, the size of mortgage debt should increase as well. In case that $r_m < r_s$, but the return on savings is uncertain, then a similar movement should occur. Due to the uncertainty of r_s, the increase in mortgage debt is smaller, but there should still be an increase. The most simple way to test for this is to perform a regression which only looks at the change in mortgage debt explained by the change in the current value of the house. This is shown in the following estimating equation:

$$(MD_t - MD_{t-1}) = \alpha_0 + \alpha_1(CV_t - CV_{t-1}) + \varepsilon$$

Where MD denotes mortgage debt (including homeowners without mortgages) and CV the current value of the house. For this analysis the waves of 2002, 2006 and 2009 are used. The age cohorts consist of 4-year age groups, ranging from 1927-1930 to 1975-1978. In order to increase the number of observations a distinction is made between 4 country regions (north, east, south and west). All cohorts which are included in the analyses have at least 35 observations on average per region (this is an arbitrarily chosen cut off point). The regression results for the time intervals 2002-2006, 2006-2009 and 2002-2009 are shown in table 6.

	2002-2006 ($R^2 = 0.02$)	2006-2009 ($R^2 = 0.09$)	2002-2009 ($R^2 = 0.03$)
Constant	33945***	11569***	16023
$CV_t - CV_{t-1}$	-0.217	0.233**	0.333

Table 6: Regression results of synthetic cohort analyses. *, ** and *** respectively indicate a 10%, 5% and 1% confidence interval.

The results show that the change in the current value of the house does not significantly affect the change in mortgage demand during the periods 2002-2006 and 2002-2009. However, the results are significant for the period 2006-2009. The coefficient is positive, which is in line with the expectation of Brueckner's model. The observation that the other time intervals are not significant do raise some doubts about generalizing the conclusion.

The results may be affected by new homeowners, or by movers. When considering households which did not move recently (i.e. they purchased the house before 2002), the analysis would consider the refinancing of mortgages (which indicates activity on the mortgage market). Therefore table 7 provides the same regression analyses as performed in table 6, but now it is applied to the homeowners which bought their house before 2002.

	2002-2006 ($R^2 = 0.02$)	2006-2009 ($R^2 = 0.00$)	2002-2009 ($R^2 = 0.01$)
Constant	11650***	5207***	16558**
$CV_t - CV_{t-1}$	-0.071	-0.008	-0.052

Table 7: Regression results of synthetic cohort analyses excluding new homeowners and movers. *, ** and *** respectively indicate a 10%, 5% and 1% confidence interval.

The results in table 7 show that in this regression all the changes in the current value of the house do not significantly affect the change in mortgage debt. This implies that the significant results for the period 2006-2009 do not hold when excluding the new homeowners and movers. A conclusion about the activity of saving behavior cannot be drawn based on these results.

However, as shown in the previous sections in this thesis, the old and young can have very different preferences. According to the lifecycle models, the young are expected to accumulate capital, while the old are expected to decumulate capital. This may bias the results in table 6 and 7. In order to take this into account, a cross-term will be included in the regression analyses. The cross-term multiplies the average age of the cohort with the change in the current value of the house. This leads to the following estimating equation.

$$(MD_t - MD_{t-1}) = \alpha_0 + \alpha_1(CV_t - CV_{t-1}) + \alpha_2 age * (CV_t - CV_{t-1}) + \varepsilon$$

The regressions will be estimated for the sample which excludes new homeowners and movers and the results are shown in table 8.

	2002-2006 ($R^2 = 0.46$)	2006-2009 ($R^2 = 0.26$)	2002-2009 ($R^2 = 0.63$)
Constant	6055*	3084*	4232
$CV_t - CV_{t-1}$	0.519***	1.019***	0.838***
Age*$(CV_t - CV_{t-1})$	-0.008***	-0.015***	-0.012***

Table 8: Regression results of synthetic cohort analyses excluding new homeowners and movers. *, ** and *** respectively indicate a 10%, 5% and 1% confidence interval.

The results in table 8 show a significantly positive effect of the change in the current value of the house on the change in mortgage debt. The cross-term has a negative coefficient, implying that the older the household is, the smaller the effect of a change in the current value of the house on mortgage debt is. The results suggest that the young will increase mortgage debt when they can, probably because they are more liquidity constrained. The old however do not take on additional mortgage debt. The age in which the effect of a change in the current value of the house crosses zero ranges from 65 to 70. It appears that the expected increase in mortgage debt among the old is not supported in this estimation.

In order to be able to draw better conclusions, one should perform the regression among only young or old households. There is a drawback of specifying the sample further, because the sample size will get smaller as well. Therefore the estimation is performed among the young and

middle-aged ranging from 31 to 62 (in 2009) and among the old ranging from 63 to 82. The results for the young and middle-aged homeowners and the old homeowners are respectively shown in table 9 and 10.

	2002-2006 ($R^2 = 0.35$)	2006-2009 ($R^2 = 0.35$)	2002-2009 ($R^2 = 0.60$)
Constant	7014**	6027***	11539**
$CV_t - CV_{t-1}$	0.524***	1.520***	0.954***
Age*$(CV_t - CV_{t-1})$	-0.009***	-0.028***	-0.017***

Table 9: Regression results of young and middle-aged (31-62 years old) synthetic cohort analyses excluding new homeowners and movers. *, ** and *** respectively indicate a 10%, 5% and 1% confidence interval.

	2002-2006 ($R^2 = 0.04$)	2006-2009 ($R^2 = 0.15$)	2002-2009 ($R^2 = 0.02$)
Constant	6968	1231	-2755
$CV_t - CV_{t-1}$	-0.046	-1.588	0.188
Age*$(CV_t - CV_{t-1})$	-0.001	0.019	-0.002

Table 10: Regression results of old (63-82 years old) synthetic cohort analyses excluding new homeowners and movers. *, ** and *** respectively indicate a 10%, 5% and 1% confidence interval.

The results in table 9 and 10 show that the estimation yields significant results for the young, but not for the old. Table 9 shows that an increase in the current value of the house has a positive effect on the change in mortgage debt up to the age of 54 to 59. This suggests that young and middle-aged homeowners will use the opportunity to increase mortgage debt when it is possible. The old however do not show any significant effect in this model. This points at passive behavior of the old and shows that elderly are not significantly increasing mortgage debt to decumulate capital.

The most important lesson from this panel study is that the old do not actively increase mortgage debt when the current value of the house increases. This adds a direction to the outcome of the previous instrumented variable estimations in section 5, since these findings imply that the current value of the house is taken into account when choosing mortgage debt. These results imply that households facilitate the effect of the current value of the house in changing the type of mortgage rather than in increasing mortgage debt. This trend was clearly shown in table 2 and figure 4 (the share of mortgageholders which are 70-80 years old is 80%). This trend can be interpreted as indirect capital decumulation, because households maintain the level of mortgage debt rather than paying off mortgage debt. This implies that less home equity is accumulated at old age than in case of entirely passive behavior.

7. Conclusion and suggestions

The main research question in this thesis was whether the elderly home equity puzzle can be explained by passive saving behavior in the Netherlands. Before this question could be answered, it had to be clear what the elderly home equity puzzle is, whether it is important (does it actually exists) and why the Netherlands offers a nice opportunity to apply the research question to.

In order to answer the sub-questions, a substantial descriptive analysis on the Dutch house market is provided. It is shown that homeownership increased rapidly during the past decades and that home equity among the old is very large in the Netherlands, while standard lifecycle theorem expects elderly to decumulate their capital. The conclusion is drawn that the home equity puzzle exists, even in a country in which the precautionary savings motive should be small (i.e. no large medical expenses, a public pension scheme etc.).

It was argued that the easiest way to decumulate capital is to use mortgage debt (i.e. no movement is required as in Artle and Varaiya, 1978 or Venti and Wise, 2004). Households can simply change the type of mortgage to an interest-only mortgage or increase mortgage debt in order to liquefy home equity at old age. Therefore one should consider the development of mortgage debt in order to observe optimizing behavior among the old. The empirical work in this thesis departs from the model for mortgage demand as proposed by Brueckner (1994). In this model Brueckner showed that households will increase mortgage debt until the maximum allowed mortgage debt when the returns on savings are larger than the interest payments on mortgage debt (in case of certainty). He also suggests an instrumented variable estimation for mortgage debt, which has been performed in this thesis.

In the empirical analyses three different techniques have been used. Two stage least squares models, tobit models and synthetic panel cohort analyses have been estimated. The first two methods lead to the same conclusions. Elderly do show some movement towards (indirect) capital decumulation. So there is active optimizing behavior which aims to decumulate home equity at old age. However, the effect of this active behavior on the amount of maintained home equity is rather small.

The third estimation however tested whether elderly are actively increasing mortgage debt in order to decumulate home equity. No significant results for active behavior among the old were

found, implying that the effect of the current value of the house on mortgage debt is facilitated by changing the type of mortgage towards cheaper types of mortgages such as an interest-only mortgage (rather than increasing the size of mortgage debt). This movement was also illustrated in the descriptive analysis and supports the conclusion that elderly do reveal active behavior (the movement to cheaper types of mortgages), but that they prefer to stop accumulating home equity rather than decreasing home equity.

So the main research question can be answered. Active behavior among the old exists, but the effect remains small. This can also be interpreted as passive behavior when considering the amount of home equity that is left out of the optimizing behavior. The main conclusion is that the hypothesis that the elderly home equity puzzle can be explained by passive saving behavior in the Netherlands cannot be rejected, given that the active revealed behavior only has a minor effect on maintained home equity.

Further research would benefit from more extensive panel datasets, which are not available at the time of writing this thesis. Especially the panel study on synthetic age cohorts could be performed on the individual rather than on the aggregate level. This would yield more insight on personal characteristics and the relation to active behavior on the mortgage market (conditional on the development of the current value of the house).

Additionally, further research could focus more on the possibilities and the costs or risks of reverse mortgages. Davidoff and Welke (2005) suggests that the costs are of reverse mortgages are large due to adverse selection and moral hazard (i.e. only households which expect to live long will apply and when they have a reverse mortgage, they will not maintain the house properly). Caplin (2002) showed that the average transaction costs to start a reverse mortgage (in the US) are 14% of the initial loan. Besides these transaction costs, the costs such as interest payments and additional taxation still have to be added. This implies that reverse mortgages are not only perceived as risky, but also as very costly. One could investigate these costs in the Netherlands and compare these costs with the costs of an interest-only mortgage. This comparison would add to the understanding of mortgage choice.

8. References

Artle, R. and P. Varaiya (1978), Life cycle consumption and homeownership, *Journal of Economic Theory*, 18 (1), pp. 38-58

Attanasio, O.P. and H.W. Hoynes (2000), Differential mortality and wealth accumulation, *The Journal of Human Resources*, 35 (1), pp. 1-29

Bank, J., R. Blundell and S. Tanner (1998), Is there a retirement-savings puzzle? *American Economic Review*, 88 (4), pp. 769-788

Barth, R.B., P. Gotur, N. Manage and A.M.J. Yezer (1983), The Effect of Government Regulations on Personal Loan Markets: A Tobit Estimation of a Microeconomic Model, *The Journal of Finance*, 38 (4), pp. 1233-1251

Bernheim, B.D., A. Shleifer, and L. Summers (1985), The strategic bequest motive. *Journal of Political Economy*, 93 (6), pp. 1045-1076

Bernheim, B.D., J.S. Skinner and S. Weinberg (2001), What accounts for the variation in retirement wealth among U.S. households? *American Economic Review*, 91 (4), pp. 832-857

Börsch-Supan, A. and K. Stahl (1992), Life cycle savings and consumption constraints, *Journal of Population Economics*, 5 (4), pp. 289-303

Bruecker, J.K. (1994), The Demand for Mortgage Debt: Some Basic Results, *Journal of Housing Economics*, 3, pp. 251-262

Brueckner, J.K. (1997), Consumption and investment motives and the portfolio choices of homeowners. *Journal of Real Estate Finance and Economics*, 15 (2), pp. 159-180

Caplin, A. (2002), The reverse mortgage market: Problems and prospects. Innovations in Housing Finance for the Elderly, In: *Pension Research Counsil*. Editor: O. Mitchell

Caplin, A (2002), Turning Assets into Cash: Problems and Prospects in the Reverse Mortgage Market. In: *Innovations in Retirement Financing*. Editors: O.S. Mitchell, Z. Bodie, B. Hammond, and S. Zeldes. University of Pennsylvania Press, pp. 234-253.

Chetty, R. and A. Szeidl (2010), *The effect of housing on portfolio choice*. NBER working paper 15998

Choi, Namkee G. (1996), Older persons who move: Reasons and health consequences. *Journal of Applied Gerontology*, 15, pp. 325–344

Davidoff, T. (2009), Housing, health and annuities, *Journal of Risk and Insurance*, 76 (1), pp. 31-52

Davidoff, T. and G. Welke (2005), *Selection and moral hazard in the reverse mortgage market*. SSRN working paper 608666

Deaton, A (1985), Panel data from time series of cross-sections. *Journal of Econometrics*, 30 (1-2), pp. 109-126

Doorslaer, E. van, and C. Masseria (2004), *Income-related inequality in the use of medical care in 21 OECD countries*. OECD health working paper, 14

Dynan, K.E., J.S. Skinner and S.P. Zeldes (2002), The Importance of Bequests and Life-Cycle Saving in Capital Accumulation: A New Answer. *American Economic Review*, 92 (2), pp. 274-278

Feinstein, J. and D. McFadden (1989), The dynamics of housing demand by the elderly: Wealth, cash flow, and demographic effects. In: D. Wise, Editor, *The economics of aging*, University of Chicago Press, pp. 55–86

Fisher, I. (1930), *The theory of interest: as determined by impatience to spend income and opportunity to invest it*, The Macmillan Co., New York

Hubbard, R., J.S. Skinner and S.P. Zeldes (1995), Precautionary Savings and Social Insurance. *Journal of Political Economy*, 103 (2), pp. 360-399

Hurd, M.D. (1987), Savings of the elderly and desired bequests. *American Economic Review*, 77 (3), pp. 298-312

Iyengar, S.S., R.E. Wells and B. Schwartz (2006), Doing better for feeling worse: looking for the "best" job undermines satisfaction. *Psychological Science*, 17 (2), pp. 143-150

Kadaster (2011), *Prijsindex bestaande koopwoningen*, www.kadaster.nl, February 15th, 2011

Kapteyn, A., R.J.M. Alessie and A. Lusardi (2005), Explaining the wealth holdings of different cohorts: productivity growth and social security, *the European Economic Review*, 49, pp. 1361-1391

Kimball, M.S. (1990), Precautionary savings in the small and in the large, *Econometrica*, 58 (1), pp. 53-73

Kliger, M. and B. Schwartz (2005), *Maximizing tendencies: Evidence from a national sample*, Unpublished raw data

Kotlikoff, L.J. and L.H. Summers (1981), The role of intergenerational transfers in aggregate capital accumulation, *Journal of Political Economy*, 89 (4), pp. 706-732

Levition, R. (2001), Reverse mortgage decision-making. *Journal of Aging and Social Policy*, 13 (4), pp. 1-16

Modigliani, F. (1988), The Role of Intergenerational Transfers and Life-Cycle Saving in the Accumulation of Wealth. *Journal of Economic Perspectives*, 2 (2), pp. 15-40

Modigliani, F. and R. Brumberg (1954), Utility analysis and the consumption function: an interpretation of cross-section data, In: *Post Keynesian Economics*, K.K. Kurihara, Rutgers University Press, New Brunswick, pp. 388-436

Palumbo M.G. (1999), Uncertain medical expenses and precautionary saving near the end of the life cycle. *Review of Economic Studies*, 66 (2), pp. 395-421

Rouwendal, J. (2007), Ageing, homeownership and mortgage choice in the Netherlands. *Netspar Discussion Paper*, 49

Rouwendal, J. (2009), Housing wealth and household portfolio in an ageing society. *De Economist*, 157 (1), pp. 1-48

Schors, A. van der, R.J.M. Alessie and M. Mastrogiacomo (2007), Home and mortgage ownership of the Dutch elderly: explaining cohort, time and age effects. *De Economist*, 155 (1), pp. 99-121

Schwartz, B., A. Ward, J. Monterosso, S. Lyubomirsky, K. White, and D.R. Lehman (2002), Maximizing versus satisficing: Happiness is a matter of choice. *Journal of Personality and Social Psychology*, 83, pp. 1178-1197

Skinner, J.S. (1988), Risky income, life cycle consumption and precautionary savings. *Journal of Monetary Economics*, 22 (2), pp. 237-255

Skinner, J.S. (1996), Is housing wealth a sideshow? In: *Advances in the economics of aging*. Editor: D. Wise, University of Chicago Press, pp. 241-272

Spoor, L. (2008), Je huis of je leven? ('Your house or your life?'). *Netspar NEA Paper*, 9

Venti, S.F. and D.A. Wise (1989), Aging, moving, and housing wealth. In: *The economics of aging*. Editor: D. Wise, University of Chicago Press, pp. 9–48

Venti, S.F. and D.A. Wise (1990), But they don't want to reduce housing equity. In: *Issues in the economics of aging*. Editor: D. Wise, University of Chicago Press, pp. 13–32

Venti, S.F. and D.A. Wise (2004), Aging and housing equity: another look. In: *Perspectives on the economics of aging*. Editor: D. Wise, University of Chicago Press, pp. 127-180

Wagstaff, A. and E. van Doorslaer (2000), Chapter 34; Equity in health care finance and delivery. In: *Handbook of Health Economics*. Editors: A.J. Culyer and J.P. Newhouse, Vol 1 (2), pp. 1803-1862