RUBEN COX

To Own, To Finance, and To Insure

Residential Real Estate Revealed

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Residential Real Estate Revealed

To Own, To Finance, and To Insure
residential real estate revealed

Bezitten, financieren, en verzekeren
residentieel vastgoed onderzocht

THESIS

to obtain the degree of Doctor from the
Erasmus University Rotterdam
by command of the
rector magnificus

Prof.dr. H.G. Schmidt

and in accordance with the decision of the Doctorate Board

The public defence shall be held on
Thursday 12 September 2013 at 15:30 hrs

by

Ruben Henricus Gerardus Maria Cox
born in Maastricht

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Erasmus Research Institute of Management – ERIM
The joint research institute of the Rotterdam School of Management (RSM)
and the Erasmus School of Economics (ESE) at the Erasmus University Rotterdam
Internet: http://www.erim.eur.nl

ERIM Electronic Series Portal: http://hdl.handle.net/1765/1

ERIM PhD Series in Research in Management, 290
ERIM reference number: EPS-2013-290-F&A
ISBN 978-90-5890-337-0

Design: B&T Ontwerp en advies www.b-en-t.nl

This publication (cover and interior) is printed by haveka.nl on recycled paper, Revive®.
The ink used is produced from renewable resources and alcohol free fountain solution.
Certifications for the paper and the printing production process: Recycle, EU Flower, FSC, ISO14001.
More info: http://www.haveka.nl/greening

Acknowledgements

After four years, a challenging journey comes to an end. The PhD trajectory is not only a search for the boundaries of knowledge, but also a period in which the candidate learns about his own personality. I am greatly indebted to my guides during this journey: Dirk Brounen and Peter Neuteboom for their supervision, encouragement, advice and help. Their wonderful personalities kept me going and were able to turn (imaginary) tears into a smile. Dirk's energetic, humorous, and curious personality, was a big inspiration for me to 'go out there and get things done'. However, after your move to Tilburg, my contact with Peter intensified. Peter, there is only one thing I can say: you taught me everything that *I* know, but you did not teach me everything that *you* know.[1] Our discussions on housing and mortgage markets as well as other matters in life were very insightful, but it was your vivacious personality that helped me to put things in perspective.

I would also like to thank the other members of the committee: Dion Bongaerts, Mathijs van Dijk, and Kees Koedijk, whose comments helped me to improve my dissertation. I owe a special word of appreciation to Dion for assisting me on econometric issues, interpreting results, and using common sense during all these years.

I am indebted to my colleagues at the Finance department of RSM, who helped me out on research, teaching, and handling the peculiarities of academic life: Arjen, Ben, Joop, Lars, Mathijs, Mark, Marno, Marta, Peter and Tao. Further, I thank Egemen and Viorel for their help in preparing me for the job market. I also want to extend my appreciation to my real estate colleagues: Maarten, who convinced me to start a PhD, and Melissa, for sharing her insights and experiences with me as an office-mate. Furthermore, I thank my PhD colleagues with whom I shared the days (and sometimes nights and weekends): Dimitrios, Joris, Henry, Oguz, Pooyan, Teng, Teodor, and Steve. I would like to extend a special word of gratitude to Dominik, Eric ("Bobby") and Manuel. It was my pleasure to be working with you and our discussions, which often took place in "De Smitse",

[1] In order to avoid being accused of plagiarism, I must confess that I got this quote from Chuck Findley speaking about the skills of his older brother Bob Findley (two grandmasters of the trumpet).

sometimes literally caused tears of laughter. I am also grateful to Flora and Myra for their excellent administrative support.

At the start of my PhD, I decided to spend a semester at the real estate department of the National University of Singapore. Although it was a turbulent time (laptop crashes etc.), I want to express my gratitude to professor Seow Eng Ong and professor Yuming Fu for hosting me and giving me the opportunity to gain a unique experience in Asia.

I gratefully acknowledge the generous financial support from Nationale Hypotheek Garantie. Their decision to invest in academic research enabled me to pursue my doctoral studies. My meetings with Hans Mersmann and Martijn De Jong-Tennekes helped me in translating academic findings back to practical implications and deepened my understanding of the Dutch real estate market. I am also deeply indebted to employees from the Autoriteit Financiële Markten, De Nederlandsche Bank, IG&H, ING, and NIBUD, for sharing valuable insights and data with me. Their willingness to free up some time greatly improved my understanding of how the Dutch housing and mortgage market operates in practice. The discussions with them enabled me to assess whether the right questions were being asked and whether the answers that I provided made sense.

I started compiling a list of friends, family, ex-colleagues, former teachers, and other people that had an influence on my development, but quickly found out that this would lead to mutual disappointment, as there are too many of you to list individually: please know that I greatly appreciated working, learning, and relaxing with you, and that I am looking forward to seeing all of you again some day.

My final words of gratitude go out to Elise, my brothers, and my parents. Elise, you came into my life when the stress of finishing my dissertation and finding a new job gradually started to build up. Your love and support motivate me to go the extra mile; I look forward to making the next step in my life with you by my side. Further, I thank “Los Banditos”: Justin and Michiel, my brothers, who always know how to make me laugh. Finally, I am deeply indebted to my parents; their unconditional support is the foundation for everything I undertake. It is to them that I dedicate this thesis.

Ruben Cox
Rotterdam
April, 2013

Contents

Chapter 1
Introduction

The eruption of the subprime crisis in 2008 dramatically shook up financial and housing markets and required governments around the world to step in and bail financial institutions out. Following its break out, politicians and academics started to investigate how this crisis could emerge (Demyanyk and Van Hemert, 2011) and which measures should be adopted to prevent it from happening in the future (Shiller, 2008). [2] Although financial institutions were severely affected, the consequences to homeowners were probably as severe since many of them defaulted on their mortgage payments and got foreclosed upon. It is the perspective of the homeowner that dominates this thesis and a useful starting point is to examine their demand for housing.

Housing demand by households can be viewed as a combination of demand for a consumption good (e.g. shelter from the elements) and an investment good (e.g. an asset which can be sold at a different price in the future) (Ioannides and Rosenthal, 1994). Viewed as an investment good, it provides a way for individuals to accumulate wealth, for example through the generation of capital gains from home price appreciation or rental income (Quigley, 2006). As with other financial assets, this perspective is consistent with a market wherein individuals participate and act to generate returns on their investment. Moreover, the risks of investing in housing markets such as house price volatility are of concern to the investor and affect his ability and willingness to hold positions. However, Shiller (2008) contends that one of the causes of the subprime crisis is due to naïve investors flooding the real estate market. The oversupply of capital allocated to real estate pushed up its prices to unsustainable levels, which had – in hindsight – far-reaching consequences.

This brings us to the view where housing demand is considered as demand for a consumption good. Observed actions in the housing market can be thought of

[2] However, there is no consensus on which actions should be taken (see Howden and Bagus, 2009).

as reflecting the need of households to fulfill their preferences for the consumption of housing services. Empirical evidence indeed suggests that observed demand in the housing market appears to be consistent with that for a consumption good rather than an investment good (Arrondel and Lefebvre, 2001; Ioannides and Rosenthal, 1994). An implication of the consumption-based view is that the actions of individuals in the housing market are not necessarily driven by return-seeking motives but rather the need to find a suitable place to live in. Hence, even absent the subprime crisis, we would expect that the average buyer or seller in the housing market is relatively 'naïve' because the information it processes and the decisions it makes are on consumption rather than investment based grounds.

Governments are aware of the need of their residents to participate in the housing market and consequently intervene in residential housing markets through subsidies, social housing, land zoning policies and regulation of financial institutions, to ensure widespread availability and affordability of housing. One non-trivial question that rises is the relevance of the tenure-mode to fulfill this demand for housing services.[3] Viewed in the light of the subprime crisis, this question has yet again gained importance because part of the housing bubble in the United States (U.S.) was fueled by policies aimed to increase homeownership rates (Hendershott and Villani, 2012).

Moreover, most households are, once they decide to become a homeowner, required to enter the mortgage market in order to finance the purchase of a house. Regulators across nations expressed their concerns with the rapid growth of new mortgage products that defer or abolish amortization in the past decades (Federal Reserve Board, 2007). These concerns are based on indications that households have limited understanding of finances in general (Lusardi and Mitchell, 2008). The consequences of choosing an unsuitable product can have a long-lasting impact on the household budget. Moreover, empirical evidence has documented unfair and abusive lending practices (Agarwal *et al.,* 2012) in the U.S., which might particularly flourish in the presence of borrowers with limited understanding of their mortgages (Carr and Kolluri, 2001). The overarching question is whether households make informed decisions based on an understanding of the features of mortgages and the risks involved. Recently, the role of financial literacy of individuals in their decision making started to receive attention, for example to decide to participate in the stock market (e.g. Van Rooij *et al.,* 2011), but empirical evidence for the mortgage market is lacking so far.

[3] Tenure-mode in housing markets refers to whether households own or rent their primary residence.

Another topic that is related to the previous one is the development of underwriting standards among mortgage lenders (Demyanyk and Van Hemert, 2011). As originators increasingly started to securitize and sell mortgages in the secondary market, incentives to carefully screen loan applications and prevent over-crediting of households diminished (Keys *et al.,* 2010). The 'Originate-to-Distribute' model combined with compensation schemes that incentivize sales volume potentially lead to a misalignment of interest between lenders and households. These issues appear to be especially acute when brokers are involved in mortgage origination (LaCour-Little, 2009). However, it is unclear why lenders are willing to fund riskier mortgages when brokers are involved compared to what they would lend directly to households if they are exposed to credit and reputation risk. In this case it is expected that lending standards remain unaffected and that brokers are monitored by lenders.

So far the discussion focused on the 'own' and 'finance' component of homeownership. In many housing markets, homeowning households hold a portfolio wherein real estate is the major asset class and mortgage debt the major liability (Campbell, 2006). Standard theories in finance suggest that households benefit from hedging or diversifying their risk exposure to real estate (Englund *et al.,* 2002). Despite that house-price insurance is largely unavailable, many households do not engage in precautionary behavior such as purchasing mortgage insurance. Given the impact that the burst of the subprime bubble had on household's wealth, it is interesting to understand why so many decide not to insure against the risk and consequences of mortgage default. An exploration of the factors affecting the default-option among homeowners is crucial to provide input to and examine the effectiveness of changing the mode in which mortgage markets operate.

The answers that this dissertation provides shed more light on the behavior of households in the residential real estate market. The subprime crisis brought the housing and mortgage market at the center of the political debate and both are subject to reforms. A deeper understanding of the behavior of market participants is needed to provide input for the effective revision of housing market policies, financial sector regulation and the re-allocation of (fiduciary) duties and responsibilities.

This chapter continues with a brief motivation for the research in this dissertation in Section 1.1 and its outline in Section 1.2.

1.1 Housing and mortgage markets across the world

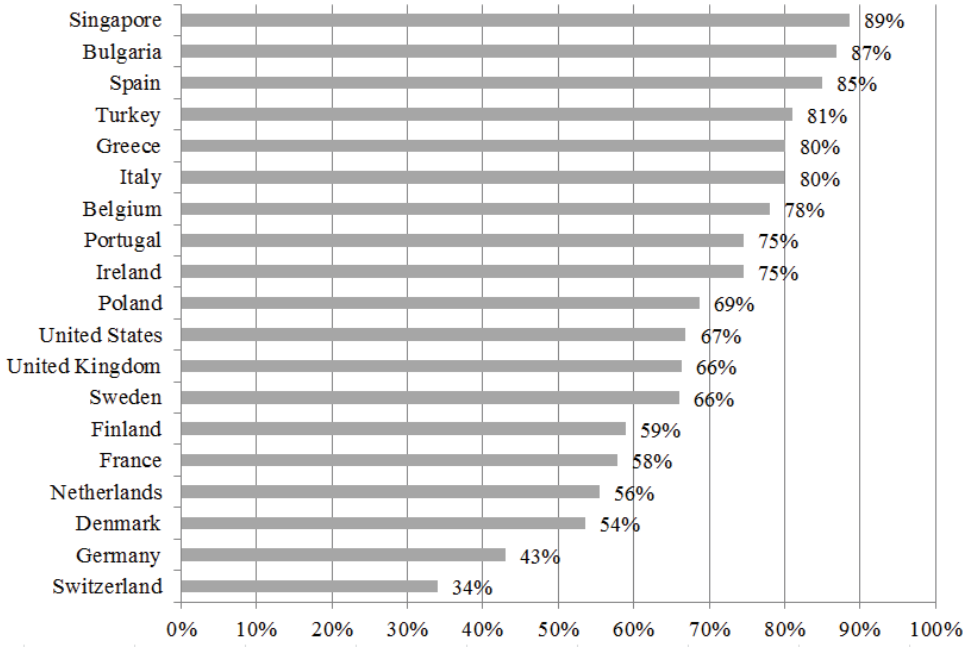
Housing market research is an established discipline within the finance and economics literature. Housing and mortgage markets are at the heart of developed nations and their omnipresence lead to a wide range of theoretical and empirical work. However, there is a major difference that distinguishes real estate research from other research streams in finance. This comes from the substantial differences in the governing and functioning of residential real estate markets across nations (Neuteboom, 2008). Heterogeneity in institutional context and local culture lead to differences in ownership structures, completeness of financial markets, and market governance.

It also affects the way in which market forces can shape (equilibrium) outcomes and the behavior of its participants. Therefore it is ex-ante unclear how theoretical propositions generalize across contexts. Assuming that results obtained in one market can be automatically applied to another one can lead to incorrect conclusions and the development of ineffective policies.

To illustrate this heterogeneity, homeownership rates for eighteen developed countries across the world are shown in Figure 1.1. It can be seen that the majority of the Bulgarians and Singaporeans are homeowners while housing markets in countries like Denmark, the Netherland, Germany and Switzerland have much more rental housing (Voigtländer, 2009). This heterogeneity in housing stock composition and homeownership rates provides a clear indication that the housing market is functioning differently across nations.

Figure 1.1 ■ Homeownership rates across countries

This figure shows homeownership rates for eighteen countries (reporting year in brackets): Belgium (2007), Bulgaria (2009), Denmark (2010), Finland (2009), France (2008), Germany (2009), Greece (2010) Ireland (2010), Italy (2008), Netherlands (2009), Poland (2009), Portugal (2009), Singapore (2011), Spain (2008), Sweden (2010), Switzerland (2010), Turkey (2002), United Kingdom (2009 and the United States (2010). Source: European Mortgage Federation (2011),Bourassa and Hoesli (2010), Voigtländer (2009).



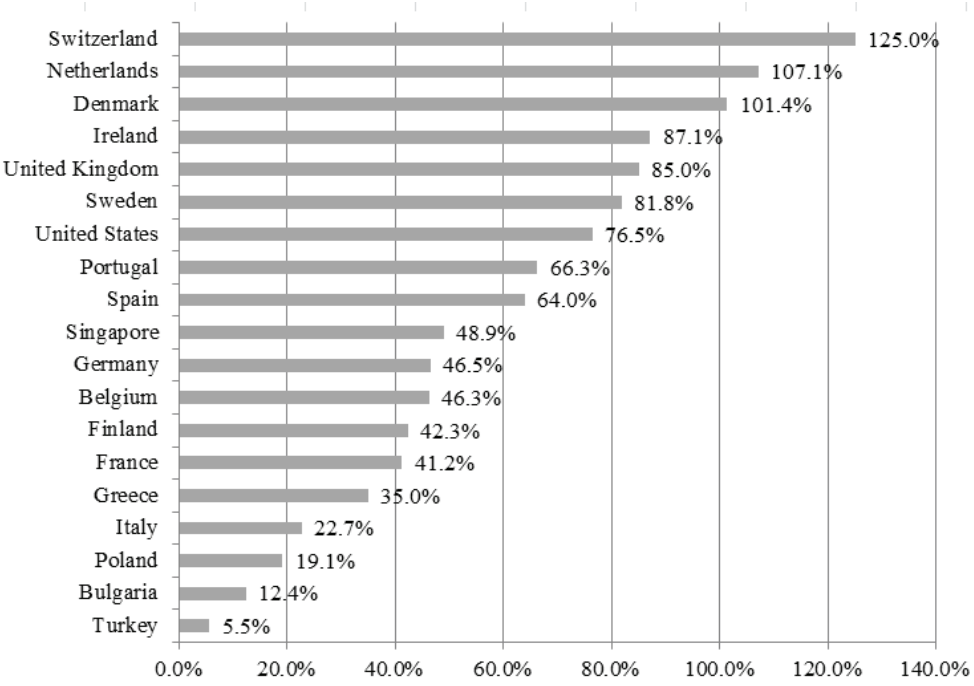
To the extent that homeownership-rates are driven by access to mortgage debt, the ratio of residential mortgage debt to country gross domestic product (GDP) is shown in Figure 1.2. Despite relatively low homeownership rates, the amount of mortgage debt in countries such as the Netherlands, Switzerland and Denmark exceeds their gross domestic product. While on the other side of the spectrum countries are found where the outstanding amount of mortgage debt is only a small fraction of GDP despite high homeownership rates (e.g. Turkey and Bulgaria).[4]

This appears surprising: how can high homeownership rates be sustained without high mortgage-debt ratios? Households owning their residence in countries like the Netherlands, United Kingdom and Denmark, tend to finance their property with mortgage debt.

[4] There is considerable heterogeneity across countries as to what is included in the reported outstanding mortgage balance. For example, in the Netherlands and Denmark, amortization and dedicated savings are not taken into account in the computation of outstanding mortgage debt. However, even if these were taken into account, these countries would still be in the top of the distribution.

Figure 1.2 ■ Mortgage debt-to-GDP ratios across countries

This figure shows the amount of residential mortgage debt relative to national GDP in 2010 for eighteen countries across the world. Source: Finaccord (2012), European Mortgage Federation (2011).



Consequently, mortgage markets in such countries are highly developed and competitive. Households in Bulgaria and Greece use other financial resources, such as savings and inheritance to acquire a house, subsequently making them less reliant on mortgage debt.

To what extent existing academic findings – often based on the U.S. market – have explanatory power in other markets is as such largely an empirical question. For example, the choice for an adjustable rate or fixed rate mortgage has received considerable attention in the academic literature, but mortgage markets outside the U.S. are typically not so easily characterized. As another example, the desire to promote and stimulate homeownership in the U.S. has led to questionable lending practices, which are magnitude-wise hardly found anywhere else. To gain more understanding about the functioning of housing and mortgage markets and the generalizability of results asks for empirical evidence at the country level, especially because housing markets are not integrated.

This dissertation focuses on the housing and mortgage market in the Netherlands. The availability of high quality data helps to examine in detail how Dutch households behave in the housing and mortgage market and to what extent propositions in the existing real estate literature carry over to contexts outside the Netherlands.

Specifically, the effects of homeownership and the factors relevant to the mortgage decision process are probably fairly universal, and results obtained for the Netherlands are therefore expected to be reasonably generalizable to other contexts. This is less apparent for the mortgage underwriting process, as the market-structure of the financial sector and the ease with which financial institutions can fund themselves (e.g. through securitization) have an important effect on the risks a lender can take and the underwriting standards it will set. Also for mortgage insurance decisions the results are critically dependent on the structure of the policy and the discretion that households have to purchase them. In this respect our setting is unique because it yields a quasi-experimental context that allows households to freely choose mortgage insurance. As completely voluntary mortgage insurance is absent in most other markets (for example the U.S. and Canada), the presented findings for the Netherlands are not at first glance applicable to these housing markets. However, the results are probably applicable to other insurance markets that evolved around similar types of risk (e.g. disability and unemployment risk). In any case, the insights presented in this dissertation provide a baseline for further comparative work.

1.2 Outline

This dissertation consists of four chapters covering the social and financial aspects of homeownership in the Netherlands. Specifically, it starts with examining the effects of homeownership, followed by an analysis of the decision making and mortgage origination process. Finally, the adoption of mortgage insurance is analyzed. I provide a brief overview of the research questions and main findings.

Different regimes around the world stimulate homeownership through subsidies such as the deductibility of mortgage interest expenses. Chapter two analyzes a long-standing question in the real-estate literature; namely why homeownership should be stimulated. One motivation for these subsidies is that it is thought to create positive external effects in neighborhoods. For the city of Rotterdam, we examine whether the rate of homeownership is related to external

effects such as neighborhood safety and residential satisfaction. The evidence suggests that this is indeed the case and that there is even a weak causal relation. However, our findings also show that there is a concave relationship between homeownership and external effects. That is, increases in homeownership yield smaller increases in neighborhood safety and satisfaction if current ownership levels are higher.

Owning a house often involves arranging mortgage financing by the household. Chapter three examines the decision-making process of households with respect to their mortgage. We analyze how risk aversion and financial literacy influence the type of mortgage that households choose. In the aftermath of the subprime crisis, the debate started whether mortgages – especially alternative mortgage products – where missold to households. Therefore we need to understand to what extend households could be reasonably expected to understand the products they bought. It is shown that households with lower levels of literacy and risk tolerance are significantly less likely to choose alternative mortgage products such as deferred-amortization and interest-only mortgages. The results indicate that there is a non-negligible influence of these factors in the decision-process. Moreover, it is found that the role of financial literacy and risk aversion persists after allowing for other explanations such as the influence of financial advisors, learning effects from peers and experience with prior homeownership. In general, alternative mortgage products are chosen by wealthier, older and more sophisticated households, who are also more likely to have understanding of the risks and the benefits associated with these products.

In chapter four, I examine the mortgage origination process. In general three actors are involved in the process: mortgage lenders, households and financial intermediaries. Households can obtain their mortgage directly with the originator (*direct written*) or through an intermediary. Research in the U.S. has shown that, in the presence of commission-based compensation and competition, the involvement of intermediaries can lead to a conflict of interest between them and households. However, it is *ex-ante* not clear why originators would not monitor brokers as credit risks must be acceptable to them. Removing credit risk from the balance sheet or being able to insure credit risk both reduce the monitoring incentives that originators have. This chapter shows indeed that the involvement of intermediaries does not systematically lead to over-levering of households in the Netherlands. Moreover, I do not find that intermediaries have an impact on the underwriting process conditional on the mortgage being insured. As mentioned, mortgage insurance has the potential to reduce screening incentives because it eliminates the risk exposure for originators. From a regulatory perspective, it seems more

important to focus attention on lender regulation rather than regulating financial intermediaries.

The demand for mortgage insurance is the topic of the fifth chapter. Many homeowning households hold an undiversified asset portfolio concentrated in real estate. Recourse mortgages create a wealth risk for households because they are liable for repayment of principal beyond what is recovered in a foreclosure. If this occurs, the remaining shortfall has to be covered by other personal wealth. Mortgage insurance covers this shortfall in case of an involuntary default. Despite the consequences, only 50 percent of the eligible Dutch households obtained mortgage insurance during the analysis period. The analysis indicates that households are more likely to purchase mortgage insurance the larger their risk exposure, consistent with standard economic intuition. However, I also examine the impact of behavioral traits of the decision maker. Specifically, I test whether overconfidence is able to explain the insurance decision and find this to be the case. The evidence suggests that overconfident households are up to 13 percent less likely to insure their mortgage, but contrarily to other studies no significant differences were found for the gender of the decision maker. Mortgage insurance rates shot up to levels over 85 percent following the start of the subprime crisis, which acted as a wake-up call for all market participants.

Chapter 2
Safe and Satisfied?
External Effects of Homeownership in Rotterdam[5]

2.1 Introduction

To own or not to own your home? The aftermath of the financial crisis has shown that this is still an important question. Governments around the world subsidize homeownership by mortgage interest tax deductions and first-time home buyer subsidies (Megbolugbe and Linneman, 1993). Or as the Secretary of the U.S. Department of Housing and Urban Development stated "we recognize that American families deserve the opportunity to achieve and sustain the dream of homeownership". The Netherlands also supports such a housing policy and subsidises homeownership via a mortgage interest deduction. Homeownership in the Netherlands is subsidised – net of taxation – at 15 billion euros in 2009, equalling almost 3 per cent of Dutch GDP (Statistics Netherlands, 2009).

The effect of homeownership has received considerable attention in the academic literature. At the individual level, homeownership has been related to the performance of children at school (see Jensen and Harris, 2008; Aaronson, 2000 and Green and White, 1997). The level and number of social connections that residents develop with the neighbourhood are positively influenced by being or becoming a homeowner (Engelhardt *et al.,* 2010; Kleinhans *et al.,* 2007; DiPasquale and Glaeser, 1999).

This paper focuses on the effects of homeownership at the neighbourhood level. We examine to what extent homeownership rates are related to

[5] This chapter is based on Cox, Brounen and Neuteboom (forthcoming in *Urban Studies*).We thank Dion Bongaerts, Eric Fesselmeyer, Donald Haurin, Melissa Porras Prado, Amanda Ross, Carine Smolders, two anonymous referees, the editor Mark Stephens and participants at the Rotterdam School of Management, the ERES Annual Meeting 2010, AREUEA International Meeting 2010, CESifo conference on Housing Taxation and Regulation and the ARES Annual Meeting 2011 for their valuable comments.

neighbourhood safety and neighbourhood satisfaction. Rohe and Stewart (1996) find that higher ownership levels decrease neighbourhood turnover and stabilise property values. However, a potential downside of homeownership and thus decreased turnover is a reduction of labour market mobility (Green and Hendershott, 2001). Glaeser and Sacerdote (1999) observe that homeownership has a negative impact on certain crimes while Glaeser and Sacerdote (2000) report that residents of apartment buildings face increased street crime because they are less connected to the street. Residential satisfaction and, more generally, personal self-esteem is documented to be positively influenced through homeownership by Rohe and Basolo (1997), Rossi and Weber (1996) and Galster (1987). However, there is little empirical evidence of homeownership and the impact on neighbourhood safety.

Most studies so far have focused on U.S. housing markets. Our research makes use of a unique panel dataset for Rotterdam, the second largest city in the Netherlands. With an ownership level of around 30 per cent, Rotterdam is clearly below average U.S. and Dutch ownership levels, which are 68 per cent and 55 per cent, respectively. We examine whether there are positive effects of homeownership on neighbourhood safety and neighbourhood satisfaction in a market where homeownership is not dominant and social housing[6] is a viable alternative. Moreover, we pay special attention to the causal direction of the effects. We also investigate whether external effects are a linear function of the homeownership rate. Haurin *et al.* (2003) suggest there might be diminishing returns to scale. Stimulating ownership in neighbourhoods which have already attained high ownership levels might be less effective than stimulation in low-ownership neighbourhoods (see the discussion of Engelhardt *et al.,* 2010). Shlay (2006) contradicts that homeownership for low-income households might be an effective tool in alleviating neighbourhood distress. Given this debate, we shed light on whether policies should aim at increasing homeownership.

There are several methodological issues that have to be addressed. Haurin *et al.* (2003), Dietz and Haurin (2002) and Rohe *et al.* (2001) provide a series of review studies on the external effects of homeownership. They conclude that empirical approaches taken in earlier papers are sensitive to omitted variables and selection issues. They warn that the evidence so far should be interpreted with caution. Nowadays, availability of detailed panel datasets and advances in

[6] In the Netherlands social housing is provided by private housing associations that, up to 1995, received government subsidies. Dutch social housing is subject to rent control, and households with an income of up to €29,125 are eligible for rent subsidy. As such, the system provides housing for lower-income households. In recent years projects have been initiated that allow the renter to buy his/her from the housing association at a discount to the prevailing market price.

econometric techniques provide the opportunity to deal with these methodological challenges in a more rigorous way.

Aware of the methodological challenges, we find that there is a positive effect of homeownership on neighbourhood safety and satisfaction, but the economic magnitude of this effect is small. Our results show that a 10 percent increase in homeownership rates, on average, raises neighbourhood safety by 0.6 percent and satisfaction by 0.7 percent. Additional robustness analyses show that the results are not driven by our model specification or endogeneity. We report a relation that shows diminishing returns between homeownership and external effects. Marginal changes in external effects become small once ownership rates reach levels of around 55 per cent. Our results corroborate with evidence found in the U.S. The fact that external effects already emerge in low ownership rates and are subject to diminishing returns provides input for the reassessment of housing market policies both in and outside the Netherlands (see also Chase, 2010).

The remainder of this paper is as follows: Section 2.2 discusses the extant literature underlying our research questions. In Section 2.3 we present our model and discuss our data, while the analysis are reported in Section 2.4. We discuss our findings and conclude in Section 2.5.

2.2 Socioeconomic effects of homeownership

The socioeconomic consequences of homeownership have received considerable attention in the academic literature. One of the most apparent consequences is that homeowners are less mobile than renters e.g. due to transaction costs, implying that they are less likely to move (Boehm, 1981). As a result, the average tenure of a homeowner is longer compared to a renter. Rohe and Stewart (1996) provide evidence of this. Using U.S. Census data, they find that the homeownership rates increase the percentage of households who reside at the same location for five years or longer. Many studies use the average tenure length of neighbourhood residents as an indicator for neighbourhood stability, but Rohe *et al.* (2001) warn that stability does not equal neighbourhood health or stability of property values, although they might be related with stability.

However, there are other effects related to the increased tenure of homeowners. Studies have found that the longer an individual lives in a neighbourhood, the higher the probability that he or she will develop a social network/capital with other citizens in that neighbourhood (see Kleinhans *et al.,*

2007; DiPasquale and Glaeser, 1999). For example, DiPasquale and Glaeser (1999) report that homeowners have an increased number of memberships in nonprofessional organizations and are more inclined to help solve neighbourhood problems. However, the effect of homeownership decreases substantially when they add (individual) fixed effects and tenure length to their model. This provides a clear warning that uncontrolled idiosyncratic differences and unobserved processes can lead to spurious results.

2.2.1 Homeownership and neighbourhood safety

So if homeownership stabilises neighbourhoods and if homeowners develop more social ties with their neighbours and tend to help solve neighbourhood problems, does this make neighbourhoods safer? There is relatively limited empirical evidence whether homeownership helps to reduce crime rates (Alba *et al.,* 1994; Glaeser and Sacerdote, 1999). Obviously, homeowners have a financial incentive to invest in crime prevention. Several studies show that increases in crime rates decreases property values, thereby forming a direct cost for homeowners. Gibbons (2004) for example shows for London that a one-standard deviation increase in crimes leads to a 10 per cent reduction in house prices. Glaeser and Sacerdote (1999) examine the relation between city size and crime rates and they control for homeownership but do not discuss their reasons for doing so. Reporting a negative effect on the level of property and violent crime, it might be tempting to conclude that homeownership helps to reduce crime. However, Dietz and Haurin (2003) comment that homeowners might be more likely to own alarm systems and participate in neighbourhood watch programs. The relation between crime rates and homeownership might also be driven by a selection process: homeowners might want to live in safer neighbourhoods. In their 2000 study, Glaeser and Sacerdote examine whether building structure influences social interactions and crime rates. They find a positive relation between multi-unit dwellings (apartment buildings) and street crimes such as the number of auto thefts and burglaries. They argue that this is due to an increased distance between the residents and the street, leading to a reduction in social control. The owner-occupier rate is not significant in their regressions.

So, at best there is mixed evidence that homeownership might have a positive impact on neighbourhood safety. Moreover, increasing homeownership in one neighbourhood might lead to displacement of criminal activities to another one,

leading to a reduction in safety adjacent neighbourhoods. We also examine whether neighbourhood satisfaction is related to homeownership levels.

2.2.2 Homeownership and residential satisfaction

Empirical work has focused on various forms of satisfaction such as life satisfaction (the satisfaction of individual with his/her life) and residential satisfaction (the satisfaction with the property and the surrounding neighbourhood). Homeownership might lead to higher residential satisfaction because homeowners have more freedom to customize the units to their own taste (Rohe *et al.,* 2001). Moreover, they live in environments that provide more amenities catering to their needs, thereby raising satisfaction levels with respect to both the residence and the surrounding neighbourhood (Galster, 1987). Galster points out that homeowners in later stages of the life-cycle tend to be more satisfied with their residential situation regardless of dwelling or neighbourhood characteristics.

Rossi and Weber (1996) use the General Social Survey to evaluate whether homeowners are satisfied with their neighbourhoods. Finding that owners and renters do not significantly differ in the satisfaction with their neighbourhood or safety perception, they conclude that there is not enough evidence to claim that homeownership induces higher neighbourhood satisfaction. Moreover, the physical and socioeconomic status of the neighbourhood influences the level of neighbourhood satisfaction, but in the light of Galster's discussion, this might be dependent on the age of the homeowner. If the socioeconomic status of the neighbourhood is defined in terms of wealth, Watson and Webb (2009) find that homeowners are less likely to perceive themselves as being in poverty, because owning a home might insure them against future uncertainty. This might alter their perception of their socioeconomic position, their well-being, and their residential satisfaction.

We can conclude that residential and neighbourhood satisfaction is related to homeownership but that the underlying reasons are not exactly clear. Rohe *et al.* (2001) point to this concern by mentioning that there might be mediating variables, which impact the association between homeownership and social outcomes. Moreover, it is not clear whether these effects are subject to diminishing returns or have a non-linear relation. Haurin *et al.* (2003) report that the returns to scale might diminish as homeownership rates become higher. Galster *et al.* (2000) find that indicators of neighbourhood distress progressively increase when rental occupancy rates reach 85 per cent, implying that increasing homeownership rates in these

neighbourhoods might not be effective in alleviating distress. Harkness and Newman (2002) report similar results and find that the results of homeownership are weakened in distressed neighbourhoods.

2.2.3 Negative effects of homeownership

The evidence so far supports the view that effects of homeownership are following a non-linear relation, but also indicates the existence of potential negative consequences to homeownership. The results of Harkness and Newman (2002) point to the "ownership"-trap. Homeowners cannot as easily flee distressed neighbourhoods as renters when neighbourhood-conditions change, such as an increase in crime rates because of transaction costs etc. As such homeownership can act as a 'trap', preventing households from leaving undesirable neighbourhoods.

Another important disadvantage of homeownership is that it reduces labour market mobility of households. Green and Hendershott (2001) show evidence that a 10 percentage point increase in homeownership leads to a 2 percentage point increase in unemployment rate. However, Leuvensteijn and Koning (2004) find that the probability of being unemployed is lower for Dutch homeowners compared to renters and they find no negative effect on job mobility. The absence of the effect might be due to the population density in the Netherlands, where changing jobs is not related to changing residence.

Moreover, homeownership has an impact on household finances and household wealth. To the extent that the dwelling is financed with mortgage debt, households are exposed to interest rate risk and negative equity arising when house prices decline. The illiquidity of real estate poses another potential negative effect of homeownership if households are forced to sell their house on short notice against depressed prices.

Furthermore, ownership requires commitment of a significant amount of resources, both in terms of money as well as time, by households to maintain their dwelling[7]. Although, in principle it is in the own interest of households to maintain and improve their property for example to raise its value, changes in the personal (e.g. aging) or financial (e.g. unemployment) situation might prevent households from doing so, thereby destroying equity value.

[7] Meijer (1993) shows that The average Dutch homeowner spends €1431 a year on technical management, while Harding et al. (2007) state that the sizable contribution of maintenance to house price appreciation underscores the importance of ensuring that homeowners—and especially low-income homeowners—have sufficient means to maintain their homes.

2.3 Data description and summary statistics

To evaluate our research questions empirically, we compiled a dataset that contains the complete cross-section of neighbourhoods in Rotterdam for the period 2000-2008. Data are obtained from the Rotterdam Centre for Research and Statistics (COS), the Rotterdam Safety Directorate (SD) the Rotterdam Department of Youth, Education and Society (JOS) and Statistics Netherlands (CBS). We deleted fifteen neighbourhoods from the analysis because they are located in industrial or harbour areas. The resulting sample comprises 78 neighbourhoods in 13 sub-municipalities.[8] Yearly household income data for 2007 were obtained from the CBS since these were missing from the COS dataset. Depending on the variable, a maximum of 624 neighbourhood-year observations were used. Table 2.1 shows the variable definitions and measurement units.

Our indicators for ownership effects are constructed from various data sources. The safety index is based on multiple data records from the Rotterdam Police and Fire Department and Roteb, the municipal department responsible for waste disposal and maintenance of public spaces. Using data on reported incidents, crimes and misdemeanours is only one side of neighbourhood safety, since differences in willingness to report among neighbourhoods can lead to understating or overstating the actual safety situation (see also Glaeser and Sacerdote, 1999). Therefore the safety data is appended by survey data[9] which measures the 'perceived' safety by neighbourhood residents. In order to further cope with (under)reporting issues, neighbourhood context variables are taken into account such as the value of the housing stock and reliance on social security by residents. The final index score of a neighbourhood is weighted by the size of the neighbourhood and the severity of the crime as perceived by residents. The resulting index is normalized to a 1-10 scale with 10 indicating the highest safety level.

[8] The city of Rotterdam is divided into 13 sub-municipalities each with their own council. A comprehensive overview of the city-structure is contained in Appendix II Table II.1.

[9] Survey-data often raises selection issues because certain groups of residents might be more willing to participate. For confidentiality reasons we were not allowed to analyse the raw survey data and therefore no formal tests for selection bias are presented. The COS shares this concern and reports that "specific attention is paid to the representativeness of the sample for each neighbourhood with respect to socioeconomic characteristics".

Table 2.1 ■ Variable definitions and measurement units

Name	Definition
lnown	log of % properties that is owner-occupied
lnsocial	log of % properties that is social housing
lnsafe	log of safetyindex score
lnsatis	log of % satisfaction
lnhhinc	log of avg yearly household income in 1000 Euros
citz1217	% of residents aged 12-17
citz1823	% of residents aged 18-23
citz65	% of residents aged 65 or older
immigrant	% of residents that has a non-western nationality
overocc	% of properties that is over-occupied
singlehh	% of single households
multifam	% of properties that belong to a multi-apparment building
prop4room	% of properties that feature 4 or more rooms
ten10yr	% of residents living in the neighborhood 10 or more years
bltpreWar	% of properties built before Second World War
blt194559	% of properties built between 1945 and 1959
blt1960	% of properties built after 1960
welfare	% of residents relying on welfare
unemployment	% of residents that are unemployed

The neighbourhood satisfaction measure is constructed in a similar fashion, but the resulting scores are the percentage of residents that is satisfied with the neighbourhood. The score gives an indication of neighbourhood perception in general, thus reflecting factors such as amenities and socioeconomic climate. Unfortunately, the data do not contain scores on individual survey questions (see footnote 3), which prevents us from carrying out a detailed analysis of satisfaction indicators as done by Rossi and Weber (1996). Implicitly, our analysis assumes that homeownership is a homogeneous variable. However, when analyzing the real market, we observe vast heterogeneity among homeowners and their housing careers. For instance, we realize that mortgage behaviour may well vary across households. However, our data from the NHG show that the heterogeneity regarding mortgage structures amongst new homeowners in the neighbourhoods in our sample is relatively limited. The vast majority of the first-time buyers in our sample, originated from rental dwellings (social rented sector), and needed to borrow the full amount of the sale price from the bank.

Moreover, feelings of safeness and satisfaction on a neighbourhood level may be rather volatile. This may be partly caused by a high turnover rate.[10] On first hand, this looks high, particularly in the rental sector. However, in Rotterdam and elsewhere in the Netherlands, in both sectors still more than 50 per cent of all households do live in their dwelling more than 8 years and more than 11 years in the same neighbourhood (Woononderzoek 2009). I.e., high turnover rates seem to be concentrated in a relative small segment of the housing market (as in certain stages of the housing career). Finally, note that it is a-priori not certain whether a high turnover rate signals unsafeness and/or discontent with the neighbourhood or that a high turnover-rate causes these feelings amongst households.

Table 2.1 lists the control variables used in the empirical model.. Ideally, we would like to control for education levels as done by Glaeser and Sacerdote (2000) and DiPasquale and Glaeser (1999) but only incomplete and noisy data is available for a small sub-period in our sample, thereby greatly reducing the number of observations we can use in our estimation. We control for over-occupation of dwellings since this is indicative of socioeconomic distress in neighbourhoods. Over-occupation is defined by the COS as the number of people that are living in a dwelling, adjusted for the size of the dwelling.[11] Over-occupation might occur for example among low-income households with many children who are not able to afford a house of adequate size. Moreover, the municipality of Rotterdam explicitly considers over-occupation as a serious hazard to general neighbourhood- and fire safety.

[10] As elsewhere, safety and satisfaction of the neighbourhood may also be linked to the ethnicity of new entrants in the neighbourhood; however, we do not have adequate information to deal with this subject in our analysis.
[11] More formally a dwelling is over-occupied if 3 persons are living in a 1 room dwelling, 4 persons in a 2 room dwelling, 5 or 6 persons in a 3 room dwelling and 7 or more persons in a 4 room dwelling

Table 2.2 ■ Descriptive statistics for neighbourhoods in Rotterdam

Classification of neighbourhoods is based on the sample mean (median) ownership-rate in Panel A (Panel B). *t*-statistics for the equality in means between rental and owner-occupied dominated neighbourhoods are reported. Variable definitions are shown in Table 2.1. Significance * p <0.10, ** p<0.05, *** p<0.01. Source: COS

Panel A: Mean-based	**Rental-dominated**		**Owner-occupied dominated**			
	Mean	Median	Mean	Median	t-test	Obs
safe	5.95	5.9	7.81	8.2	-12.66***	589
satisfaction	73.8%	75.0%	83.2%	85.0%	-10.67***	536
hhinc (* K Euro)	21.5	22.0	28.5	28.2	-13.05***	544
citz1217	6.9%	6.8%	6.1%	6.0%	3.95***	589
citz1823	9.8%	9.5%	7.5%	6.5%	6.75***	612
citz65	13.1%	10.9%	15.0%	13.2%	-2.96***	622
immigrant	40.1%	38.0%	15.5%	12.0%	17.47***	622
overocc	8.4%	8.0%	5.5%	5.0%	8.02***	622
singlehh	49.3%	47.2%	39.2%	37.0%	9.80***	621
multifam	54.0%	59.0%	36.0%	28.0%	8.28***	622
prop4room	37.9%	37.0%	58.4%	61.0%	-18.70***	622
ten10yr	35.3%	35.2%	38.7%	37.8%	-3.12***	622
bltpreWar	37.0%	35.0%	38.0%	38.0%	-0.40	615
hsblt194559	14.0%	3.0%	12.0%	7.0%	1.36*	615
blt1960	46.0%	38.0%	49.0%	41.0%	-1.35*	615
welfare	8.3%	8.6%	3.0%	2.4%	20.70***	622
unemployment	8.6%	8.5%	3.8%	3.1%	19.38***	617

Panel B: Median-based	**Rental-dominated**		**Owner-occupied dominated**			
	Mean	Median	Mean	Median	t-test	Obs
safe	5.79	5.75	7.67	8	-13.20***	589
satisfaction	72.9%	74.0%	82.5%	84.5%	-11.20***	536
hhinc (* K Euro)	21.1	21.8	27.9	27.4	-13.05***	544
citz1217	7.0%	7.0%	6.0%	6.1%	5.01***	589
citz1823	10.0%	9.5%	7.6%	6.5%	7.31***	612
citz65	12.7%	10.6%	15.0%	13.2%	-3.68***	622
immigrant	42.3%	41.0%	17.3%	14.0%	18.31***	622
overocc	8.9%	9.0%	5.5%	5.0%	9.71***	622
singlehh	49.6%	48.0%	40.5%	40.0%	8.90***	621
multifam	54.0%	59.0%	39.0%	39.0%	6.60***	622
prop4room	36.9%	36.0%	56.1%	56.0%	-17.45***	622
ten10yr	35.4%	35.1%	38.1%	37.5%	-2.46***	622
bltpreWar	39.0%	40.0%	36.0%	34.0%	1.06	615
hsblt194559	15.0%	3.0%	12.0%	7.0%	1.97**	615
blt1960	43.0%	37.0%	52.0%	47.0%	-3.35***	615
welfare	8.7%	9.1%	3.4%	2.8%	21.95***	622
unemployment	8.9%	9.0%	4.2%	3.5%	20.08***	617

Table 2.2 shows mean and median summary statistics for all variables. The sample of neighbourhoods is divided according to the mean (median) ownership rate in Rotterdam which is 29 per cent (25 per cent) for the total sample. We classify neighbourhoods as rental-dominated when the ownership rate is below the mean (median) value and owner-occupier dominated otherwise. The fifth column presents *t*-tests for the difference in means between the two groups. This difference is highly significant for most variables with the majority according to expectation. Some interesting facts emerge from the statistics. The percentage of multi-family (*multifam*) is significantly higher in the rental-dominated subsample than in the owner-occupier subsample. This is due to the fact that 47 per cent of the dwelling units in Rotterdam are social (rental) housing and most of these are located in old apartment buildings, many of them built in the 50s and 60s. Given this fact, it can be seen that neighbourhood safety and satisfaction are significantly lower in the rental-dominated sample, consistent with the 'distance-to-the-street' hypothesis in Glaeser and Sacerdote (2000). The presence of social housing also explains the significant difference in household income between the two groups and the significantly higher unemployment and welfare rates in the rental dominated sample. Finally, with respect to mobility, the percentage of households that has lived at the same address for ten years or longer (*ten10yr*) is significantly higher for owner-occupier dominated neighbourhoods than rental dominated ones but the absolute difference is small with only 3 per cent.

2.4 Empirical results

As mentioned before, we use several techniques to examine the impact of homeownership on neighbourhood safety and satisfaction. In this section, all models take the following general form:

$$\ln(Outcome_{it}) = \alpha + \beta \ln(ownership_{it}) + \gamma(\mathbf{X}_{it}) + \tau_t + \mu_i + \varepsilon_{it}$$
$$with\ \varepsilon_{it} \sim IID(0, \sigma^2) \qquad (2.1)$$

Where $Outcome_{it}$ refers either to the safetyindex or the satisfaction and $\mathbf{X}_{it}$ is the vector with explanatory variables contained in Table 2.1. Given the results of DiPasquale and Glaeser (1999), we include neighbourhood fixed effects and since it is a panel we also introduce time fixed effects to prevent spurious results. In addition, we cluster all standard errors by neighbourhood as suggested by Petersen (2009), because OLS standard errors become biased when the fixed effect is not

constant over time or when there is correlation between the residuals within a neighbourhood. The initial results are presented in Table 2.3.

Many control variables turn out to be insignificant, but this is due to the inclusion of the time dummies. Models 1 to 3 do not include homeownership and show relations that are consistent with previous studies. We find support for Galster (1987) that residents who are in a later stage in the life-cycle (proxied by *citz65*) tend to be more residentially satisfied. The percentage of immigrants from non-western countries has a negative and significant impact on the safety level in the neighbourhood. This is similar to findings reported in Glaeser and Sacerdote (1999 and 2000), who find a negative impact of minority groups on crime rates.

The size of the dwelling, *prop4room,* has a positive effect on the level of safety, even when controlled for the proportion of apartment buildings (*multifam*), which supports Glaeser and Sacerdote's hypothesis that crime rates might increase when residents are less connected to the street. A substantial portion of the multi-family buildings in Rotterdam have three-roomed apartments and therefore the properties featuring four or more rooms are more likely to be single family houses and thus these residents have increased connection to the street [12]. Finally, unemployment rates have a significant negative impact on neighbourhood safety consistent with the literature on neighbourhood distress (see e.g. Glaeser and Sacerdote, 1999).

With respect to neighbourhood satisfaction, over-occupation plays a significant role as long as neighbourhood safety is not included in the analysis. We found no evidence for excessive multicollinearity, and given the results in the other models in Table 2.3, it supports the previous argument that over-occupation is a safety hazard, which is captured once *lnsafe* is included in the model. Surprisingly, unemployment rates have a positive effect on satisfaction. This seems counterintuitive: being unemployed tends to lower life satisfaction (see Duncan and Russell, 1998), but apparently it does not necessarily reduce residential satisfaction. The favourable labour market [13] conditions during our sample period might be another reason why unemployment has a positive impact on satisfaction, since it was relatively easy to find a job. Unfortunately, our data does not allow us to test this further.

[12] Models that include solely *multifam* or *prop4room* yield the same results. During reconstruction projects in Rotterdam many multi-family buildings with small apartments have been demolished and new multi-family buildings with larger apartments have been built, explaining why, in our case, size is significant instead of structure type.

[13] During the sample period, the average Dutch unemployment rate was 4.9 percent, which is one of the lowest rates among European Union members (Eurostat, 2009).

Table 2.3 ■ Fixed effect estimates of ownership rates on external effects indicators

Dependent variable is the log of safetyindex or satisfaction rate respectively. *t*-statistics are clustered by neighbourhood and reported in brackets. Variable definitions are shown in Table 2.1. Significance *p <0.10, ** p<0.05, *** p<0.01.

	(1) lnsafe	(2) lnsatis	(3) lnsatis	(4) lnsafe	(5) lnsatis	(6) lnsatis	(7) lnsafe	(8) lnsatis	(9) lnsatis
lnown				0.0671*	0.0642*	0.0772*			
				[1.93]	[1.96]	[1.95]			
lnsocial							0.000	0.085	0.122*
							[0.01]	[1.43]	[1.98]
lnsafe			0.263**			0.248**			0.265**
			[2.50]			[2.48]			[2.47]
lnhhinc	-0.192	0.128	0.0815	-0.141	0.164	0.0963	-0.139	0.118	0.0505
	[-1.23]	[0.85]	[0.61]	[-0.83]	[1.05]	[0.72]	[-0.73]	[0.73]	[0.36]
citz65	-1.283	0.458	0.917*	-1.651**	0.509	1.107**	-1.050	0.545	1.110**
	[-1.43]	[0.89]	[1.96]	[-2.31]	[0.97]	[2.07]	[-1.13]	[1.07]	[2.33]
immigrant	-1.402*	0.367	0.479	-1.522*	0.411	0.625	-1.730**	0.337	0.538
	[-1.73]	[0.66]	[0.79]	[-1.84]	[0.81]	[1.08]	[-2.09]	[0.60]	[0.85]
overocc	-0.887	-1.213**	-0.842	-0.844	-0.921*	-0.428	-0.725	-1.183**	-0.682
	[-1.30]	[-2.18]	[-1.52]	[-1.20]	[-1.69]	[-0.76]	[-1.04]	[-2.03]	[-1.21]
singlehh	-0.156	-0.252*	-0.335	-0.325	-0.256	-0.334	-0.374	-0.221	-0.250
	[-0.56]	[-1.82]	[-1.51]	[-1.11]	[-1.65]	[-1.13]	[-1.35]	[-1.36]	[-0.93]
multifam	0.184	0.268	0.0273	0.508	0.295	0.0662	0.854	0.439	0.134
	[0.37]	[0.51]	[0.05]	[1.02]	[0.51]	[0.12]	[1.65]	[0.82]	[0.27]
prop4room	1.770***	0.453	-0.143	1.326**	-0.0182	-0.621	2.251***	0.675	0.0771
	[4.52]	[0.96]	[-0.29]	[2.61]	[-0.03]	[-0.96]	[5.27]	[1.22]	[0.14]
ten10yr	-0.234	0.112	0.150	-0.225	0.268	0.328	-0.248	0.0721	0.120
	[-0.91]	[0.37]	[0.53]	[-0.78]	[0.83]	[1.12]	[-0.97]	[0.24]	[0.44]
bltpreWar	-0.200	-0.169	-0.177	-0.0918	-0.137	-0.142	-0.0787	-0.142	-0.156
	[-1.00]	[-1.41]	[-1.62]	[-0.50]	[-1.05]	[-1.22]	[-0.48]	[-1.18]	[-1.39]
blt194559	0.923*	0.334	0.100	0.664	0.219	-0.102	0.811	0.355	0.117
	[1.76]	[0.45]	[0.14]	[1.10]	[0.25]	[-0.12]	[1.32]	[0.40]	[0.14]
blt1960	0.245	0.263	0.302	-0.00859	0.224	0.272	0.159	0.206	0.281
	[0.62]	[0.94]	[1.19]	[-0.02]	[0.73]	[0.95]	[0.41]	[0.68]	[0.95]
welfare	-0.577	-0.948	-1.134*	-0.248	-0.930	-1.214*	-0.802	-1.135*	-1.276*
	[-0.54]	[-1.63]	[-1.69]	[-0.23]	[-1.59]	[-1.93]	[-0.71]	[-1.89]	[-1.88]
unemployment	-1.854***	1.122*	1.548***	-1.603**	1.083*	1.500***	-1.384**	1.058*	1.356**
	[-2.68]	[1.93]	[3.03]	[-2.25]	[1.81]	[2.86]	[-2.14]	[1.84]	[2.59]
constant	2.187***	-1.226	-1.213	2.415***	-1.114	-1.070	1.631*	-1.285	-1.230
	[2.78]	[-1.64]	[-1.63]	[2.73]	[-1.44]	[-1.39]	[1.70]	[-1.63]	[-1.59]
neighbourhood fixed eff.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
time fixed eff.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	498	444	420	482	433	410	477	431	408
adj. R-sq	0.644	0.432	0.507	0.649	0.458	0.532	0.644	0.436	0.513

Ownership rates indeed show a positive impact on safety and satisfaction levels in the neighbourhood (see models 4-6), but they are only marginally significant[14]. As a matter of counterfactual reasoning, we use social housing rates in specifications 7-9 where we would expect social housing to show insignificance or a negative sign if external effects can be attributed to homeownership. This is observed, except for model 9 which shows that once we control for neighbourhood safety levels, social renting becomes marginally positive significant. It is important to note that the relation between ownership and neighbourhood satisfaction is significantly moderated by the actual safety levels in the neighbourhood.

2.4.1 Robustness analysis

We perform various robustness checks to examine whether the model suffers from misspecification, multicollinearity or sensitivity to the way some variables are measured. The results of these checks are reported in Table 2.4. The average household income is often a strong indicator of the socioeconomic status of the neighbourhood. Since it is not significant in any of the specifications presented in Table 2.3, we change it to a dummy variable equalling 1 if the average household income is below the sample average and 0 otherwise. We also check for multi-collinearity and sensitivity of the results for welfare and unemployment rates in models 4-9. Subsequently, we examine whether the effects of homeownership are mere artefacts of tenure length and therefore we exclude our control for tenure length *ten10yr* in models 10-12. Finally, we analyse whether social housing has an impact if we use our income dummy instead of the log of household income but the results are similar to those in Table 2.3.

The main result in Table 2.3 – a marginally positive effect of homeownership on safety and satisfaction – is robust to all these alternative specifications. Moreover, the income-dummy is significant and shows signs as expected. If average income in the -neighbourhood is below the sample average, it causes a negative impact on external effects. An interesting result is the consistent negative impact of the percentage of single households in the neighbourhood. Van Beckhoven and Van Kempen (2003), argue that the neighbourhood plays a limited role in the lives of residents, since they engage in many activities outside the neighbourhood.

[14] When the year dummies are left out of the specification, *lnown* becomes highly significant in all models, but the results in Table 2.3 are more conservative estimates.

Table 2.4 ■ Robustness checks of model specification

Dependent variable is the log of safetyindex or satisfaction rate respectively. *t*-statistics are clustered by neighbourhood and reported in brackets. Variable definitions are shown in Table 2.1. Significance *p <0.10, ** p<0.05, *** p<0.01.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	lnsafe	lnsatis	lnsatis	lnsafe	lnsatis	lnsatis	lnsafe	lnsatis
lnown	0.0700*	0.0564*	0.0608*	0.0709*	0.0593*	0.0634*	0.0714*	0.0594**
	[1.83]	[1.90]	[1.73]	[1.82]	[1.96]	[1.73]	[1.89]	[2.12]
lnsocial								
lnsafe			0.269***			0.269***		
			[2.74]			[2.70]		
income-dummy	0.0464**	0.0263*	0.0310**	0.0460**	0.0215	0.0243	0.0344*	0.0267**
	[2.43]	[1.80]	[2.02]	[2.32]	[1.52]	[1.66]	[1.86]	[2.09]
citz1217	-0.487	-1.797*	-1.889*	-0.513	-1.787*	-1.970*	-0.500	-1.107
	[-0.19]	[-1.78]	[-1.87]	[-0.21]	[-1.76]	[-1.96]	[-0.20]	[-1.13]
citz1823	2.492	-0.458	-1.653**	2.476	-0.444	-1.722**	2.450	-0.259
	[1.26]	[-0.76]	[-2.12]	[1.24]	[-0.73]	[-2.17]	[1.20]	[-0.42]
citz65	-0.832	-0.651	-0.217	-0.840	-0.676	-0.278	-0.953	-0.400
	[-0.92]	[-1.14]	[-0.45]	[-0.91]	[-1.18]	[-0.57]	[-1.10]	[-0.66]
immigrant	-1.224	-0.198	0.109	-1.242	-0.296	-0.0311	-1.446*	-0.0898
	[-1.59]	[-0.50]	[0.24]	[-1.66]	[-0.73]	[-0.07]	[-1.95]	[-0.25]
overocc	-0.910	-1.031**	-0.573	-0.910	-1.091**	-0.587	-0.947	-1.059**
	[-1.36]	[-2.05]	[-1.04]	[-1.36]	[-2.19]	[-1.08]	[-1.50]	[-2.54]
singlehh	-0.551***	-0.332**	-0.371*	-0.551***	-0.379***	-0.372*	-0.620***	-0.275**
	[-2.96]	[-2.60]	[-1.84]	[-2.98]	[-3.24]	[-1.77]	[-3.40]	[-2.37]
multifam	0.207	0.0380	0.0219	0.203	0.0534	0.0207	0.509	0.0462
	[0.42]	[0.10]	[0.06]	[0.41]	[0.13]	[0.06]	[1.18]	[0.17]
prop4room	1.248*	0.357	-0.0420	1.256*	0.381	-0.00611	1.065*	0.562
	[1.67]	[0.90]	[-0.13]	[1.75]	[0.93]	[-0.02]	[1.72]	[1.39]
ten10yr	-0.190	0.247	0.304	-0.188	0.255	0.315	-0.151	0.190
	[-0.74]	[1.16]	[1.60]	[-0.73]	[1.20]	[1.66]	[-0.61]	[0.99]
bltpreWar	-0.197	-0.260	-0.209	-0.196	-0.248	-0.199	-0.156	-0.238
	[-0.87]	[-1.58]	[-1.48]	[-0.86]	[-1.44]	[-1.31]	[-0.80]	[-1.46]
blt194559	0.780	0.468	0.247	0.785	0.453	0.260	0.523	0.678
	[1.39]	[0.82]	[0.45]	[1.39]	[0.78]	[0.47]	[1.02]	[1.15]
blt1960	0.387	0.498**	0.447*	0.389	0.492*	0.449*	0.288	0.472*
	[0.82]	[2.03]	[1.98]	[0.82]	[1.94]	[1.91]	[0.69]	[1.95]
welfare	-0.157	-0.698*	-0.924**					
	[-0.15]	[-1.70]	[-2.21]					
unemployment	-1.446**	1.044**	1.235***	-1.450**	1.010**	1.202***		
	[-2.36]	[2.35]	[2.86]	[-2.37]	[2.27]	[2.76]		
constant	1.954**	-0.217	-0.567	1.953***	-0.235	-0.579	1.641**	-0.457
	[2.65]	[-0.53]	[-1.34]	[2.66]	[-0.56]	[-1.30]	[2.60]	[-1.35]
neighbourhood fixed eff.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
time fixed eff.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	538	498	470	538	498	470	543	502
adj. R-sq	0.626	0.449	0.540	0.626	0.447	0.537	0.619	0.430

Table 2.4 continued

	(9) lnsatis	(10) lnsafe	(11) lnsatis	(12) lnsatis	(13) lnsafe	(14) lnsatis	(15) lnsatis
lnown	0.0621*	0.0712*	0.0541*	0.0589*			
	[1.90]	[1.89]	[1.89]	[1.77]			
lnsocial					0.0839	0.0614	0.0383
					[1.01]	[1.34]	[0.73]
lnsafe	0.249**			0.264***			0.286***
	[2.57]			[2.66]			[2.74]
income-dummy	0.0313**	0.0447**	0.0293**	0.0336**	0.0511**	0.0278*	0.0318**
	[2.29]	[2.30]	[2.00]	[2.20]	[2.47]	[1.88]	[2.10]
citz1217	-1.400	-1.087	-1.213	-1.000	-1.780	-1.508	-1.754
	[-1.44]	[-0.46]	[-1.00]	[-0.84]	[-0.89]	[-1.27]	[-1.36]
citz1823	-1.467*	2.452	-0.377	-1.554**	1.682	-0.949*	-1.718**
	[-1.90]	[1.24]	[-0.60]	[-2.00]	[0.81]	[-1.78]	[-2.09]
citz65	0.0889	-1.024	-0.457	0.0191	-0.409	-0.463	-0.171
	[0.18]	[-1.11]	[-0.80]	[0.04]	[-0.48]	[-0.85]	[-0.43]
immigrant	0.174	-1.223	-0.177	0.109	-1.346*	-0.151	0.113
	[0.47]	[-1.58]	[-0.46]	[0.25]	[-1.83]	[-0.30]	[0.21]
overocc	-0.624	-0.816	-1.142**	-0.757	-0.798	-1.231**	-0.811
	[-1.38]	[-1.21]	[-2.16]	[-1.33]	[-1.15]	[-2.37]	[-1.38]
singlehh	-0.261	-0.586***	-0.305**	-0.339*	-0.490**	-0.277**	-0.290
	[-1.60]	[-3.44]	[-2.53]	[-1.86]	[-2.42]	[-2.25]	[-1.67]
multifam	-0.0160	0.265	-0.0531	-0.0795	0.0496	0.0924	-0.0217
	[-0.06]	[0.55]	[-0.14]	[-0.23]	[0.11]	[0.22]	[-0.06]
prop4room	0.294	1.165	0.460	0.0895	1.536**	0.722*	0.251
	[0.75]	[1.60]	[1.11]	[0.28]	[2.14]	[1.73]	[0.73]
ten10yr	0.226				-0.199	0.0907	0.165
	[1.34]				[-0.88]	[0.41]	[0.75]
bltpreWar	-0.181	-0.187	-0.277	-0.230	-0.236	-0.253	-0.225
	[-1.24]	[-0.86]	[-1.60]	[-1.53]	[-1.08]	[-1.64]	[-1.59]
blt194559	0.569	0.646	0.640	0.459	0.618	0.503	0.376
	[0.95]	[1.24]	[1.12]	[0.85]	[1.03]	[0.87]	[0.67]
blt1960	0.409*	0.394	0.498*	0.447*	0.492	0.460*	0.448*
	[1.70]	[0.84]	[1.97]	[1.92]	[1.05]	[1.91]	[1.95]
welfare		-0.121	-0.730*	-0.971**	-0.652	-0.978**	-1.093**
		[-0.11]	[-1.77]	[-2.37]	[-0.59]	[-2.52]	[-2.46]
unemployment		-1.476**	1.049**	1.274***	-1.468**	0.861*	1.112**
		[-2.43]	[2.33]	[2.97]	[-2.34]	[1.78]	[2.44]
constant	-0.824**	1.980***	-0.230	-0.585	2.016***	-0.328	-0.751
	[-2.23]	[2.72]	[-0.57]	[-1.38]	[2.75]	[-0.69]	[-1.52]
neighbourhood fixed eff.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
time fixed eff.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	474	538	498	470	534	495	467
adj. R-sq	0.513	0.625	0.446	0.535	0.615	0.422	0.517

Although this might be debatable for certain groups of residents, it offers an explanation as to why single households have a negative impact on neighbourhood effects. They are less reliant on the direct surroundings of the neighbourhood and as such might be less worried about neighbourhood stability and less inclined to actively contribute to raise it.

2.4.2 Analysis of external effects accounting for endogeneity

Our analysis so far might be driven by endogeneity if explanatory variables are omitted from the model, causing results found with OLS-based techniques to be biased. Specifying homeownership rates as being endogenous to external effects and using instrumental variables is a common strategy, but requires a convincing and preferably a strong instrument. Manturuk *et al.* (2009) and Green and White (1997) use the relative cost of owning versus renting as an instrument for homeownership. The underlying rationale for this instrument is that the relative cost of owning a home affects the tenure-choice and thus the homeownership rate, while it is not related to neighbourhood safety or satisfaction.

Unfortunately, we do not have data that can reliably proxy for the cost of renting and ownership. As an alternative, we follow Hilber's (2005) approach and use a difference-in-differences model and examine whether increases in homeownership rate are related to increases in external effects. Given that most control variables in our study remain relatively stable over short periods of time and that external effects might occur with a delay, we use 3-year differences. This specification introduces autocorrelation in the errors, so we cluster them again by neighbourhood thereby allowing for serial correlation. The results are found in Table 2.5.

The impact of ownership rates on external effects remains similar to that presented in Table 2.3 and Table 2.4. Again as can be seen in model 3, neighbourhood safety is significant mediating the relation. A counterintuitive result is the positive sign of *bltPrewar* in the safety model, but this is probably because major restructuring in neighbourhoods (see Kleinhans *et al.,* 2007 for an example) lead to a decrease in buildings that were built during or just after the War, thereby 'artificially' increasing the relative amount of Pre-War dwellings (as a percentage of the total housing stock).

Table 2.5 ■ Difference-in-difference estimates of ownership rates on external effect indicators

Dependent variable is the third-order difference ($\Delta = obs_t - obs_{t-3}$) of the log of safetyindex or satisfaction rate respectively. *t*-statistics are clustered by neighbourhood and reported in brackets. Variable definitions are shown in Table 2.1. Significance *p <0.10, ** p<0.05, *** p<0.01.

	(1)	(2)	(3)	(4)	(5)	(6)
	Δlnsafe	Δlnsatis	Δlnsatis	Δlnsafe	Δlnsatis	Δlnsatis
Δlnown	0.204**	0.180*	0.166*			
	[2.53]	[1.84]	[1.88]			
Δlnsocial				-0.0952	-0.173	-0.001
				[-0.69]	[-1.32]	[-0.01]
Δlnsafe			0.361***			0.383***
			[2.90]			[2.84]
Δlnhhinc	0.0640	0.0392	-0.0258	0.0433	0.0737	-0.0250
	[0.58]	[0.22]	[-0.17]	[0.35]	[0.46]	[-0.16]
Δcitz65	0.906	-0.326	-1.252	-1.179	-1.276	-2.444
	[0.46]	[-0.17]	[-0.63]	[-0.54]	[-0.63]	[-1.13]
Δimmigrant	1.118	2.471*	1.635	0.311	1.990*	1.170
	[0.67]	[1.91]	[1.38]	[0.17]	[1.68]	[1.07]
Δoverocc	0.588	0.157	0.765	-0.0324	-0.0276	0.414
	[0.80]	[0.14]	[0.70]	[-0.04]	[-0.03]	[0.39]
Δsinglehh	0.0891	-0.550	-0.440	0.119	-0.629	-0.508
	[0.10]	[-0.45]	[-0.45]	[0.13]	[-0.46]	[-0.49]
Δmultifam	0.0318	0.540	-0.305	0.0130	0.201	-0.655
	[0.12]	[1.08]	[-0.42]	[0.05]	[0.47]	[-1.03]
Δprop4room	-0.534	-0.525	-0.425	0.408	-0.330	0.124
	[-0.90]	[-0.55]	[-0.57]	[0.45]	[-0.34]	[0.16]
Δten10yr	0.393	0.644	0.446	0.361	0.619	0.459
	[0.99]	[1.57]	[1.36]	[1.20]	[1.44]	[1.36]
ΔbltpreWar	0.931***	0.623*	0.319	0.752**	0.419	0.178
	[3.23]	[1.76]	[0.96]	[2.40]	[1.18]	[0.54]
Δblt194559	-1.387	-1.989	-1.044	-0.976	-2.027	-1.040
	[-1.28]	[-1.46]	[-0.79]	[-0.81]	[-1.45]	[-0.80]
Δblt1960	-0.701	0.251	0.386	-0.443	0.597	0.709
	[-1.08]	[0.31]	[0.56]	[-0.58]	[0.69]	[0.96]
Δwelfare	-0.479	-1.640***	-1.581***	-0.416	-1.692***	-1.600***
	[-1.34]	[-3.26]	[-3.89]	[-1.15]	[-3.59]	[-4.14]
Δunemployment	0.520	-1.069	-1.629	0.512	-1.122	-1.634
	[0.50]	[-1.03]	[-1.54]	[0.52]	[-1.09]	[-1.62]
constant	0.0295	0.0507	0.0488	0.0179	0.0484	0.0564
	[0.58]	[0.96]	[1.03]	[0.33]	[0.94]	[1.24]
N	269	212	201	270	213	202
adj. R-sq	0.098	0.161	0.334	0.051	0.128	0.308

As an additional robustness check, we allow for endogeneity via a dynamic panel data model and check for autoregressive behaviour. The exact specification and execution of this approach is reported in Appendix I. We proceed here with a discussion of the results (see Table I.1). The effect of ownership on safety and satisfaction remains positively significant and lagged levels of external effects are not significant in explaining current levels with the autoregressive coefficient ranging from 0.105 (model 7) to 0.385 (model 8). The coefficients of the ownership variable are somewhat larger compared to previous analyses. However, the economic magnitude of the coefficients remains small: a 10 per cent rise in neighbourhood ownership rates increases safety by 1.15 to 1.62 per cent and similar results hold for neighbourhood satisfaction.

2.4.3 Non-linear effects of homeownership

As mentioned before, Galster *et al.* (2000) find that neighbourhood distress rises at an increasing rate when homeownership falls below 15 per cent, suggesting some threshold level before externalities emerge. Engelhardt *et al.* (2010) argue that if expanding homeownership generates externalities, these are likely to arise in the lower income and probably renting part of the population since ownership rates are already high among middle and upper income households. Moreover, Haurin *et al.* (2003) note that increasing returns to scale are unlikely since this would imply that renters and owners would segregate completely, something that is not observed in reality.

Of course this argument assumes perfect market conditions. In the more regulated market like the Netherlands and the UK, the dispersion of homeownership and rental dwellings on neighbourhood scale is more directed by governments and housing associations.

The ambiguity between the relationship of externalities and homeownership cannot be solved merely on theoretical grounds; overall, there is limited empirical evidence on the functional form of the relation either. Hence, we need a more generalized form of Equation (2.1) to allow for - at least the possibility - of non-linearity's in the relationship between externalities and homeownership rate. However, given the limitations of our dataset (*e.g.* a small sample size) we are rather restricted in our options to take this into account

We estimated several functional forms – controlling for year-effects - by including a quadratic polynomial of homeownership rates and quartile dummies. Unreported results confirm that external effects are smaller once ownership rates are higher, but are insignificant when controlling for year-effects.

Alternatively, we hypothesize that the externalities to ownership might have a functional form that resembles a production externality:

$$Y = AK^{a} \tag{2.2}$$

This function is increasing and concave under the following assumptions: $A > 0$, $K > 0$ and $0 < a < 1$, where A is a constant, K the ownership rate and Y the resulting external effect. Rewriting the equation as a loglinear model leads to (3):

$$\ln(Y) = \ln(A) + a\ln(K) + \varepsilon \quad with \quad \varepsilon \sim IID(0, \sigma^2) \tag{2.3}$$

Since the relation between Y and K might be driven by omitted variables, estimating (2.3) directly would lead to biased estimates for a for the same reasons as discussed in the previous section. Therefore, we use a two-stage procedure where we start by estimating the model in Equation 2.1 with ownership rate as the dependent variable. In the second stage, we use the fitted values of the ownership rate we obtained in the first stage as observations for K and estimate a in Equation (2.3) using OLS with neighbourhood fixed effects. Because the ownership rate is estimated conditional on all explanatory variables and neighbourhood and time effects, it should hold for the fitted values of the ownership-rate $\widehat{K}_{it}$ that:

$$E\{\widehat{K}_{it}\varepsilon_{it}\} = 0 \tag{2.4}$$

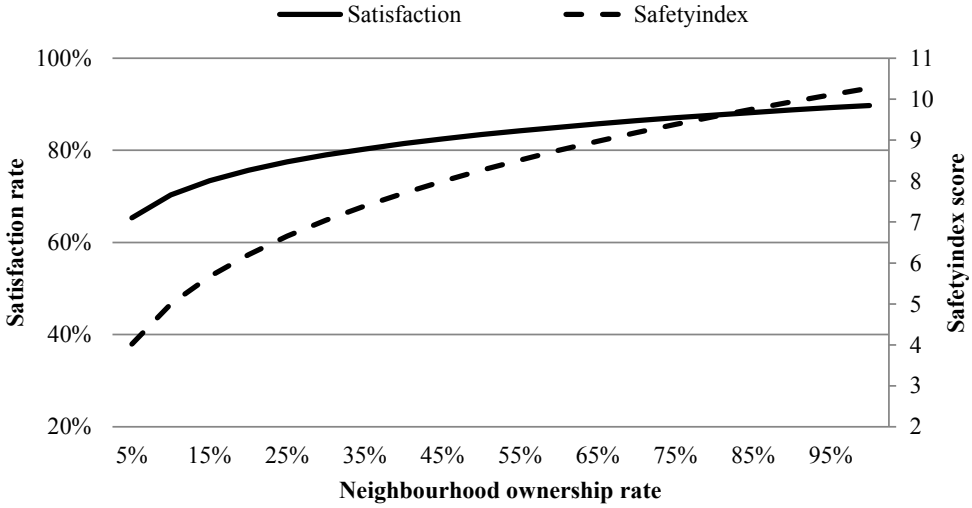
Table 2.6 shows the estimates of *ln(A)* and *a* of Equation 2.3. We estimate the models twice. Panel A shows estimations when the logarithmic transformation of the original ownership rates is used, yielding results that are subject to omitted variables bias. In Panel B, we used the log fitted values of ownership rates constructed in the way we discussed.

Table 2.6 ■ Estimation results for diminishing external effects of ownership

Regression results for the model ln(Y) = ln(A) + a ln(K), where Y is lnsafe or lnsatis. Panel A uses the orginal log ownership rates as observations for K. Panel B is estimated using fitted values of a regression that explains log ownershiprates from all the other explanatory variables as observations for K. t-statistics are clusted by neighbourhood and reported in brackets. Significance *** p<0.01, ** p<0.05, * p<0.1

	(1)	(2)
	lnsafe	lnsatis
Panel A		
a	0.313***	0.106***
	[0.0398]	[0.0296]
ln(A)	2.329***	-0.108**
	[0.0617]	[0.0437]
N	567	513
R-squared	0.311	0.125
Number of clusters	72	74
Panel B		
a	0.448***	0.151***
	[0.0292]	[0.0195]
ln(A)	2.546***	-0,029
	[0.047]	[0.0305]
N	498	444
R-squared	0.351	0.167
Number of clusters	72	75

Figure 2.1A ■ Non-linear effects Panel A

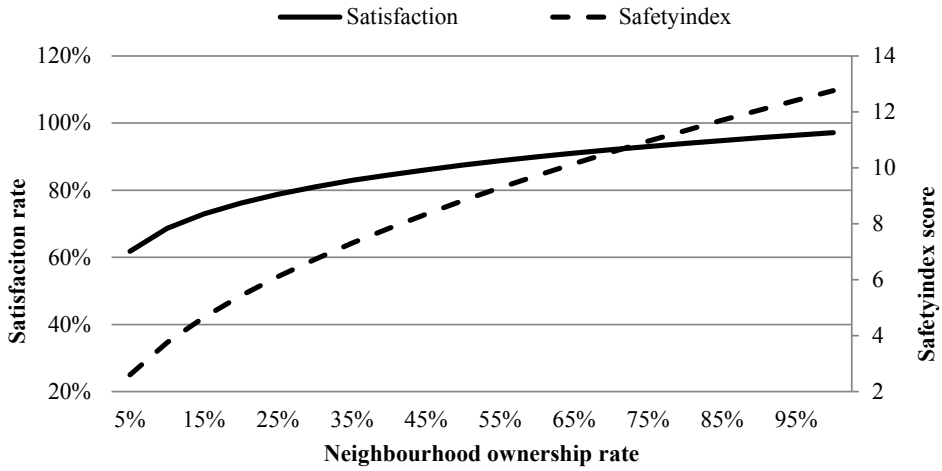


The level of external effects as a function of ownership rates for both Panel A and Panel B is plotted in Figures 2.1A and 2.1B, respectively. Neighbourhood satisfaction, as a percentage, is plotted on the left vertical axis and safety, as a score between 1 and 10, is plotted on the right axis. Table 2.6 shows that the coefficient for a is almost twice as high for all external effects in Panel B compared to Panel A.

This implies that panel B predicts a faster increase in the level of external effects as ownership rates increase. The estimated function is indeed increasing and concave in K since all coefficients a are between 0 and 1 and all A are positive. The consequence of the higher estimates for a in Panel B is that the maximum levels of safety and satisfaction are reached at 55 per cent and 65 per cent respectively, since a further increase in ownership rates only theoretically leads to higher outcomes. If estimates in Panel A are considered, increasing ownership rates have an effect even if they are in excess of 95 per cent.

So how do the marginal changes in external effects evolve when homeownership is increased? We consider two scenarios. In the first, ownership rates increase from 5 per cent to 15 percent. According to Panel A (Panel B) this would lead to an increase in safety of 1.7 (2.3) points. In the second scenario, ownership rates go up from 50 per cent to 60 per cent. In this scenario, the same 10 per cent rise in ownership leads to an increase of 0.5 (0.98) points in safety, showing that marginal benefits become smaller once ownership rates become higher. A similar result is obtained for neighbourhood satisfaction.

Figure 2.1B ■ Non-linear effects Panel B



The question which ownership levels are 'right' is not the focus of our paper, but our results are supportive of the hypotheses in Engelhardt *et al.* (2010) and Haurin *et al.* (2003) that incremental changes in external effects of homeownership are largest when current homeownership-rates are low, thus indicating a non-linear relation

2.5 Discussion and conclusion

In this paper we aim to explain whether homeownership improves neighbourhood safety and satisfaction using data from the Netherlands. We examine at a neighbourhood level whether external effects of ownership materialize in the same way as found by U.S. studies and whether this relation is linear or subject to diminishing returns.

Using a panel dataset for Rotterdam, we find that homeownership is positively related to neighbourhood safety and satisfaction. A negative relation between social housing and external effects was not found, suggesting that external effects evolve asymmetrically. Moreover, we observe a relation between ownership and external effects that is subject to diminishing returns. However, we add two cautionary remarks. First, we were not able to control for education, an important determinant of an individual's prospects. However, to the extent that education levels are fixed over time we captured it through neighbourhood fixed effects. Second, our data did not allow us to create an external instrument such as the

relative costs of housing (see Manturuk *et al.,* 2009 and Green and White, 1997) limiting the possibilities to control for endogenous selection.

Increasing ownership rates that are already high causes fewer external effects. Analysis of the marginal homeowner in a neighbourhood could shed more light on this issue. In terms of housing market policy, it questions the level of homeownership subsidies. Shlay (2006) reports that the effects of homeownership might be marginal in neighbourhoods, especially low-income ones. As such, the policy question emerges what the 'feasibility' range of ownership subsidies is, or stated differently, when is direct investment in neighbourhoods more effective than (possible) indirect investment through homeownership?

Governments around the world are struggling to get public finances back on track. The efficiency of subsidising homeownership is currently a relevant topic, but with the apparent difficulties in establishing the causal relationship between homeownership and external effects the prime question is whether there is a defendable rationale for subsidizing homeownership.

Furthermore, the level of intervention of governments in the housing market is up to debate. Should the housing market be left over to market forces, where citizens make informed choices, or is a paternalistic role for the government appropriate? Although this normative question is not the focus of our paper, it offers a potential direction for future research.

Finally, it is hard to assess to what extent our results can be generalized to other markets, given institutional differences between countries. The homeownership market in Rotterdam has within the Dutch landscape his own peculiarities, but it must be emphasised that the similarities with other cities is quite high. Within the Dutch housing market, there is a strong geographical partition of homeownership and rental dwellings. In that respect, the stated differences on a housing market level between Rotterdam and other submarkets in the Netherlands tend to fade away on lower levels, and hence, for our analysis become indifferent. Given that the institutional context within the Netherlands is homogeneous, it is likely that similar results can be found for other Dutch markets.

The similarity between our results and those found for other markets, such as the U.S. and U.K., strengthens our believe that enhanced neighbourhood safety and residential satisfaction as a function of homeownership is universal and therefore likely to be observed for other cities and countries as well.

2.6 Appendix I Dynamic panel model estimates

Dynamic panel data models allow for an endogenous relation between external effects and ownership rates when exogenous instruments are not available. The main idea is to use lagged values of the endogenous variable as instruments for this variable. This yields GMM-type estimators such as in Arellano and Bond, (1991) and Blundell and Bond (1998). In the A&B estimator, valid instruments are obtained for ownership rates - provided ε_{it} is not autocorrelated - by using lagged levels as instruments for first differences. Since the efficiency of GMM-estimators increases if more moment conditions are imposed, Blundell and Bond (1998) developed a system estimator, which also includes lagged first differences as instruments for levels, thereby obtaining additional moment conditions. The system estimator is also less subject to finite sample bias, which arises when *T* is relatively small as in our dataset. We estimate a model with and without autoregressive component, using the two-step procedure with the covariance matrix corrected for finite sample bias (Windmeijer, 2005). The first four models are similar to Equation 2.1, but now we specify ownership rates as being endogenous. Models 5 through 8 allow for autoregressive behaviour through θ:

$$\ln(Outcome_{it}) = \alpha + \theta \ln(Outcome_{it-1}) + \beta \ln(ownership_{it}) + \gamma(\mathbf{X}_{it}) + \tau_t + \mu_i + \varepsilon_{it} \quad with \quad \varepsilon_{it} \sim IID(0, \sigma^2) \tag{2.5}$$

The results for both estimators are reported in Table I.1, and include diagnostic tests. One expects first-order serial correlation and no second-order correlation in the disturbances (Baltagi, 2008). According to Table I.1, only models 5 and 7 fail to reject the AR(1) test for first-order autocorrelation in the disturbances. All models fail to reject the AR(2) and Hansen test for overidentifying restrictions. Since too many moment conditions can bias the estimator, we restrict the number of instruments used in the estimation. For the B&B estimator we also report the difference-in-Hansen test for the exogeneity of instruments, with the null being that the instruments are exogenous.

Table I.1 ■ Dynamic panel model estimates of ownership rates on external effect indicators

Dependent variable is the log of safety index or satisfaction rate respectively. Robust t-statistics are reported in brackets. Variable definitions are shown in Table 2.1. Significance: *p <0.10, ** p<0.05, *** p<0.01. "L." indicates the first lag of the variable. Models 1, 2, 5 and 6 are estimated using the Arellano-Bond first difference-estimator. Models 3, 4, 7, and 8 are estimated using the Blundell and Bond system estimator. All models treat *lnown* as an endogenous variable. The AR(1), AR(2) and Hansen tests report p-values.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	lnsafe	lnsatis	lnsafe	lnsatis	lnsafe	lnsatis	lnsafe	lnsatis
lnown	0.162**	0.274***	0.136**	0.167**	0.119**	0.112**	0.115***	0.0817
	[2.50]	[2.78]	[2.50]	[2.16]	[2.31]	[2.13]	[2.63]	[1.64]
lnsafe		0.00490		0.0189		-0.155		-0.204
		[0.01]		[0.07]		[-0.37]		[-0.60]
L.lnsafe					0.240		0.105	
					[1.04]		[0.29]	
L.lnsatis						0.342		0.385
						[1.26]		[1.28]
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Neighbourhood fixed eff.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed eff.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	410	340	482	410	345	275	416	345
# of instr.	26	25	28	27	25	24	27	26
AR(1) test	0,064	0,051	0,033	0,009	0,175	0,096	0,497	0,088
AR (2) test	0,88	0,725	0,632	0,133	0,541	0,93	0,867	0,664
Hansen overid restrict.	0,346	0,111	0,576	0,437	0,513	0,731	0,722	0,741
Difference in Hansen	-	-	0,973	0,965	-	-	0,689	0,388

2.7 Appendix II Overview municipal structure of Rotterdam

Table II.1 ■ Sub-municipalities of Rotterdam and their neighbourhoods

Neighbourhoods excluded from the analysis are not reported.

Sub-municipality	Neighbourhood	Sub-municipality	Neighbourhood
Charlois	Carnisse	Ijsselmonde (c'td)	Lombardijen
	Heijplaat		OudIJsselmonde
	OudCharlois	Kralingen-Crooswijk	De Esch
	Pendrecht		KralingenOost
	Tarwewijk		KralingenWest
	Wielewaal		KralingseBos
	Zuiderpark		NieuwCrooswijk
	Zuidplein		OudCrooswijk
	Zuidwijk		Rubroek
Delfshaven	Bospolder		Struisenburg
	Delfshaven	Noord	Agniesebuurt
	Middelland		Bergpolder
	Nieuwe Westen		Blijdorp
	NieuwMathenesse		Blijdorpse Polder
	OudMathenesse		Liskwartier
	Schiemond		Oude Noorden
	Spangen		Provenierswijk
	Tussendijken	Overschie	Kleinpolder
	Witte Dorp		Landzicht
Feijenoord	Afrikaanderwijk		NoordKethel
	Bloemhof		Overschie
	Feijenoord		Schieveen
	Hillesluis		Spaanse Polder
	Katendrecht		Zestienhoven
	Kop van Zuid	Pernis	Pernis
	Kop van ZuidEntr	Prins Alexander	Het Lage Land
	Noordereiland		Kralingseveer
	Vreewijk		Nesselande
Hillegersberg-Schiebr	HillegersbergNoord		Ommoord
	HillegersbergZuid		Oosterflank
	Molenlaankwartier		Prinsenland
	Schiebroek		sGravenland
	Terbregge		Zevenkamp
Hoek van Holland	Dorp	Stadscentrum	C.S. Kwartier
	Strand en Duin		Cool
Hoogvliet	HoogvlietNoord		Dijkzigt
	HoogvlietZuid		Nieuwe Werk
IJsselmonde	Beverwaard		Oude Westen
	GrootIJsselmonde		Stadsdriehoek

Chapter 3
Financial Literacy, Risk Aversion and Choice of Mortgage type by Households[15]

3.1 Introduction

For many households, a house is the most valuable asset in their wealth portfolio (Campbell, 2006); a substantial number of households need to finance at least part of a house purchase with mortgage debt. Mortgage markets have changed greatly over the last few decades, with an increasing number of products available in addition to extensive customization possibilities (Gerardi *et al.,* 2010b). Driving forces behind the innovation of new mortgages were market deregulation, securitization, and increased competition.

However, the increased menu of mortgage designs complicates the choice process that households face. Although there is an extensive literature on household mortgage choice, a growing body of research indicates that households have only a very limited understanding of basic economic principles (Van Rooij *et al.,* 2011; Lusardi and Mitchell, 2007a+b; Lee and Hogarth, 1999). Such low levels of financial literacy impede a rational decision process due to limited understanding of the risks and features of financial products.

The impact of financial literacy on household decision making is documented for stock market participation (Van Rooij *et al.,* 2011; Grinblatt *et al.,* 2011a; Guiso and Japelli, 2005), portfolio diversification and trading behavior (Grinblatt *et al.,* 2011b; Goetzmann and Kumar, 2008), and retirement planning (Lusardi and Mitchell, 2007a); however, evidence on mortgage choice is limited (see Coulibaly and Li, 2009; Moore, 2003). This is surprising since the number of

[15] This chapter is based on a working paper by Cox, Brounen and Neuteboom (2012, *under review*). We thank Dion Bongaerts, Eric Duca, Andra Ghent, Melissa Porras Prado, Avichai Snir, Manuel Vasconcelos, Vincent Yao and seminar participants at the Rotterdam School of Management, the AREUEA Mid-Year Meeting 2011, the Understanding Society Meeting 2011 and the 3rd ReCAPNet Conference for valuable comments.

households with a mortgage is twice the number that participate in the stock market. Moreover, the rise of mortgage products that defer amortization—so-called alternative mortgage products (AMPs) (Cocco, 2011; LaCour-Little and Yang, 2010; Demyanyk and Van Hemert, 2011)—has been a growing concern to governments and regulators (see Authority of Financial Markets, 2008; Federal Reserve Board, 2007; U.S. Government Accountability Office, 2006). These concerns are fueled by the observation that these products have increasingly been offered to less sophisticated and less wealthy borrowers, who may not be well-informed about the risks inherent in these products.

This paper examines how financial literacy affects the choice of mortgage-type in Dutch households. The Dutch market offers a recourse debt setting and the advantage of homogeneity in mortgage supply (De Haan and Sterken, 2011), and underwriting standards.[16] Analysis of an extensive Dutch panel dataset shows that higher levels of reported financial sophistication, measured as self-assessed financial knowledge and participation in financial markets, increase the probability that households choose AMPs, while more risk-averse households opt for traditional contracts, as is consistent with LaCour-Little and Yang (2010). This indicates that, in the Netherlands, AMP's have not systematically been offered to those households that are less financially literate. Further analyses show that the results are robust to controlling for financial advice, the effect of peers, or experience through prior homeownership. Involving professional advisors does increase the probability of choosing mortgages that defer amortization, while the opposite effect is found when family members or acquaintances are consulted instead. Whether the effect of financial advisors is good or bad is difficult to assess as maximizing tax-benefits of interest-rate deductibility can explain the observed pattern.

This paper contributes to several literature streams. Its extension of the literature on financial literacy and its impact on decision making into the mortgage market explicitly accounts for the rising popularity of AMPs. Since mortgages constitute a substantial liability on a households' balance sheet, a better understanding of the decision processes common to those mortgages provides insights into how households' wealth portfolios are constructed, as well as permitting analysis of the portfolio in the life-cycle setting (e.g., Van Hemert, 2010; Cocco *et al.,* 2005; Cocco, 2005; Campbell and Cocco, 2003). The present paper also contributes to the literature on financial advice by documenting how the involvement of different advisors alters households' mortgage decisions (Collins,

[16] Recourse debt holds households for complete repayment of their mortgage in case a foreclosure occurs and proceeds fall short of the outstanding balance.

2010; Elmerick *et al.,* 2002). This is in contrast to work by Mullainathan *et al.* (2010), Hackethal *et al.* (2012), and Schum and Faig (2006), who examined investment advice.

Finally, the results provide input for regulatory authorities and educational programs, as well as banks and financial advisors. A goal of regulatory authorities is to prevent households from buying unsuitable financial products; increased financial education can address this by creating a greater awareness among households of basic financial concepts. Moreover, financial institutions and financial advisors need to be aware of the role and responsibility they have in consumer credit markets, including clear description of a product's features, as especially less literate households rely on public sources of information instead of professional advice. Unclear presentation of the risks and benefits of financial products might be especially harmful to them.

This paper is organized as follows. Section 3.2 provides an overview of the literature on mortgage choice, financial literacy and risk aversion. . Section 3.3 discusses the dataset, while Section 3.4 through Section 3.7 contain the empirical analysis and robustness checks. Section 3.8 presents some conclusions.

3.2 Literature review

3.2.1 Mortgage choice

An extensive literature on mortgage choice has emerged the past three decades. Most studies have focused on households' choice between fixed-rate mortgages (FRMs) and adjustable-rate mortgages (ARMs) as these are the main mortgage products in the U.S. (Campbell, 2006). Brueckner and Follain (1988) showed that the interest rate differential between ARM and FRM mortgages and the level of the FRM rate is an important determinant of mortgage choice. Borrowers with shorter expected tenure also tended to prefer ARMs, in order to take advantage of lower initial teaser rates (Stanton and Wallace, 1999; Coulibaly and Li, 2009). Besides mobility expectations and the ARM–FRM spread, papers have also examined the effect of mortgage contract features such as the choice of points at origination[17] (Chang and Yavas, 2009; Stanton and Wallace, 1998; Kau and Keenan, 1987), the rate of the contract (see for example Duca and Rosenthal,

[17] Discount points are a origination cost and are the percentage discount between the mortgage amount agreed on and the amount actually received e.g. a one point discount means repaying a 100.000 dollar mortgage while receiving only 99.000 dollar at origination.

1994), and the intervals at which ARM rates are adjusted (Sa-Aadu and Sirmans, 1995; Cunningham and Capone, 1990) on mortgage choice. More recently, Koijen, Van Hemert, and Van Nieuwerburgh (2009) examined the influence of bond risk premia on mortgage choice, finding that these premia are a more accurate predictor of mortgage choice than, for example, yield spreads. Other papers have related the choice explicitly to borrower characteristics, such as the riskiness, in terms of FICO-scores and employment status, of the household (Harrison *et al*., 2004) or the choice for reverse mortgages by elderly homeowners (Fratantoni, 1999).

Besides the influence of mortgage characteristics on mortgage choice, recent studies have examined households' optimal mortgage decisions in the context of a life-cycle model. Campbell and Cocco (2003), for example, showed that households with a risky income, as well as those that are risk-averse, are less attracted to an ARM contract since monthly payments are sensitive to changes in the interest rate. Van Hemert (2010) examined the interest rate risk for households and—using a life-cycle setting—found that, in most cases, the ARM is the preferred contract, except for older, less-mobile, and risk-averse borrowers who hold FRM debt.[18] His findings corroborated those of Campbell and Cocco (2003).

The literature on AMPs is only starting to emerge. Alternative mortgage products increase the accessibility of homeownership for households by optimizing the tax-advantages on interest payments and deferral of amortization charges, thereby effectively lowering monthly payments. LaCour-Little and Yang (2010) documented that households with a larger tolerance for risk tend to choose non-amortizing contracts. Moreover, they documented that low-income and borrowing-constrained households have increasingly turned to these types of contracts. Non-amortizing contracts entail a larger equity-driven default risk since no principal repayments are made. Speculators and aggressive borrowers are attracted to these products to reap the benefits of rising house prices. Cocco (2011) used the British mortgage market as his laboratory, relying on the life-cycle consumption smoothing hypothesis, and concluding that financially constrained households that expect their future resources to be higher tend to choose products with deferred amortization. This decreases current mortgage payments and, as such, helps smooth their current consumption. However, it is questionable to what extent households actually understand the features of these new mortgage types including the risks that come with them (Authority of Financial Markets, 2008).

[18] The intuition behind this result is that the interest-rates on FRM contracts incorporate a term premium and are therefore less appealing to households who are currently borrowing-constrained or are more likely to move in the near future. Since they are generally younger, they are expected to choose ARM mortgages ceteris paribus, to take advantage of the lower initial interest rate.

3.2.2 Financial literacy and risk aversion

The literature on financial literacy and its impact on decision making is developing rapidly. Studies by Lusardi and Mitchell (2007b; 2008) showed that financial illiteracy is widespread among households and is not confined to certain groups or countries. Financial literacy measurement is not straightforward as it can involve a combination of interests, awareness (Guiso and Jappelli, 2005), cognitive ability, risk aversion (Dohmen *et al.*, 2010), cultural values, and advice by peers, parents, neighbors or professionals (Hackethal *et al.,* 2012; Shum and Faig, 2006; Elmerick *et al.,* 2002). Although the psychometric measurements and determinants of financial literacy is not the focus of this paper, we do briefly examine the indicators that have appeared in other empirical work.

Van Rooij *et al.* (2011) devised an extensive module of survey questions that measure the understanding of economic concepts like compound interest and inflation. They showed that even a very basic understanding of economics is limited among households and that low literacy levels deter stock market participation. Grinblatt *et al.* (2010a) reported similar results for stock market participation, using IQ as an indicator for cognitive ability and reported as well in a related paper that affluent individuals earn larger risk-adjusted returns (Grinblatt *et al.,* 2010b). Households that are more sophisticated—that is wealthier, and higher-educated—are also less prone to investment mistakes, such as underdiversification and disposition bias (Goetzmann and Kumar, 2008; Calvet *et al.,* 2009).

Dohmen *et al.* (2010) examined the impact of cognitive abilities on risk aversion. Individuals with lower cognitive test scores are less likely to choose for lottery-type payoffs, indicating higher risk aversion. Their results held after controlling for educational attainment and income. Individuals with lower cognitive abilities were found to be less patient and might therefore take less time to understand contract designs. Moreover, risk aversion is found to decrease with increases in wealth (see Morin and Suarez, 1983). Morin and Suarez also examined the impact of life-cycle effects and documented that risk aversion increases uniformly with age.

Consistent with studies on stock market participation and investment behavior, empirical research in mortgage markets has shown that the degree of literacy matters in households' decision-making process. Although the mortgage market is quite complex and not perfectly transparent (see Woodward and Hall, 2010), the popularity of AMPs is widespread and not confined to more literate households (Gerardi *et al.*, 2010a). Empirical work so far has mostly dealt with the mechanics of refinancing and interest rates, rather than choice of product type.

Miles (2004), for example, found that mortgage borrowers have limited understanding of interest rate risk and the potential savings arising from refinancing. Donker and Van Soest (1999), using survey data, showed that households who report to have a higher interest in financial matters take out smaller mortgages on their house, while Moore (2003) reported that households with lower financial literacy are more likely to hold a high-interest mortgage. Gerardi *et al.* (2010b) examined the role of financial illiteracy on subprime mortgage delinquency. Using numerical ability as an indicator for literacy, analysis showed that foreclosure rates are approximately two-thirds lower for groups with the highest numerical ability. This matches work by Bucks and Pence (2006), who showed that low-income and low-educated households tend to underestimate how much interest rates can change, which consequently can trigger default. The impact of literacy on mortgage-type choice has not been examined so far except for some indirect measures in LaCour-Little and Yang (2010) and Coulibaly and Li (2009).

3.3 Data description

The data used in this paper are obtained from the DNB Household Survey (DHS), a panel dataset comparable to the panel survey of income dynamics (PSID) in the U.S. It has been administered by Centerdata among 2,000 Dutch households annually since 1993 and contains a wide variety of information on income, work, psychological- and wealth-related issues. This paper uses all waves throughout from 1994 up to 2009.

Administration of the survey takes place via the internet and, in earlier waves, through a Netbox providing internet via the television. Participants are recruited by phone and based on random selection. Households that do not have an internet connection or personal computer are provided one by Centerdata. Moreover, participants receive no financial compensation for participation in the household survey.

The survey does not require intervention of an interviewer [19] and panel members can fill out the questionnaires at a time that is convenient for them. Moreover, since the entire survey is administered at the panel member's residence, the probability of reporting errors is reduced because the member can directly look up their annual and bank balance statements. Finally, internet surveys are less

[19] See for a more elaborate discussion Schober and Conrad (1997).

prone to reporting biases than surveys administered via telephone (Chang and Krosnick, 2003).

As responses on household-level issues might be completed by another member of the household, the household head is defined as the member that has the highest income. This has the advantage that his or her views are likely to have greater weight with respect to the financial consequences of decision making. For example, the implications of unemployment are largest for the household member with the highest income and their risk aversion might influence subsequent financial decisions of the household as a whole.

Inherent in all consumer surveys is measurement error. To alleviate biases due to response errors, we follow (Cocco, 2011) and winsorize all continuous variables at 10 percent of their distribution, while obvious response errors (e.g., if amounts were asked in thousands of euros and were not reported as such) were corrected in the dataset to the extent that they could be logically inferred from the other responses of the panel member. Moreover, the introduction of the euro in 2003 requires us to convert all amounts reported before 2003 to euros.

This paper analyzes how risk aversion and financial literacy matter in the households' decision of mortgage-type. To rule out variations in unobserved effects, we only include observations when the origination year of the mortgage coincides with the survey year to counteract endogeneity. E.g. the learning effect from the mortgage choice is likely to influence subsequent self-assessments of financial knowledge, particularly when the decision and self-assessment are further apart. Although this condition reduces the sample substantially, it ensures that the impact of distorting factors is minimized. Moreover, questioning respondents *ex-post* on their literacy and risk aversion levels is likely to include learning and experience effects, especially when the transaction took place several years ago. In a number of cases, it is also impossible, as households have left the panel. Imposing this condition yields a sample of 777 mortgage observations.

Since a large number of different mortgage contracts are available, they are sorted into three categories based on the repayment schedule. The three categories are traditional amortizing contracts, deferred amortization mortgages and interest-only mortgages. Our sample includes 292 amortizing mortgages, 137 deferred amortization mortgages and 348 interest-only mortgages. Section 3.9 Appendix I offers a detailed discussion of the differences between the contracts and the evolution of interest and amortization payments over the mortgage term.

Table 3.1 ■ Summary statistics

This table shows weighted mean and median values for control variables by mortgage type. The definition of mortgage categories can be found in Table I.1. Data is from the DNB Household Survey and cover mortgages originated between 1994-2009.

	Amortizing		Deferred amortization		Interest-only		Total		
	Mean	Median	Mean	Median	Mean	Median	Mean	Median	*N*
Age	39.72	37.00	38.63	37.00	50.54	51.00	44.44	42.00	774
Household size	2.93	3.00	3.17	3.00	2.62	2.00	2.83	2.00	774
Log household income	10.49	10.61	10.48	10.55	10.51	10.60	10.50	10.60	774
Log house value	4.63	4.60	4.89	4.94	4.78	4.84	4.74	4.77	774
Log mortgage debt	4.68	4.70	5.07	5.09	4.69	4.69	4.76	4.79	774
Frequencies of dummy variables									
Starter	32.47%		29.97%		14.18%		23.75%		189
Wealth quartiles									
First wealth quartile	45.89%		41.02%		37.46%		41.18%		338
Second wealth quartile	10.74%		14.79%		9.53%		10.96%		85
Third wealth quartile	26.18%		18.98%		23.36%		23.56%		186
Fourth wealth quartile	17.18%		25.21%		29.64%		24.31%		165
Selfemployed	0.57%		1.62%		2.59%		1.69%		10
Retired	1.96%		2.95%		19.49%		10.11%		75
Higher vocational	25.71%		33.02%		26.20%		27.32%		204
University	13.41%		8.13%		20.31%		15.55%		104
Male	92.09%		96.53%		89.91%		91.94%		696
Married	84.88%		91.38%		81.54%		84.60%		630

Summary statistics reported in Table 3.1 show that interest-only mortgages tend to be chosen by older households and those smaller in size (implying grown children). Moreover, deferred amortization contracts are associated both with more expensive houses as well as with higher levels of mortgage debt. A closer look at the dummy variables reveals that only 14.2 percent of first-time homebuyers (*starters*) have an interest-only mortgage, while 32.5 percent of them have a traditional contract. This is in line with the idea that older and wealthier are less constrained in making a down payment because they have built up assets and home-equity during their life. As such they can be expected to be more likely to obtain an interest-only mortgage.

Our measure of wealth is defined analogously to Van Rooij *et al.* (2011) and Morin and Suarez (1983) as the sum of checking and savings accounts, employer-sponsored savings plans, the value of life insurance, home equity, other real estate, and the value of holdings in financial assets minus total debt and is measured using

quartile-dummies.[20] Households with interest-only mortgages are concentrated in the third and fourth wealth quartile in contrast to those with an amortizing contract which are more likely to be in the first and second quartile. Other controls reveal that households with interest-only contracts are more likely to be retired, or self-employed, consistent with the observed difference in age. Finally, households with a deferred amortization or interest-only product are more likely to be highly educated (higher vocational or university).

3.4 Analysis of mortgage choice

This section reports multivariate analysis of mortgage choice by households. We first estimate a basic multinomial model and then expand it with indicators for risk aversion, financial literacy, and financial advice. We follow the same methodology as Sa-Aadu and Sirmans (1995) and Cocco (2011). Households can choose between three alternative mortgage products: amortizing mortgages (j = 1), deferred amortization mortgages (j = 2) and interest-only mortgages (j = 3). Households' i choice for a certain mortgage contract j can be viewed as one that the maximizes the utility function, where each alternative gives a utility of U_{ij} for i = 1,2,….N and j = 1, 2 or 3. A general function for the utility level can be defined as:

$$U_{ij} = \alpha_j + \beta_j \mathbf{X}_{ij} + \varepsilon_{ij} \tag{3.1}$$

where $\mathbf{X}_{ij}$ is a vector of control variables. If the error terms ε_{ij} have a Weibull-distribution, then the probability that household i chooses mortgage type j is given by:

$$P(y_i = j) = \frac{\exp(\alpha_j + \beta_j \mathbf{X}_{ij})}{\sum_{j=1}^{3} \exp(\alpha_j + \beta_j \mathbf{X}_{ij})} \tag{3.2}$$

The vector $\mathbf{X}_{ij}$ contains control variables for household demographics (age, marital status, gender level of education, income and household size), labor market position (self-employed or retired), and mortgage terms (interest rate and a fixed rate period dummy). Additional controls for house value and amount of mortgage debt are also included alongside dummy variables for household wealth. In order to

[20] The number of observations per quartile is not equal to 25 percent of the total because household wealth and the corresponding quartile are computed year by year allowing for the possibility of transition to another wealth quartile.

control for time trends- and supply effects, year-dummies are included in the specifications. All models are estimated by maximum likelihood and the households are weighted to ensure that the statistics are representative for the Dutch population. Reported are Hubert-White heteroskedasticity-robust standard errors.

3.5 Mortgage choice: the base model

Base results are reported in Table 3.2, which include house value in Panel A and the amount of mortgage debt in Panel B as a proxy for size. The results indicate that deferred amortization mortgage products are used to buy more expensive houses and, that those mortgages are on average larger, in line with the descriptive statistics.

We examine how our results change by including various sets of explanatory variables, such as mortgage terms, year effects and wealth quartiles.

Mortgage choice seems to be explained primarily by the age of the household head, with older households having a higher probability of choosing an interest-only mortgage, and household size, which decreases the probability of an interest-only contract. This reflects the capability of households to meet the underwriting criteria associated with interest-only mortgages. Typically, banks cap the loan to 75 percent of house value, thereby requiring households to make a down payment. Naturally, older households who are supposedly wealthier due to equity built up in their previous house are better able to meet these underwriting criteria. In unreported analysis, we examined differences in loan-to-value ratios, which indeed show that these are lower for households with interest-only mortgages.

University-educated households have a lower chance of having a deferred amortization contract, in line with results reported by Cocco (2011). Probably these households are aware of the additional costs associated with life-annuity contracts and endowment funds, and therefore are less likely to choose this product type.

Moreover, the choice of a contract is not significantly related to whether a household is new to the ownership market, since the inclusion of *starter* does not change our results. Because many of our control variables are insignificant, we examine whether collinearity problems are causing insignificance, though our explanatory variables are only moderately correlated. An F-test on multiple restrictions indicates that the demographic controls are jointly highly significant in all specifications while wealth controls are jointly insignificant.

Table 3.2 ■ Mortgage choice base model estimations

This table shows weighted multinomial logit regression results for mortgage choice of households. Included are all mortgages originated between 1994 and 2009 with amortizing mortgages being the reference category (see Table I.1). Robust t-statistics are reported in brackets. ***,**,* denotes significant at 1, 5 and 10 percent level respectively. Data is from the DNB Household Survey.

Panel A Model with house value						
	(1)		(2)		(3)	
Independent Variables	Deferred amor	Interest-only	Deferred amor	Interest-only	Deferred amor	Interest-only
Log house value	0.784***	0.614***	0.399*	0.346*	0.397*	0.368*
	[4.25]	[3.81]	[1.80]	[1.81]	[1.76]	[1.92]
Starter					0.071	-0.316
					[0.23]	[-1.16]
Second wealth quartile						
Third wealth quartile						
Fourth wealth quartile						
Log household income	-0.103	-0.186	0.439	-0.004	0.438	-0.01
	[-0.40]	[-0.87]	[1.43]	[-0.02]	[1.42]	[-0.07]
Age	-0.007	0.077***	-0.001	0.088***	-0.000	0.084***
	[-0.61]	[7.18]	[-0.09]	[7.46]	[-0.02]	[6.69]
Self-employed	0.718	1.332	0.597	1.244	0.596	1.248
	[0.58]	[1.06]	[0.48]	[1.02]	[0.48]	[1.02]
Retired	0.806	0.925*	0.658	0.658	0.659	0.678
	[1.00]	[1.82]	[0.68]	[1.16]	[0.69]	[1.20]
Higher vocational	0.127	-0.022	0.119	0.174	0.114	0.168
	[0.49]	[-0.10]	[0.42]	[0.69]	[0.40]	[0.67]
University	-0.867*	0.176	-0.963**	0.260	-0.967**	0.272
	[-1.92]	[0.62]	[-1.99]	[0.87]	[-2.00]	[0.91]
Male	0.296	-0.494	0.513	-0.379	0.504	-0.382
	[0.46]	[-1.11]	[0.66]	[-0.84]	[0.65]	[-0.84]
Married	0.160	-0.056	0.331	0.159	0.328	0.136
	[0.34]	[-0.15]	[0.65]	[0.40]	[0.65]	[0.34]
Household size	0.074	-0.070	0.015	-0.141	0.022	-0.156*
	[0.77]	[-0.84]	[0.15]	[-1.56]	[0.23]	[-1.71]
Constant	-3.578	-3.544	-8.363**	-4.488*	-8.426**	-4.109*
	[-1.30]	[-1.62]	[-2.46]	[-1.84]	[-2.46]	[-1.66]
Mortgage terms	No		No		No	
Year fixed effects	No		Yes		Yes	
Joint significance demographics (p-value)	0.000		0.000		0.000	
Joint significance wealth controls (p-value)	-		-		-	
No of Observations	757		757		757	
Pseudo R-squared	0.137		0.221		0.222	
Log-Likelihood	-680.7		-614.6		-613.5	

Table 3.2 Panel A continued

	(4)		(5)		(6)	
Independent Variables	Deferred amor	Interest-only	Deferred amor	Interest-only	Deferred amor	Interest-only
Log house value	0.384*	0.350*	0.319	0.359*	0.286	0.390*
	[1.71]	[1.83]	[1.35]	[1.70]	[1.18]	[1.84]
Starter					0.134	-0.293
					[0.40]	[-1.01]
Second wealth quartile	0.752*	0.268			0.564	0.226
	[1.81]	[0.75]			[1.30]	[0.61]
Third wealth quartile	-0.295	0.101			-0.560	0.003
	[-0.93]	[0.39]			[-1.58]	[0.01]
Fourth wealth quartile	0.259	0.200			-0.006	0.189
	[0.79]	[0.71]			[-0.02]	[0.61]
Log household income	0.473	-0.014	0.283	-0.272	0.326	-0.295
	[1.52]	[-0.06]	[0.78]	[-1.05]	[0.88]	[-1.13]
Age	-0.002	0.087***	0.001	0.092***	0.004	0.088***
	[-0.16]	[7.34]	[0.08]	[7.16]	[0.24]	[6.42]
Self-employed	0.448	1.160	0.481	1.007	0.351	0.934
	[0.39]	[0.97]	[0.38]	[0.78]	[0.29]	[0.73]
Retired	0.682	0.671	0.860	0.375	0.855	0.381
	[0.71]	[1.17]	[0.98]	[0.62]	[0.96]	[0.63]
Higher vocational	0.132	0.179	0.211	0.135	0.234	0.124
	[0.46]	[0.71]	[0.70]	[0.50]	[0.76]	[0.46]
University	-1.048**	0.254	-0.824	0.257	-0.925*	0.235
	[-2.12]	[0.84]	[-1.50]	[0.79]	[-1.67]	[0.71]
Male	0.429	-0.390	0.410	-0.340	0.319	-0.341
	[0.56]	[-0.87]	[0.52]	[-0.72]	[0.41]	[-0.73]
Married	0.360	0.152	0.374	0.179	0.441	0.154
	[0.69]	[0.39]	[0.67]	[0.43]	[0.75]	[0.37]
Household size	0.005	-0.137	-0.035	-0.227**	-0.046	-0.241**
	[0.06]	[-1.50]	[-0.34]	[-2.28]	[-0.43]	[-2.41]
Constant	-8.479**	-4.430*	-5.433	0.115	-5.563	0.402
	[-2.47]	[-1.80]	[-1.30]	[0.04]	[-1.29]	[0.14]
Mortgage terms	No		Yes		Yes	
Year fixed effects	Yes		Yes		Yes	
Joint significance demographics (p-value)	0.000		0.000		0.000	
Joint significance wealth controls (p-value)	0.330		-		0.335	
No of Observations	757		660		660	
Pseudo R-squared	0.226		0.224		0.231	
Log-Likelihood	-610.7		-528.0		-523.2	

Table 3.2 continued

Panel B Model with mortgage debt

	(1)		(2)		(3)	
Independent Variables	Deferred amor	Interest-only	Deferred amor	Interest-only	Deferred amor	Interest-only
Log mortgage debt	1.278***	0.613***	0.813**	0.016	0.807**	0.045
	[4.52]	[2.94]	[2.36]	[0.07]	[2.33]	[0.20]
Starter					0.0840	-0.541
					[0.23]	[-1.64]
Second wealth quartile						
Third wealth quartile						
Fourth wealth quartile						
Log household income	-0.695*	-0.750**	-0.349	-0.375	-0.345	-0.408
	[-1.88]	[-2.55]	[-0.82]	[-1.21]	[-0.80]	[-1.30]
Age	0.005	0.079***	0.002	0.083***	0.003	0.076***
	[0.30]	[5.67]	[0.12]	[5.74]	[0.15]	[4.98]
Self-employed	0.350	0.718	0.405	1.069	0.353	1.054
	[0.33]	[0.64]	[0.41]	[1.00]	[0.36]	[0.99]
Retired	0.849	1.044	0.828	0.640	0.812	0.669
	[0.86]	[1.60]	[0.80]	[0.91]	[0.78]	[0.98]
Higher vocational	0.115	-0.186	0.239	-0.002	0.230	-0.001
	[0.35]	[-0.62]	[0.69]	[-0.01]	[0.67]	[-0.01]
University	-1.379***	-0.015	-1.200**	0.101	-1.213**	0.139
	[-2.65]	[-0.05]	[-2.12]	[0.28]	[-2.15]	[0.39]
Male	0.652	-0.101	0.761	-0.009	0.738	-0.029
	[0.93]	[-0.24]	[0.94]	[-0.02]	[0.89]	[-0.06]
Married	0.101	0.161	0.327	0.348	0.331	0.318
	[0.19]	[0.41]	[0.57]	[0.83]	[0.57]	[0.74]
Household size	0.089	-0.173	0.017	-0.269**	0.027	-0.300**
	[0.82]	[-1.61]	[0.14]	[-2.34]	[0.23]	[-2.55]
Constant	-0.370	2.377	-2.306	-1.616	-2.421	-0.767
	[-0.10]	[0.81]	[-0.55]	[-0.51]	[-0.57]	[-0.24]
Mortgage terms	No		No		No	
Year fixed effects	No		Yes		Yes	
Joint significance demographics (p-value)	0.000		0.000		0.000	
Joint significance wealth controls (p-value)	-		-		-	
No of Observations	503		503		503	
Pseudo R-squared	0.158		0.244		0.248	
Log-Likelihood	-437.0		-392.2		-390.1	

Table 3.2 Panel B continued

	(4)		(5)		(6)	
Independent Variables	Deferred amor	Interest-only	Deferred amor	Interest-only	Deferred amor	Interest-only
Log mortgage debt	0.805**	0.018	0.775*	-0.114	0.773*	-0.084
	[2.29]	[0.09]	[1.95]	[-0.40]	[1.91]	[-0.29]
Starter					0.102	-0.330
					[0.26]	[-0.96]
Second wealth quartile	0.277	0.095			0.285	0.223
	[0.49]	[0.21]			[0.50]	[0.49]
Third wealth quartile	-0.289	-0.069			-0.332	-0.044
	[-0.76]	[-0.21]			[-0.79]	[-0.13]
Fourth wealth quartile	0.036	0.131			0.046	0.120
	[0.09]	[0.38]			[0.10]	[0.33]
Log household income	-0.307	-0.375	-0.495	-0.359	-0.455	-0.369
	[-0.72]	[-1.20]	[-1.10]	[-1.07]	[-1.00]	[-1.09]
Age	0.000	0.089***	0.008	0.080***	0.008	0.076***
	[0.03]	[5.68]	[0.43]	[4.94]	[0.41]	[4.50]
Self-employed	0.319	1.026	0.253	0.864	0.150	0.843
	[0.33]	[0.95]	[0.25]	[0.72]	[0.15]	[0.70]
Retired	0.923	0.676	0.551	0.428	0.593	0.461
	[0.87]	[0.94]	[0.53]	[0.62]	[0.56]	[0.67]
Higher vocational	0.237	-0.006	0.289	-0.011	0.284	-0.009
	[0.68]	[-0.02]	[0.81]	[-0.03]	[0.79]	[-0.03]
University	-1.262**	0.067	-1.137*	0.181	-1.224**	0.167
	[-2.17]	[0.18]	[-1.90]	[0.48]	[-1.99]	[0.43]
Male	0.741	-0.001	0.615	-0.190	0.569	-0.199
	[0.93]	[-0.00]	[0.76]	[-0.39]	[0.71]	[-0.41]
Married	0.336	0.349	0.234	0.347	0.250	0.337
	[0.58]	[0.83]	[0.38]	[0.79]	[0.40]	[0.76]
Household size	0.007	-0.272**	-0.016	-0.322***	-0.018	-0.343***
	[0.07]	[-2.37]	[-0.14]	[-2.64]	[-0.15]	[-2.78]
Constant	-2.615	-1.623	-0.077	3.925	-0.201	4.007
	[-0.62]	[-0.51]	[-0.02]	[1.13]	[-0.04]	[1.14]
Mortgage terms	No		Yes		Yes	
Year fixed effects	Yes		Yes		Yes	
Joint significance demographics (p-value)	0.000		0.000		0.000	
Joint significance wealth controls (p-value)	0.966		-		0.964	
No of Observations	503		465		465	
Pseudo R-squared	0.246		0.243		0.246	
Log-Likelihood	-391.4		-358.9		-357.4	

3.6 Mortgage choice: financial literacy and risk aversion

As discussed, a variety of indicators for literacy and risk aversion such as holdings of financial assets, financial education, survey data, IQ, and cognitive ability tests have appeared in empirical work. No consensus has emerged yet as to which measurement protocol yields the most reliable information on household financial decision making. The empirical analysis makes use of two indicators for financial literacy: one self-reported measure and one based on asset holdings. Risk aversion is measured using a comprehensive scale based on six survey questions. The exact wording of the questions is reported in Appendix II.

The first literacy measure (*Financial Literacy*) asks to which extent respondents consider themselves knowledgeable with respect to financial matters, ranging from *not knowledgeable* to *very knowledgeable*. Our second indicator (*Financial Active*) measures holdings of financial assets by households. The survey distinguishes between seven different asset classes, ranging from stockholdings to positions in derivatives. We construct a scale ranging from 0 (no holdings of financial assets) to 7 (positions in all mentioned assets), rather than looking at specific financial assets. There are two reasons for this approach. Firstly, it is not clear *a priori* which asset classes indicate financial literacy and which ones do not. Coulibaly and Li (2009), for example, only use stockholdings as a proxy for financial sophistication of the household. Secondly, the resulting scale is a measure both of the sophistication of the household in terms of diversification (Goetzmann and Kumar, 2008; Calvet *et al*., 2009) as well as awareness in financial markets (Guiso and Japelli, 2005).[21]

Obviously, both measures are imperfect proxies for financial literacy. Household responses and their actions might be driven by overconfidence rather than financial literacy.[22] Overconfidence in self-reported data and in financial behavior is reported for example in Barber and Odean (2001). An obvious indicator for overconfidence is the 'better than average' effect, which occurs when more than half of the households report they are better than the average household (see for example Nosić and Weber, 2010). Unfortunately, our variable is not suitable to assess overconfidence in this way, because households are not asked to compare financial knowledge with the average household. However, we do observe that the scores on *Financial Literacy* are close to the scale average (2.5), and that this

[20] The analysis that follows treats *Financial Literacy* and *Financial Active* as a continuous variable, rather than creating separate dummies. The results, when measured as dummies, remain similar, but in the case of *Financial Literacy* suffered from collinearity with year-dummies.

[22] We thank an anonymous referee for this suggestion.

remains stable over time. If overconfidence was present, we would expect the response average to be higher, and potentially varying with the economic climate.

Moreover, RLA (2011) show (Table 4 in their paper) that objective and subjective measures of financial literacy are strongly correlated: people that assess their own knowledge as being higher also show higher scores on objective questions regarding financial concepts. Although we use the same data-set, the measures employed in this paper are slightly different. Therefore we obtained the original data from RLA (2011) and analyzed to what extend our measures correlate to both their subjective and objective measures. The results are positive and significant correlations. Moreover, an one-way ANOVA indicates that RLA's *basic literacy* score is increasing in our measure and that those differences are highly significant ($F = 4.31$, $p = 0.004$).

Risk aversion is measured using six statements that question to what extent households are willing to take risk on investments. Households that are more willing to borrow money for investments or are prepared to lose money on investments are supposedly more risk-tolerant. After recoding responses on questions 3, 5, and 6, the resultant scale shows high consistency with a Cronbach Alpha of 0.927. A natural question is to what extent *self-reported* measures of literacy and risk aversion actually predict household financial behavior. Schooley and Worden (1996) compared the reported willingness of households to take financial risk to the actual riskiness of their portfolio and concluded that portfolio allocations are consistent with self-reported risk aversion.

Table 3.3 ■ Risk aversion and financial literacy across mortgage types and demographics

This table shows weighted mean values for risk aversion and financial literacy by mortgage type (Panel A) and demographics (Panel B). The exact measurement of risk aversion and financial literacy can be found in Appendix II. The definition of mortgage categories can be found in Table I.1. Data is from the DNB Household Survey and cover mortgages originated between 1994-2009.

Panel A Literacy and Risk Aversion across mortgage types

	Amortizing	Deferred amortization	Interest-only
Risk Aversion	20.27	18.40	19.85
Financial Literacy	2.22	2.31	2.29
Financial Active	0.24	0.36	0.59
Number of observations	292	137	348

Panel B Literacy and Risk Aversion across demographics

	Age categories				
	20-30 years	31-40 years	41-50 years	51-60 years	61+ years
Amortizing mortgages	46.8%	46.4%	37.2%	26.0%	10.0%
Deferred amortization mortgages	26.7%	26.5%	22.4%	6.0%	4.2%
Interest-only mortgages	26.5%	27.1%	40.4%	68.0%	85.8%
Risk Aversion	18.29	18.55	19.19	22.05	20.98
Financial Literacy	2.51	2.30	2.16	2.38	2.05
Financial Active	0.30	0.32	0.42	0.44	0.75
Number of observations	88	258	194	129	101

	Income classes		
	Low	Medium	High
Amortizing mortgages	33.0%	35.6%	40.1%
Deferred amortization mortgages	22.2%	19.9%	13.0%
Interest-only mortgages	44.8%	44.5%	46.8%
Risk Aversion	23.41	24.80	25.50
Financial Literacy	2.26	2.24	2.34
Financial Active	0.27	0.46	0.47
Number of observations	209	410	158

	Education level		
	Primary or secondary	Higher vocational	University
Amortizing mortgages	38.93%	33.36%	30.58%
Deferred amortization mortgages	19.12%	22.97%	9.94%
Interest-only mortgages	41.95%	43.68%	59.49%
Risk Aversion	23.69	25.68	26.22
Financial Literacy	2.27	2.31	2.20
Financial Active	0.38	0.41	0.59
Number of observations	466	204	104

Table 3.3 Panel B continued

	Wealth quartiles			
	First QRT	Second QRT	Third QRT	Fourth QRT
Amortizing mortgages	40.29%	35.45%	40.17%	25.55%
Deferred amortization mortgages	18.68%	25.32%	15.10%	19.44%
Interest-only mortgages	41.04%	39.24%	44.73%	55.01%
Risk Aversion	21.45	23.51	26.83	26.01
Financial Literacy	2.21	2.19	2.22	2.39
Financial Active	0.22	0.12	0.33	0.80
Number of observations	338	85	186	165

Weighted descriptive statistics on risk aversion and financial literacy are reported across mortgage types (Panel A) and demographic characteristics age, income, education and wealth (Panel B) in Table 3.3.[23] Households with AMPs appear to be less risk averse and have more positions in financial assets than those with traditional amortizing contracts (consistent with LaCour-Little and Yang, 2010), but the level of financial literacy is not very different between mortgage-types. Holdings of financial assets and risk aversion exhibit patterns that are consistent with prior literature (Panel B) as they increase with age, income, and wealth (Goetzmann and Kumar, 2008; Morin and Suarez, 1983). Financial literacy appears to be decreasing in age, especially after the respondent is 60 years old, can be reflective of the cognitive aging effect (e.g. decline in memory function and/or increasingly acting according to rules of thumb) documented in (Korniotis and Kumar, 2011). Literacy leads to increased wealth since literate households save more, as documented in Lusardi and Mitchell (2007a) and Hilgert *et al.* (2003). Moreover, the share of AMPs, especially interest-only mortgages, is higher among older and wealthier households as a result of down payment requirements.

Table 3.4 reports regression results when financial literacy and risk aversion are added to the model, controlling for the variables of specification 6 in Table 3.2, Panel A. Unfortunately, the dataset has many missing observations on literacy and risk aversion measures, thereby reducing the sample. Since financial literacy and risk aversion might be interrelated, we examine their impact simultaneously. It also checks whether the inclusion of household wealth in Panel B alters the results, since households might privately save in order to pay down their mortgage.

[23] The increase in average household income is taken into account. Average income amounted to €32,500 in 2009, compared to only €21,780 in 1994. Low income is defined as households with an annual reported income below national average. Medium incomes are defined as households with an average up to twice the average income, and high-income are those households whose income exceeds twice the average income.

Panel A shows that households that are *more* risk-averse are 97 percent less likely to choose interest-only mortgages. This result is intuitive, as interest-only mortgages are more sensitive to equity-driven default risk, making them unattractive for risk-averse households. Coulibaly and Li (2009) mention the importance of risk attitude in contract choice, and we do find support for this statement. Specifications 2 and 3 include financial literacy and activity; those households that consider themselves more knowledgeable on financial matters and those that hold financial assets were found to be respectively 55 percent and 68 percent *more* likely to choose for interest-only mortgages. No effects were found for contract-types that defer amortization and the results do not change in sign or magnitude when household wealth is added to the model.

The inclusion of risk aversion and financial literacy simultaneously in specifications 4 and 5 does not significantly alter the results, except that risk aversion has now a marginal negative impact on the choice of a deferred amortization contract. Examination of the correlation between risk aversion and financial literacy (*rho* = 0.001) and financial activity (*rho* = -0.033) confirms that collinearity in these measures is not an issue. Moreover, the low correlation between the measures shows that they measure quite different constructs. A moderate correlation was found between literacy and activity (*rho* = 0.212), probably that the asset holdings of the household are more related to 'awareness' than to 'literacy' given the low correlation.

The results so far indicate the importance of risk attitudes and literacy in household financial decision making. However, in contrast with the concerns expressed by financial regulators (AFM, 2008), this study found that AMPs are generally chosen by households with *higher* levels of literacy. Although deferral of amortization increases riskiness of mortgages, people who are *potentially* more aware of these risks generally tend to choose deferred amortization and interest-only mortgages.

Table 3.4 ■ Analysis of risk aversion and financial literacy on mortgage choice

This table shows weighted multinomial logit results for mortgage choice of households when measures for risk aversion and financial literacy are introduced (see for the included demographic and mortgage variables Table 3.2). The exact wording and response categories of the questions are reported in Appendix II. Included are all mortgages originated between 1994 and 2009 with amortizing mortgages being the reference category (see Table I.1). Robust t-statistics are reported in brackets. ***,**,* denotes significant at 1, 5 and 10 percent level respectively. Data is from the DNB Household Survey.

Panel A Mortgage choice without controlling for household wealth

	(1)		(2)		(3)		(4)		(5)	
Independent Variables	Deferred amor	Interest-only	Deferred amor	Interest-only	Deferred amor	Interest-only	Deferred amor	Interest-only	Deferred amor	Interest-only
Risk Aversion	-0.020	-0.030**					-0.020	-0.036**	-0.026*	-0.033**
	[-1.52]	[-2.33]					[-1.37]	[-2.67]	[-1.90]	[-2.47]
Financial Literacy			-0.001	0.440**			0.028	0.523**		
			[-0.00]	[2.11]			[0.11]	[2.31]		
Financial Active					0.124	0.519***			0.0661	0.644***
					[0.51]	[2.69]			[0.22]	[2.77]
Demographics/ Mortgage terms	Yes		Yes		Yes		Yes		Yes	
Year fixed effects	Yes		Yes		Yes		Yes		Yes	
No of Observations	439		463		513		409		405	
Pseudo R-squared	0.259		0.270		0.252		0.285		0.288	
Log-Likelihood	-337.3		-346.7		-393.8		-300.1		-279.9	

Panel B Mortgage choice controlling for household wealth

	(1)		(2)		(3)		(4)		(5)	
Independent Variables	Deferred amor	Interest-only	Deferred amor	Interest-only	Deferred amor	Interest-only	Deferred amor	Interest-only	Deferred amor	Interest-only
Risk Aversion	-0.018	-0.032**					-0.019	-0.038***	-0.023*	-0.034**
	[-1.36]	[-2.45]					[-1.31]	[-2.80]	[-1.68]	[-2.50]
Financial Literacy			0.002	0.426**			0.0451	0.522**		
			[0.01]	[1.99]			[0.18]	[2.24]		
Financial Active					0.173	0.561***			0.145	0.653***
					[0.68]	[2.70]			[0.47]	[2.62]
Demographics/ Mortgage terms	Yes		Yes		Yes		Yes		Yes	
Year fixed effects	Yes		Yes		Yes		Yes		Yes	
No of Observations	439		463		513		409		405	
Pseudo R-squared	0.267		0.276		0.258		0.295		0.293	
Log-Likelihood	-333.6		-343.5		-391.0		-296.0		-295.8	

3.7 Robustness checks

This section assesses the robustness of our results considering a variety of alternative explanations. One such explanation could be that households that are more literate have received more education in economics. Van Rooij *et al.* (2011) controlled for the level and use of economics but found insignificant results on stock market participation. Unfortunately, this data is unavailable for most years, which prevents us from exploiting this explanation further. However, Mandell and Klein (2009) showed that the level of economics education received is of limited influence on later levels of financial literacy.

Moreover, literacy might be correlated to some unobserved 'ability', making causal inferences problematic. Although we acknowledge the potential severity of this problem, it is not possible to append the dataset with potential exogenous instruments (such as information on siblings), for the reasons mentioned in Section 3.3. Since Van Rooij *et al.* (2011) relied on the same dataset, the potential severity of this bias is likely to be similar. Through an extensive set of robustness checks, that study showed that their main results are robust to 'ability' endogeneity.

Other explanations for our results could include the impact of financial advice, peers, and prior experiences with home-ownership. As the dataset contains information on these topics, the robustness of the results is checked against these explanations.

3.7.1 Mortgage choice: the impact of advice

Households that face complex financial decisions affecting their wealth portfolio might rely on sources of advice to receive information and increase their understanding of financial products. For example, Elmerick *et al.* (2002) showed that older, larger households and those with more financial assets are significantly more likely to receive credit and borrowing advice. Several papers show that receiving professional advice indeed alters and improves investment decisions of households (Hackethal *et al.,* 2012), as well as borrower credit profiles (Elliehausen *et al.*, 2007). If difference in information or seeking advice are correlated with literacy and risk aversion, than our results so far would suffer from omitted variable bias.

Table 3.5 ■ Literacy, risk aversion, mortgage types and demographics by source of advice

This table shows weighted mean values and percentages for literacy and risk aversion (Panel A), mortgage types (Panel B) and demographics (Panel C) by source of advice. The exact measurement of literacy and risk aversion can be found in Appendix II. The definition of mortgage categories can be found in Table I.1. Data is from the DNB Household Survey and cover mortgages originated between 1994-2009.

Panel A Source of advice and literacy and risk aversion			
	Risk Aversion	Financial Literacy	Financial Active
Parents, family and acquaintances	26.40	2.06	0.33
Newspapers	30.16	2.31	0.78
Financial literature (magazines, guides and books)	27.19	2.75	0.71
Brochures from bank or mortgage adviors	29.67	2.12	0.39
Advertisements in the media (TV, newspapers etc.)	26.71	1.78	0.10
Professional financial advisors	28.77	2.32	0.44
Financial computer programs	25.89	2.34	0.56
Financial information on the internet	28.33	2.50	0.45
Number of observations	423	423	423

Panel B Source of advice across mortgage types			
	Amortizing	Deferred amortization	Interest-only
Parents, family and acquaintances	22.26%	23.85%	13.92%
Newspapers	6.64%	1.53%	11.95%
Financial literature (magazines, guides and books)	8.02%	2.10%	9.31%
Brochures from bank or mortgage adviors	9.49%	5.28%	9.07%
Advertisements in the media (TV, newspapers etc.)	2.42%	2.40%	1.51%
Professional financial advisors	30.71%	40.23%	28.23%
Financial computer programs	1.30%	2.33%	0.93%
Financial information on the internet	4.61%	4.79%	8.39%
Number of observations	152	72	199

Panel C Source of advice across demographics					
	Age classes				
	20-30 years	31-40 years	41-50 years	51-60 years	61+ years
Parents, family and acquaintances	31.77%	26.09%	14.63%	10.25%	10.38%
Newspapers	2.22%	3.08%	5.66%	14.37%	21.29%
Financial literature (magazines, guides and books)	3.76%	3.39%	10.12%	13.45%	8.52%
Brochures from bank or mortgage adviors	5.57%	5.97%	10.09%	12.93%	7.27%
Advertisements in the media (TV, newspapers etc.)	6.46%	0.00%	1.94%	1.52%	3.76%
Professional financial advisors	17.86%	32.94%	34.46%	33.05%	27.48%
Financial computer programs	0.00%	2.06%	0.97%	0.00%	1.09%
Financial information on the internet	6.92%	5.53%	5.08%	8.70%	8.03%
Number of observations	58	127	95	86	65

	Education level		
	Primary or secondary	Higher vocational	University
Parents, family and acquaintances	18.29%	22.43%	13.56%
Newspapers	6.38%	9.14%	13.07%
Financial literature (magazines, guides and books)	7.38%	7.83%	7.79%
Brochures from bank or mortgage adviors	8.35%	8.44%	9.27%
Advertisements in the media (TV, newspapers etc.)	2.89%	1.32%	0.00%
Professional financial advisors	30.21%	31.57%	34.21%
Financial computer programs	1.97%	0.73%	0.00%
Financial information on the internet	6.07%	6.29%	7.91%
Number of observations	239	119	65

Table 3.5 Panel C continued

	Income classes		
	Low	Medium	High
Parents, family and acquaintances	24.12%	20.43%	9.65%
Newspapers	5.99%	8.29%	9.98%
Financial literature (magazines, guides and books)	1.43%	5.79%	16.82%
Brochures from bank or mortgage adviors	10.22%	6.70%	11.52%
Advertisements in the media (TV, newspapers etc.)	7.21%	0.61%	0.99%
Professional financial advisors	21.10%	34.10%	32.69%
Financial computer programs	0.00%	1.30%	2.41%
Financial information on the internet	7.46%	6.54%	5.38%
Number of observations	96	236	91

	Wealth quartiles			
	First QRT	Second QRT	Third QRT	Fourth QRT
Parents, family and acquaintances	19.41%	23.61%	19.30%	14.95%
Newspapers	5.83%	2.68%	8.15%	13.11%
Financial literature (magazines, guides and books)	6.57%	4.55%	4.63%	12.51%
Brochures from bank or mortgage adviors	6.84%	9.09%	9.34%	9.22%
Advertisements in the media (TV, newspapers etc.)	2.47%	4.76%	1.80%	0.47%
Professional financial advisors	26.55%	30.21%	35.00%	32.92%
Financial computer programs	1.31%	0.00%	2.67%	0.64%
Financial information on the internet	3.78%	8.60%	6.75%	7.86%
Number of observations	160	55	126	127

Our dataset contains information on several alternative sources of advice and information acquisition (see Table 3.5), ranging from passive forms like newspapers to active involvement of family and acquaintances and professional financial advisors.[24] Consistent with prior work (e.g., Van Rooij *et al.,* 2011; Bluetghen *et al.,* 2008), Table 3.5, Panel A shows that more risk-averse and high-literate households tend to rely on professional financial advice, while low-literate households rely on public advertisements (TV, newspapers, etc.). Usage of financial literature such as books is also more widespread among more literate households and those that are more active in financial markets.

Breaking up the sample according to mortgage types reveals that households with interest-only mortgages rely in 14 percent of the cases on parents and family and in only 28 percent on professional advisors. These numbers are considerably lower compared to households with amortizing and deferred amortization mortgages. Consultation of newspapers is popular among households with interest-only mortgages and those with more financial assets in their portfolio. Demographically, it appears that older, higher-educated, and wealthier households tend to seek professional advice, which was also found in Elmerick *et al.* (2002) and Hackethal *et al.* (2012). Conversely, lower-educated households and those with

[24] Financial advisors are often paid on commission base and might impact the decision process according to the incentives provided to them (Inderst and Ottaviani, 2009) rather than truthful and honest information disclosure. In additional analysis, we find no bivariate dependence between advisor involvement and contract choice.

lower income tend to rely more on advice by parents and acquaintances or public media. Internet and financial program usage is not widespread, with less than 8 percent of households relying on these channels.

The multivariate model examines the impact of the most prevalent forms of advice: parents, family and acquaintances (18 percent of the respondents), and professional financial advisors (30.1 percent of the respondents). The theoretical reason for doing this is that face-to-face consultation tends to have a larger impact on decision making than passive forms of advice (Quercia and Spader, 2008). From a practical point of view, the inclusion of all forms of advice leads to collinearity as some forms of advice have only a very limited number of observations available.

Table 3.6 presents the results after controlling for financial advice. At first glance, our results remain virtually unchanged compared to those without inclusion of advisors. Risk-averse (literate) households are still significantly less (more) likely to choose interest-only mortgages, while no significant impact was observed regarding the probability of deferred-amortization contracts.

Both models show that the role of advice is a significant determinant of contract choice as distinct from literacy and risk aversion. Professional advisors increase the probability that households have deferred-amortization contracts. Probably, advisors make households aware of the affordability and interest deduction benefits of these products, thereby increasing the probability that these are chosen.

Advice by relatives, on the other hand, decreases the likelihood of AMPs being chosen. Although we do not know to what extent parents are questioned, a generational difference between the advisor and the household can explain why this negative coefficient was observed. When the households' parents chose their first mortgage, the popularity of AMPs – especially interest-only mortgages – was substantially lower. If the advice by parents is based on their own experience, then they might be more inclined to recommend a product similar to their first mortgage, thereby reducing the probability that they recommend their children an interest-only product.

Table 3.6 ■ Analysis of advice on mortgage choice

This table shows weighted multinomial logit results for mortgage choice of households when measures for risk aversion and financial literacy and financial advice are introduced. The exact wording and response categories of the questions are reported in Appendix II. "Professional advisor" is a dummy equaling 1 if the household relies on a professional financial advisor for decision making. "Advice from family" equals 1 when the household reports to rely on advice of family or acquaintances for their decision making. The included demographic and mortgage terms are the same as those in Table 3.2. Included are all mortgages originated between 1994 and 2009 with amortizing mortgages being the reference category (see Table I.1). Robust t-statistics are reported in brackets. ***,**,* denotes significant at 1, 5 and 10 percent level respectively. Data is from the DNB Household Survey.

Panel A Mortgage choice and advice from professional financial advisor										
	(1)		(2)		(3)		(4)		(5)	
Independent Variables	Deferred amor	Interest-only	Deferred amor	Interest-only	Deferred amor	Interest-only	Deferred amor	Interest-only	Deferred amor	Interest-only
Professional advisor	1.175***	0.016	1.021***	0.059	1.159***	0.041	1.187***	0.016	1.220***	0.055
	[2.67]	[0.05]	[2.66]	[0.19]	[2.83]	[0.12]	[2.70]	[0.05]	[2.67]	[0.15]
Risk Aversion	-0.027*	-0.033**					-0.028*	-0.036**	-0.026	-0.031**
	[-1.67]	[-2.27]					[-1.69]	[-2.49]	[-1.60]	[-2.11]
Financial Literacy			0.027	0.489**			0.065	0.584**		
			[0.11]	[2.27]			[0.24]	[2.41]		
Financial Active					0.203	0.532**			0.162	0.565**
Demographics/ Mortgage terms	Yes		Yes		Yes		Yes		Yes	
Year fixed effects	Yes		Yes		Yes		Yes		Yes	
No of Observations	399		450		416		399		378	
Pseudo R-squared	0.299		0.291		0.302		0.309		0.318	
Log-Likelihood	-286.7		-326.5		-296.8		-282.6		-263.7	

Panel B Mortgage choice and advice from family

	(1)		(2)		(3)		(4)		(5)	
Independent Variables	Deferred amor	Interest-only	Deferred amor	Interest-only	Deferred amor	Interest-only	Deferred amor	Interest-only	Deferred amor	Interest-only
Advice from family	-0.761	-0.725*	-0.415	-0.646*	-0.832*	-0.863**	-0.754	-0.586	-0.926*	-0.837*
	[-1.53]	[-1.71]	[-1.01]	[-1.78]	[-1.77]	[-2.15]	[-1.48]	[-1.40]	[-1.73]	[-1.89]
Risk Aversion	-0.011	-0.030**					-0.011	-0.034**	-0.009	-0.027*
	[-0.71]	[-2.13]					[-0.73]	[-2.36]	[-0.59]	[-1.87]
Financial Literacy			0.047	0.442**			0.030	0.542**		
			[0.21]	[2.02]			[0.11]	[2.23]		
Financial Active					0.135	0.527**			0.142	0.583**
					[0.43]	[2.19]			[0.43]	[2.28]
Demographics/ Mortgage terms	Yes		Yes		Yes		Yes		Yes	
Year fixed effects	Yes		Yes		Yes		Yes		Yes	
No of Observations	399		450		416		399		378	
Pseudo R-squared	0.289		0.283		0.294		0.297		0.309	
Log-Likelihood	-290.9		-330.3		-300.1		-287.3		-267.2	

3.7.2 Mortgage choice: the impact of peer effects

In order to shed more light on the impact of advice and the robustness of risk aversion and literacy as determinants of mortgage choice, the impact of peer effects on mortgage choice was considered. Peers are defined as those individuals with which households socially interact (friends and relatives). As argued in several studies (Hong *et al.,* 2004; Brown *et al.*, 2008), the impact of peer effects is not negligible in portfolio choice, as households might learn from the experiences of others. In this study, we used the level of education and income of the households' peers to assess this hypothesis, since these are related to financial sophistication in general. Table 3.7A examines the impact for literacy and risk aversion and Panel 3.7B does the same for financial advice.

Including the education level of peers (Panel A) decreases the explanatory power of risk aversion and literacy substantially. Peers of the household that attained higher education increase the probability that the household chooses an interest-only mortgage. There appears to be a learning effect present, but the risk-aversion and literacy measures remain significant overall.

Moreover, Panel B suggests that the education of peers is a closer substitute for literacy and risk aversion than the level of income. Peer income does increase the probability that interest-only products are chosen, but the main effects for the household are less affected compared to the inclusion of peer education levels.

The previous section found that advice by relatives decreases the probability of interest-only products being chosen. We argued that this might be due to a generation gap, which is driven by the 'mortgage career' of parents, for example. However, if households know this, they might rely mainly on peers who are supposedly from the same generation, instead of on parents or family, since they are more aware of the current market standard. If this is the case, then controlling for peer effects would potentially render insignificant effects for advice by family. Table 3.7B shows that even after controlling for peer effects, the sign and significance of advice by professionals and relatives remain unaffected. Households rely on various sources of advice when choosing a mortgage product and apparently these sources are compliments rather than substitutes.

Table 3.7A ■ Analysis of peer effects on mortgage choice

This table shows weighted multinomial logit results for mortgage choice of households controlling for peer effects. Panel A includes the level of education of peers, with elementary school education being the reference group. In Panel B the income of peers is included with income below €16.000 being the reference group. The exact wording and response categories of the questions are reported in Appendix II. The included demographic and mortgage terms are the same as those in Table 3.2. Included are all mortgages originated between 1994 and 2009 with amortizing mortgages being the reference category (see Table I.1). Robust t-statistics are reported in brackets. ***,**,* denotes significant at 1, 5 and 10 percent level respectively. Data is from the DNB Household Survey.

Panel A Level of education of peers

	(1)		(2)		(3)		(4)		(5)	
Independent variables	Deferred amor	Interest-only	Deferred amor	Interest-only	Deferred amor	Interest-only	Deferred amor	Interest-only	Deferred amor	Interest-only
Risk Aversion	-0.018	-0.027*					-0.017	-0.028*	-0.014	-0.022
	[-1.21]	[-1.82]					[-1.14]	[-1.94]	[-0.96]	[-1.47]
Financial Literacy			-0.235	0.358			-0.172	0.402*		
			[-0.94]	[1.63]			[-0.64]	[1.73]		
Financial Active					0.232	0.621**			0.242	0.661**
					[0.71]	[2.53]			[0.69]	[2.53]
Education peers: intermediate vocational	0.411	0.726*	0.635	0.773*	0.541	0.729*	0.461	0.639	0.539	0.782*
	[0.82]	[1.68]	[1.30]	[1.96]	[1.08]	[1.73]	[0.90]	[1.50]	[1.02]	[1.73]
Education peers: higer vocational/university	0.503	0.737	0.787	0.742	0.857	1.080**	0.615	0.555	0.824	1.170**
	[0.87]	[1.45]	[1.37]	[1.53]	[1.49]	[2.09]	[1.01]	[1.10]	[1.35]	[2.16]
Demographics/Mortgage terms	Yes		Yes		Yes		Yes		Yes	
No of Observations	375		419		390		375		357	
Pseudo R-squared	0.258		0.265		0.263		0.266		0.270	
Log-Likelihood	-283.8		-314.4		-294.1		-280.7		-266.5	

Panel B Income of peers

	(1)		(2)		(3)		(4)		(5)	
Independent variables	Deferred amor	Interest-only	Deferred amor	Interest-only	Deferred amor	Interest-only	Deferred amor	Interest-only	Deferred amor	Interest-only
Risk Aversion	-0.033	-0.047**					-0.033	-0.048**	-0.0307	-0.047**
	[-1.64]	[-2.42]					[-1.64]	[-2.50]	[-1.54]	[-2.38]
Financial Literacy			-0.058	0.498*			0.0185	0.485*		
			[-0.19]	[1.94]			[0.06]	[1.82]		
Financial Active					0.424	0.861***			0.375	0.839**
					[1.05]	[2.59]			[0.82]	[2.41]
Income peers (€16.000 < €38.000)	0.312	1.159*	0.139	1.539**	-0.292	1.243	0.331	1.219*	0.322	1.259
	[0.31]	[1.74]	[0.16]	[2.14]	[-0.36]	[1.43]	[0.32]	[1.65]	[0.34]	[1.54]
Income peers (>= €38.000)	0.805	1.093	0.588	1.388*	0.035	0.658	0.766	1.162	0.678	0.828
	[0.69]	[1.38]	[0.58]	[1.72]	[0.04]	[0.68]	[0.65]	[1.37]	[0.60]	[0.90]
Demographics/Mortgage terms	Yes		Yes		Yes		Yes		Yes	
No of Observations	262		291		270		262		250	
Pseudo R-squared	0.257		0.261		0.271		0.266		0.281	
Log-Likelihood	-197.7		-218.6		-201.0		-195.5		-182.8	

Table 3.7B ■ Analysis of peer effects and advice on mortgage choice

This table shows weighted multinomial logit results for mortgage choice of households controlling for peer effects. Model 1 and 2 include the level of education of peers, with elementary school -education being the reference group. Model 3 and 4 include the income of peers, with income below €16.000 being the reference group. "Professional advisor" is a dummy equaling 1 if the household relies on a professional financial advisor for decision making. "Advice from family" equals 1 when the household reports to rely on advice of family or acquaintances for their decision making. The included demographic and mortgage terms are the same as those in Table 3.2. Included are all mortgages originated between 1994 and 2009 with amortizing mortgages being the reference category (see Table I.1). Robust t-statistics are reported in brackets. ***,**,* denotes significant at 1, 5 and 10 percent level respectively. Data is from the DNB Household Survey.

	(1)		(2)		(3)		(4)	
Independent variables	Deferred amor	Interest-only	Deferred amor	Interest-only	Deferred amor	Interest-only	Deferred amor	Interest-only
Professional advisor	0.989***	0.166			0.832*	0.198		
	[2.60]	[0.51]			[1.86]	[0.55]		
Advice from family			-0.504	-0.955**			-0.708	-1.492***
			[-1.18]	[-2.53]			[-1.25]	[-2.81]
Education peers: intermediate	0.618	0.871**	0.632	0.931**				
vocational	[1.25]	[2.07]	[1.28]	[2.21]				
Education peers: higer	0.613	0.864*	0.766	0.970*				
vocational/university	[1.09]	[1.72]	[1.34]	[1.92]				
Income peers (€16.000 < €38.000)					-0.154	1.282*	-0.152	1.533**
					[-0.19]	[1.90]	[-0.19]	[2.20]
Income peers (>= €38.000)					0.343	0.991	0.392	1.405*
					[0.35]	[1.25]	[0.41]	[1.70]
Demographics/Mortgage terms	Yes		Yes		Yes		Yes	
No of Observations	410		410		283		283	
Pseudo R-squared	0.286		0.283		0.281		0.291	
Log-Likelihood	-298.7		-299.9		-207.4		-204.6	

3.7.3 Mortgage choice: the impact of prior homeownership

So far, we have examined learning and information effects due to interaction with peers and advice. However, learning-by-doing might be very effective. This section examines whether experience with prior home-ownership is driving mortgage choice rather than literacy or risk aversion. Experienced homeowners might be more aware of the mortgage market as well as the risks and features of certain mortgage products, subsequently altering their literacy and risk aversion levels.

Table 3.8 includes a dummy (*prior home-ownership*) measuring whether the household *owned* his previous house. It is implicitly assumed here that home-ownership is equivalent to having a mortgage, which is not necessarily true. Our dataset does not permit us to distinguish whether households had a mortgage and which type; however, over 85 percent of Dutch households take out a mortgage when purchasing a home so the majority of them have prior experience with the mortgage market. Our main results are not quantitatively and qualitatively affected: risk aversion and literacy remain significant in explaining mortgage choice. The magnitude of the effects is virtually equal to that found in Table 3.4.

3.7.4 Additional checks

Since Dutch mortgage debt is recourse, households remain liable for any outstanding balance in case of foreclosure. As mentioned, AMPs have a higher repayment risk than conventional contracts. However, the availability of mortgage insurance enables households to hedge the repayment risk away. As such, the availability of mortgage insurance might alter the choice of mortgage type at the expense of risk aversion. This potential explanation was examined, but the results on risk aversion measures were not altered. The insurance dummy shows a strong negative effect for interest-only mortgages, but this reflects the insurance terms as the insurance terms do not permit households to insure a 100 percent interest-only mortgage.

Finally, the impact of house price expectations and the financial situation of the household were examined, as these could be the main reasons for choosing AMPs (see Cocco, 2011).

Table 3.8 ■ Analysis of homeownership-experience on mortgage choice

This table shows weighted multinomial logit results for mortgage choice of households when controlled for previous home-ownership. "Prior home-ownership" is a dummy equaling 1 when the respective household has owned their previous house. The exact wording of the literacy and risk aversion questions can be found in Appendix II. The included demographic and mortgage terms are the same as those in Table 3.2. Included are all mortgages originated between 1994 and 2009 with amortizing mortgages being the reference category (see Table I.1). Robust t-statistics are reported in brackets. ***,**,* denotes significant at 1, 5 and 10 percent level respectively. Data is from the DNB Household Survey.

	(1)		(2)		(3)		(4)		(5)	
	Deferred	Interest-	Deferred	Interest-	Deferred	Interest-	Deferred	Interest-	Deferred	Interest-
Independent variables	amor	only	amor	only	amor	only	amor	only	amor	only
Prior home-ownership	-0.278	-0.038	-0.338	-0.047	-0.323	-0.362	-0.594	-0.092	-0.405	-0.087
	[-0.66]	[-0.10]	[-0.77]	[-0.13]	[-0.79]	[-1.05]	[-1.31]	[-0.24]	[-0.88]	[-0.23]
Risk Aversion	-0.017	-0.032**					-0.018	-0.038***	-0.022	-0.033**
	[-1.31]	[-2.44]					[-1.25]	[-2.76]	[-1.64]	[-2.47]
Financial Literacy			-0.003	0.427**			0.0256	0.530**		
			[-0.02]	[1.97]			[0.10]	[2.22]		
Financial Active					0.167	0.553***			0.138	0.660***
					[0.66]	[2.66]			[0.44]	[2.62]
Demographics/ Mortgage terms	Yes		Yes		Yes		Yes		Yes	
Year fixed effects	Yes		Yes		Yes		Yes		Yes	
No of Observations	439		463		513		409		405	
Pseudo R-squared	0.263		0.274		0.259		0.293		0.29	
Log-Likelihood	-335.2		-334.9		-390.4		-296.5		-297.1	

The choice for AMPs, especially interest-only mortgages, might be explained by optimistic expectations about house price appreciation rather than literacy or risk aversion. Our model was appended with a measure for house price expectations, but the results remain unaffected.

A household's level of risk aversion might be influenced to the extent that they are financially constrained. For example, households might want to take more risks to improve their current situation or less risk to avoid problems from emerging. In terms of mortgages, households with a budget deficit might opt for AMPs, despite their level of risk aversion, as they are *ceteris paribus* cheaper than traditional contracts. Although income is a proxy for the financially constrained, our dataset also includes a question asking whether the household's budget shows a monthly deficit or surplus. No support was found for this alternative explanation, as the results remain similar.

3.8 Conclusions

This paper has demonstrated that financial literacy and risk aversion have a significant impact on the choice for alternative mortgage products. Households that are more risk averse and less literate are significantly less likely to choose interest-only mortgages; our results, however, are insignificant for deferred amortization contracts.

Although psychometric measurement of literacy is neither the focus of this paper nor as refined as measures used in other work (e.g., Van Rooij *et al.,* 2011), we do find that both direct and indirect measures of financial literacy and awareness help in explaining the mortgage-type choice by households. Furthermore, the results are robust against alternative explanations, such as financial advice, the effects of peers, prior home-ownership, and price expectations.

Policy-wise, our results are not supportive of the concerns expressed by financial authorities, for at least the Netherlands, as we document that in general *more* sophisticated households choose AMP contracts. As such, it is *more* likely that these households have at least basic understanding of the product characteristics, although support for this claim is limited by the data available to us. Households with limited literacy levels and lower education tend to rely more on public media when choosing their mortgage. A clear exposition of the contract-features and inherent risks in these media is warranted as it can prevent households from choosing mortgage-types that are unsuitable for them. Although the rapid

growth in popularity of AMP's might be of concern, the benefits associated with them can be substantial in terms of income smoothing and portfolio diversification (Cocco, 2011), provided that households purchase these products with this intention. Future research could shed more light on this issue.

3.9 Appendix I Mortgage products in the Netherlands

This appendix examines the differences between available mortgage types in the Netherlands in detail. First of all it is important to note that repayments on mortgages are not tax-deductible. Maximizing benefits of tax-deduction therefore entails that any amortization charges are not directly deducted from the outstanding principal. The two categories that provide this feature are deferred amortization mortgages – where a household saves for a balloon payment at the term of the mortgage – and interest-only mortgages.[25]

No typical ARM-FRM distinction is present in the Netherlands, and mortgages normally have a 5 or 10 year fixed rate period irrespective of the type of contract. Secondly, Dutch mortgage debt is recourse, leaving the responsibility of repayment of the mortgage to the household. Although hybrid mortgages are available in the Netherlands (e.g., a combination of an annuity and endowment mortgage), they constituted only a minor part of the sample (less than 5 percent) so they are classified here as one type based on the size of the principal of the individual mortgage relative to total outstanding mortgage debt. The classification of the different contracts is reported below Table I.1.

We quantitatively compare the yearly payments on three different mortgage types in Table I.2[26] A traditional amortizing contract immediately starts repaying, and this repayment constitutes an increasing proportion of the total expenses as can be seen in the bottom half of the table. The outstanding balance decreases steadily until the mortgage is completely paid off at maturity. Consequently, the tax-benefit of interest payments decreases as they fall in tandem with the repayment of the principal.

[25] Negative amortization contracts and typical 'subprime' mortgages (e.g. 2/28 ARM's) are unavailable in the Netherlands.

[26] We have chosen an endowment mortgage as an example of a deferred amortization-type. Life-annuity and investment mortgages work in a similar way.

Table I.1 ■ Mortgage-types in the Netherlands based on DNB Household Survey

Mortgage product	Tax benefits of interest payments	Repayment charges prior to maturity
Amortizing mortgages		
Annuity mortgage	Yes, tax benefits decrease over time	Yes, increasing principal repayments over time
Linear mortgage	Yes, tax benefits decrease over time	Yes, principal repayment in equal installments over maturity of the mortgage
Savings mortgage	Yes, tax benefits do not decrease over time	Yes, through life-insurance contract which equals mortgage balance at maturity
Deferred amortization mortgages		
Endowment mortgage	Yes, tax benefits do not decrease over time	Yes, at maturity through life insurance contract. Contract value depending on investment results
Traditional life mortgage	Yes, tax benefits do not decrease over time	Yes, at maturity through life-insurance contract. Contract value depending on investment results but a minimum is guaranteed
Mortgage with life-annuity	Yes, tax benefits for both interest payments and annuity premiums	Yes, at maturity through the life annuity. However the payments of the life annuity are taxed
Life mortgage with life cover	Yes, tax benefits do not decrease over time	Yes, at maturity through life insurance contract. Contract value depending on investment results
Interest-only mortgages		
Interest-only mortgage	Yes, tax benefits do not decrease over time, low payments because no provisions for principal repayment are included	No repayment facility
Credit mortgage	Yes, tax benefits do not decrease over time	No repayment facility, optional repayments can be made prior to maturity

In the case of an AMP the repayment of the principal is deferred towards the future. The example in the table assumes an endowment mortgage. Instead of directly subtracting the amortization-payments from the principal, the repayment of the principal is converted to an annuity and the payments go to an endowment fund. In this case the 200,000 euro liability due after 30 years is annuitized, assuming that the endowment-fund will yield an average return of 6 percent over the term, with the yearly endowment in this case amounting to 2,530 euro. As the outstanding balance is not repaid, the benefits of tax-deduction are not decreasing, but instead the mortgage is paid off at maturity with the proceeds of the endowment fund.

Table I.2 ■ Payment schedule for different mortgage types

This table compared the yearly charges for three different types of mortgages: a traditional amortizing mortgage, an endowment mortgage and an interest-only mortgage. Assumed are a 200,000 euro intitial principal, a 4.5 percent interest rate, a 6 percent return on investments in the endowment fund and a tax-rate of 42 percent.

	Amortizing	Endowment	Interest-only
After year 1			
Net interest payment	€ 5,220	€ 5,220	€ 5,220
Amortization payment	€ 3,278	€ -	€ -
Endowment payment	€ -	€ 2,530	€ -
Outstanding balance	€ 196,772	€ 200,000	€ 200,000
Value endownment fund	€ -	€ 2,530	€ -
After year 15			
Net interest payment	€ 3,442	€ 5,220	€ 5,220
Amortization payment	€ 6,344	€ -	€ -
Endowment payment	€ -	€ 2,530	€ -
Outstanding balance	€ 125,519	€ 200,000	€ 200,000
Value endownment fund	€ -	€ 58,883	€ -

Finally, the interest-only mortgage – as implied by its name – only features interest-expenses until maturity. At maturity the proceeds of a sale of the collateral, private savings, or a refinancing of the mortgage, should suffice to pay off the principal. Again, this construction maximizes the benefits of tax-deductibility. It can also be seen that the net-yearly charges are highest for traditional amortizing contracts (8.498 euros), followed by endowment (7.750 euros) and interest-only mortgages (5.220 euros), hence the name 'affordability' mortgages.

The downside of the affordability argument is the increased repayment risk of AMP's, assuming that households make their payments till maturity. If the return on the endowment fund is lower than the anticipated 6 percent, the terminal value of the fund will be insufficient to repay the mortgage at maturity (i.e. a 5.5 percent return will lead to a shortfall of more than 16,000 euro at maturity). However, the mortgagor has relatively limited exposure to a negative price development of the collateral. For interest-only mortgages the risk is – all else equal– even higher as the mortgagor is very dependent on the value of his collateral at maturity.

Strong housing and labor market conditions in the Netherlands contributed to the rising popularity of these products the past two decades. But with current house prices in the Netherlands on the decline this risk increased substantially as do low-returns in financial markets put pressure on the terminal value of endowment funds.

3.10 Appendix II Measurement of Risk Aversion and Financial Literacy

For the analysis of the impact of financial literacy, risk aversion, and opinions about the current and future situation on mortgage choice, several questions from the DNB Household Survey were used. The exact wording of these questions is presented here.

Risk Aversion measures
All questions could be answered on a seven-point scale ranging from 1, *totally disagree* with the statement to 7, *totally agree*.

Risk Aversion 1:
"I think it is more important to have safe investments and guaranteed returns, than to take a risk to have a chance to get the highest possible returns"

Risk Aversion 2:
"I would never consider investments in shares because I find this too risky"

Risk Aversion 3:
"If I think an investment will be profitable, I am prepared to borrow money to make this investment"

Risk Aversion 4:
"I want to be certain that my investments are safe"

Risk Aversion 5:
"I get more and more convinced that I should take greater financial risks to improve my financial position"

Risk Aversion 6:
"I am prepared to take the risk to lose money, when there is also a chance to gain money"

The resultant scale was constructed by recoding the responses on risk aversion measures 3, 5, and 6 and adding them up together, thereby creating one scale that can range from 6 (very risk tolerant) to 42 (very risk averse). Analysis of

the scale using the Cronbach Alpha measure shows that the scale could not be improved by deleting items and the coefficient of 0.927 exceeds the 0.90 level that Nunnally (1978) suggested as a threshold for scales used in decision-making processes.

Financial Literacy measures

Financial Literate:
Respondents were asked to respond to the following statement:

> *"How knowledgeable do you consider yourself with respect to financial matters?"*

With response categories:

1. 1. *Not knowledgeable*
2. 2. *More or less knowledgeable*
3. 3. *Knowledgeable*
4. 4. *Very knowledgeable*

Financial Active:
Financial activity is measured using the following seven questions:

1. *"Did you, on 31 December [year], have investments with MUTUAL FUNDS? Do not include investments in growth funds, investments (shares, bonds) in companies, or insured saving (i.e., saving through a life-insurance) here."*

2. *"Did you, on 31 December [year], have any BONDS and/or MORTGAGE BONDS? Do not include bonds through mutual funds here. These have already been reported on."*

3. *"Did you, on 31 December [year], own any SHARES? Do not include shares of your own private limited company here, nor bonds through MUTUAL FUNDS. These have already been reported."*

4. *"Did you, on 31 December [year], have one or more PUT-OPTIONS?"*

5. *"Did you have any written PUT-OPTIONS outstanding on 31 December [year]?"*

6. *"Had you, on 31 December [year], bought one or more CALL-OPTIONS, FALCONS*[27]*, or WARRANTS?"*

7. *"Did you have any written CALL-OPTIONS, FALCONS or WARRANTS outstanding on 31 December [year]?"*

Responses are recorded as a dummy variable equaling 0 (= no) if the household did *not* hold the security at 31 December and 1 (= yes) if the household did hold the security. Final scores were obtained by counting the total number of yes-responses, resulting in a scale that ranges between 0 and 7, where 0 indicates that the household does not hold financial assets at all, while 7 indicates that the household holds all mentioned securities.

[27] Fixed term agreement for long term call option on existing securities, which is an option or warrant with an extended maturity.

Chapter 4
Screening Incentives in the Presence of Mortgage Insurance[28]

4.1 Introduction

The involvement of financial intermediaries (for example, mortgage brokers)[29] in the mortgage origination process increased over the last decade (Kerste et al., 2011; LaCour-Little, 2009; Kleiner and Todd, 2007; LaCour-Little and Chun, 1999) with the growing importance of insurance companies and pension funds as originators of mortgage debt. Typically, these originators do not have an extensive branch network, which makes them reliant on intermediaries to sell mortgages to households (Hassink and Van Leuvensteijn, 2007). Although banks still rely to a large extent on direct writing, they are also increasingly using intermediaries to sell mortgages as competition in consumer credit markets puts pressure on interest rates and profitability (De Haan and Sterken, 2011; Toolsema, 2002).[30] Originators benefit from using intermediaries because sales expenses (commissions) become contingent on product sales instead of being a fixed cost (see Rose, 2012). On the other hand, borrowers benefit from the market knowledge of intermediaries, which reduces borrowers' search costs (Vissing-Jörgensen, 2003).

However, the interests between mortgage brokers and households are not necessarily aligned, which concerns regulatory agencies across the globe (Bernanke,

[28] This chapter is based on a working paper by Cox (2012, *under review*). I thank Dion Bongaerts, Dirk Brounen, Marsha Courchane, Mathijs van Dijk, Jane Dokko, Peter Neuteboom, Lars Norden, Bertrand Renaud, Albert Saiz, Peter Zorn, and seminar participants at the ERES Annual Meeting, 2012, ARES Annual Meeting 2012, AREUEA International Meeting 2011, and Rotterdam School of Management for their valuable comments. This project is financially supported by NHG. The author is grateful to the National Institute for Household Budget Education (NIBUD) for the provision of data.

[29] Throughout the paper, the terms *mortgage broker* and *intermediary* are used interchangeably.

[30] A survey conducted among executives from financial institutions shows that reducing origination and distribution costs and raising sales productivity is regarded as the most important opportunity to cope with the market challenges (*World Retail Banking Report*, 2009).

2007; Authority of Financial Markets, 2007). Hassink and Van Leuvensteijn (2007) argued that sales commissions might prevent intermediaries from providing exhaustive information and instead encourages them to recommend products that yield the highest profits. Moreover, competitive mortgage markets and sales-based compensation potentially lead to the improper sale of financial products because intermediaries seek to sell a product following the effort exerted in searching for a prospective customer irrespective of the suitability for the customer (Inderst and Ottaviani, 2009). Pressure on underwriting standards emerges if the sales commission is not contingent on subsequent performance of the mortgage, and increases when lenders hedge credit risks (Keys et al., 2010). Empirical work by Berndt et al. (2010), LaCour-Little (2009), Jiang et al. (2009), Alexander et al. (2002), and LaCour-Little and Chun (1999) showed that loans originated through intermediaries are more likely to fall into default, be prepaid, and are costlier to households. Low-entry barriers for mortgage-brokers (Barwick and Pathak, 2011) and loose or inadequate regulation (LaCour-Little, 2009; Apgar et al., 2007) allow the problem to persist. However, the effectiveness of regulation in mitigating these problems has not received unanimous empirical support (Kleiner and Todd, 2007; Kleiner, 2006).

This paper examines this misalignment of interest by analyzing whether underwriting outcomes (for example mortgage type, loan-to-value ratio and debt-service ratio) are systematically different between direct-written and brokered mortgages. In contrast to, for example, LaCour-Little (2009), the dataset herein discriminates between direct-written and brokered loans funded by the *same* lender. The expectation is that originators will align the interest of intermediaries with their own interest through the compensation structure. Why mortgages sold through brokers would be systematically riskier (Rose, 2012) when lenders have risk exposure is unclear, because retained credit risk creates incentives to screen loan applications and monitor brokers. That is; the lender could have sold a mortgage with similar risk characteristics directly to the customer without the intervention of an intermediary.

But the presence of an originate-to-distribute model in the mortgage market, changes the incentives as Keys *et al.* (2010) demonstrate. They find empirical evidence that the easiness of securitization has an adverse effect on monitoring and screening incentives for lenders, as those loans have a higher probability of defaulting. Securitization separates the loan originator from the ultimate investor who bears the credit risks. If brokered loans are systematically more often securitized than direct written loans, the (potential) interest misalignment between brokers and households is able to materialize. Mortgage insurance, in the absence

of a co-insurance arrangement, can cause a similar weakening of screening incentives. Suppose there are three different mortgage classes: insured mortgages, non-insured mortgages eligible for insurance, and non-insured mortgages not eligible for insurance. We hypothesize that originator's screening incentives are weakened for insured mortgages as this transfers credit risks to the insurer (Keys et al., 2010; Avery et al., 1996), especially in the absence of coinsurance between the lender and mortgage insurer. On the other hand, we expect screening incentives to be unaffected for the other two categories as lenders are exposed to credit risks.[31] Subsequently, one can expect that mortgage brokers have more freedom to increase their commission income for insured mortgages, for example by increasing households leverage (e.g. the loan-to-value ratio). The hedged credit risk for insured mortgages could induce the lender to be less critical in accepting the mortgage. Although lenders can act in a similar fashion, the higher reputational costs involved and the value of relationship with their customers (Puri and Rocholl, 2008) might prevent them from doing so. Conversely, no systematic effect of intermediaries for uninsured mortgages is anticipated as originators will only fund mortgages that meet (internally) set credit risk standards, regardless of whether the mortgage is sold directly by them or through a broker.

Based on our data, we define two underwriting outcomes at origination: the first one is the initial loan-to-value ratio (LTV) as a measure for the indebtedness of the household and a proxy for the loss-given-default for the originator (Qi and Yang, 2009; Avery et al., 1996; Clauretie, 1990).[32] Our second variable is the debt-service ratio (DSR) which proxies for the affordability of the mortgage. Mortgages with a lower DSR are easier to serve out of current income by the household and less sensitive to an income shock. From an originator perspective, the DSR can be viewed as the probability of default; a higher ratio implies that a default is more likely to occur following an income shock for the borrower. For the broker, both are proxies for volume-based commission incentives; higher LTV/DSR ratios at origination imply larger mortgages, keeping the value of collateral or household income constant. As such, a systematic positive impact of intermediaries on these ratios would be indicative of a conflict of interest between them and the household (for non-insured mortgages) or with the insurer (for insured mortgages).

[31] This assumes the absence of a securitization alternative. In the next section we discuss the Dutch context of our analysis at length and show that only a small fraction of the mortgages is actually securitized, and that those that are securitized are actually insured mortgages. Moreover, the mortgage insurance policy in this paper has no coinsurance/deductibility arrangement with the lender, implying that lenders are fully reimbursed for losses on insured mortgages.

[32] Data from the National Mortgage Guarantee (the mortgage insurer) show that the LTV ratio is significantly related to the probability that households become delinquent. However, differences in delinquency rates between directly written and brokered credit cannot be distinguished based on their data.

Our results do not provide evidence that either the LTV or DSR ratio of the mortgage is systematically affected, when the mortgage is originated through an intermediary compared to those directly written, after controlling for lender fixed effects.

Furthermore, we find no support for the hypothesis that lending standards vary systematically conditional on the mortgage being insured. Brokers must work within underwriting standards set by the insurer and have limited freedom to maximize their commission income. The absence of this effect is probably explained by the reputational costs that lenders face. Consequently, we also find no evidence for "unsuitable" lending (Inderst and Ottaviani, 2009). The results are robust against endogenous selection by households (Collins et al., 2010; Elliehausen et al., 2007), regional heterogeneity, and differences in risk preferences. Auxiliary results show that the involvement of brokers does not alter the pricing of mortgage credit (see LaCour-Little, 2009).

Our results indicate that intermediaries have limited room to pursue their own interest (increasing commission income) when lenders have credit risk exposure and reputational capital at stake. As such, changing the compensation structure of brokers from commission-based to for example hourly billing diminishes their volume incentive, but also has the potential to create new misalignments of interests with customers (see Robinson, 2007). Moreover, it is not clear whether this strategy is effective in eliminating a misalignment of interest with households. Furthermore, mortgage insurers, rather than households, are potentially the ultimate victims of a conflict of interest, absent co-insurance with lenders. Although insurance parties can be expected to price this risk in their premiums, prosperous housing market conditions during our analysis period might have disguised both the probability and severity of these risks (Demyanyk and Van Hemert, 2011). The insurance provider in this paper is a public company financially backed by the government (similar to the FHA, see Hendershott and Villani, 2012). Changing the insurance contract to a co-insurance format between the insurer and the lender is similar to requiring lenders to hold an equity-position in securitized mortgages. The co-insurance ensures that lenders will incur (part of) the losses on the loan-portfolio instead of them being solely borne by the insurer. Although this paper does not document evidence that lenders take advantage of the current setup, the proposed change restores screening and monitoring incentives and assists in prevent this from occuring in the future.

This paper continues with a discussion of the Dutch mortgage market which served as the laboratory for these research questions in Section 4.2. Section 4.3 discusses the dataset and presents descriptive statistics. The empirical analyses and robustness tests are reported in Section 4.4, while Section 4.5 concludes the research.

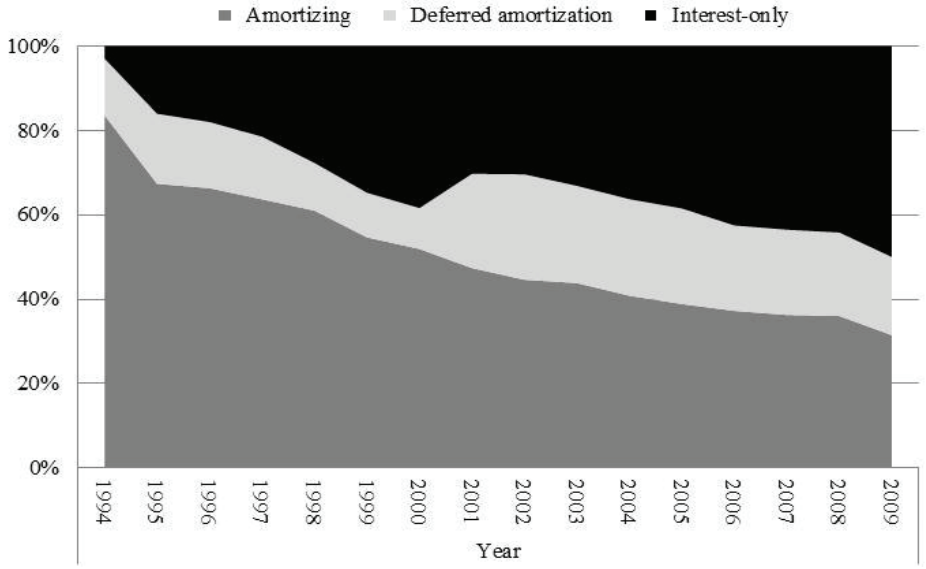
4.2 Dutch Mortgage Market

The level of competition, transparency, and market structure in Dutch mortgage and consumer credit markets has been examined by De Haan and Sterken (2011), Hassink and Van Leuvensteijn (2007), Sterken (2007), and Toolsema (2002). Ongoing consolidations in the financial sector lead to a market where 57 percent of the newly originated mortgages in 2009 were sold by the five largest banks (Kerste et al., 2011). Despite this oligopolistic characteristic of the mortgage market, recent evidence by De Haan and Sterken (2011) revealed a continuing, strong competitive pressure among originators as they are more readily adjusting mortgage rates in response to funding costs decreases than to increases.

The competitive pressure is further illustrated by declining gross interest margins on mortgages in recent years (see the World Retail Banking Report, 2009). Originators and intermediaries have limited room to extract rents from their customers through elevated interest rates. Broker or lending officer compensation in the form of overages – a form of commissions – and yield spread premiums – where interest rates are set above par – are uncommon in the Netherlands.

Figure 4.1 ■ Mortgage types and market shares in the Dutch mortgage portfolio 1994-2009

Source: DNB Household Survey.



Competitive pressure among financial institutions also fuels product innovation through the introduction of new mortgage types. Figure 4.1 depicts how the market share of traditional fully amortizing contracts, such as annuity and linear mortgages, decreased and were replaced with so-called alternative mortgage products (AMPs) or affordability mortgages.[33] While interest-only mortgages were virtually non-existent in 1994, their market share ha grown to more than 50 percent by 2009. The market share of deferred amortization mortgages – such as savings and endowment contracts – stabilized after 2001 at levels around 20 percent.

Dutch mortgage debt is recourse, implying that when the borrower defaults it is liable for the complete repayment of the mortgage. This makes strategic default unattractive for borrowers. However, households can insure the risk that foreclosure proceeds fall short of the outstanding mortgage balance through purchasing mortgage insurance with the public insurance company 'National

[33] Alternative mortgage products defer amortization charges partially or completely towards the future and were designed to profit optimally from deductibility of mortgage interest payments (see Cocco, 2011; LaCour-Little and Yang, 2010; Charlier and Bussel, 2003).

Mortgage Guarantee' (henceforth: NHG). NHG repays any shortfall fully to the lender in case of foreclosure.[34]

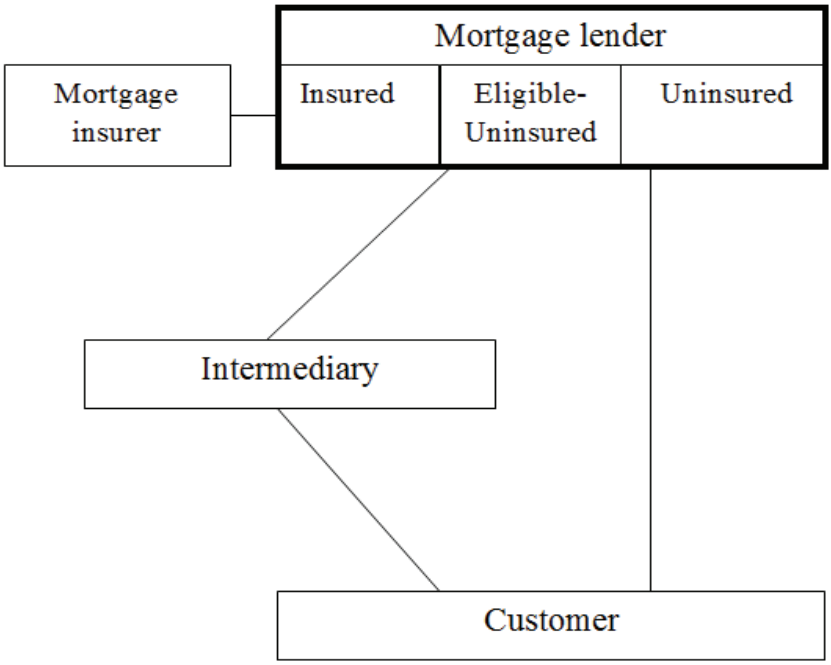
The main objective of the insurance policy is to lower the barriers to homeownership at the lower end of the housing market and NHG is financially backed by the Dutch government. Private mortgage insurers are non-existent in The Netherlands. The insurance policy of NHG is designed without risk sharing between the insurer and lender – that is, no deductibles or coinsurance applies. This implies that lenders are assured to receive the entire principal back in case of a borrower defaults. Consequently, Dutch insured mortgage debt is regarded as a high quality security in financial markets (Dirkx-Westerhof, 2009), but in contrast to the U.S., only 15 percent of the Dutch mortgage debt is securitized (Mayer et al., 2009; Aalbers, 2008). Most of the securitized Dutch mortgages are insured, implying that the uninsured debt and associated risk exposure remain with the originator.

In the Netherlands, mortgages are sold through two channels and both lenders and intermediaries can originate insured and uninsured mortgages (see Figure 4.2). A mortgage is considered directly written if the prospective borrower interacts directly with the lender. This mode of origination is mainly used by banks that employ their own loan officers who solely sell the products offered by their employer.

Brokered mortgages, on the other hand, do typically have an insurer or pension fund as the funding institution, although this channel is also becoming increasingly popular among banks as a result of debranching. The mortgage broker works independently from the lender and can recommend products from a variety of lenders. Typically, intermediaries are compensated on a volume basis – measured as yearly production – and a product-type basis, both of which are paid by the lender.

[34] Mortgages are eligible for insurance (in 2009) if the initial loan-to-value ratio does not exceed 112 percent, if the total balance is less than 265.000 euros, if the mortgage is the first lien on the primary residence and if (in case of a hybrid product) no more than 50 percent of the balance is financed with non-amortizing debt (e.g. interest-only debt).The policies covers losses that are triggered by income-shocks caused through divorces, involuntary employment, or death.

Figure 4.2 ■ Mortgage origination process in The Netherlands



Due to the scarcity of information on commission schedules, this paper relies on a report issued by Ecorys (2004) for information on the compensation structure (see Table 4.1). Although intermediaries are not obliged to sell products from one specific lender, commission incentives can induce them to do so (Inderst and Ottaviani, 2009; Hassink and Leuvensteijn, 2007). Specifically, originating a larger mortgage following the acquisition effort and selling mortgages from a limited number of originators in order to receive volume bonuses can be profitable.[35] Additionally, the product-dependent compensation favors AMPs. Despite the growing popularity of internet as a sales channel, the vast majority of mortgages are still originated through a channel where either an intermediary or a loan officer meets face-to-face with a (prospective) customer.

[35] A broker can sell 2.2 million euros worth of mortgages either by selling 11 mortgages of 200K each or 10 mortgages of 220K each. However, the latter case saves the search and screening costs of one additional borrower.

Table 4.1 ■ Commission structure financial intermediaries

This table shows a typical commission scheme for mortgage intermediaries. 'Bonus' refers to the commission that is received based on the total sales amount irrespective of type. The commission per mortgage depends on the mortgage type and the production per mortgage type. All commissions are calculated based on principal. Source: Ecorys (2004).

Mortgage production (€/year)	€ 0 - € 2.5 million	€ 2.5 - € 5 million	€ 5 - € 10 million
Bonus	0%	0.20%	0.25%
Linear mortgage	0.75%	0.95%	1.00%
Savings mortgage	2.50%	2.50%	2.50%
Endowment mortgage	2.25%	2.45%	2.50%
Life-insurance mortgage	2.25%	2.45%	2.50%

As mentioned, originators (banks, insurers, and pension funds) fund roughly three different categories of mortgages: mortgages that are insured, uninsured mortgages that are eligible for insurance (conforming mortgages), and mortgages that are not eligible for mortgage insurance by NHG. The latter two categories expose the lender to credit risk, which requires screening and broker monitoring on the lender side to determine whether the risks are acceptable. It is therefore ex-ante unclear why originators would relax screening standards for brokered loans if they could originate the exact same loan directly. However, for insured mortgages, screening incentives diminish, analogous to the securitization argument in Keys et al. (2010), because the credit risk is no longer born by the lender. Both intermediaries and originators can exploit this reallocation of risk by originating larger or riskier mortgages, thereby increasing the commission income and profitability of the product, leaving the losses with the mortgage insurer.

One could expect this behavior to be more prevalent for intermediated mortgages than direct-written ones, because brokers are more reliant on commission income (Woodward, 2008). First, the customer-originator relationship is likely to be valuable to the lender because it can generate multiple transactions (Puri and Rocholl, 2008). Second, originators can generate additional revenue through the sales of other services, such as insurance policies and credit cards, while brokers are more likely to have a single transaction relationship with their customer. Thirdly, reputational risks are likely to be higher for lenders than intermediaries.

Table 4.2 ■ Underwriting outcomes per mortgage category and channel

This table shows mean loan-to-value and debt-service ratios per origination channel for (NHG) insured mortgages, eligible mortgages that are not insured, and mortgages that are not eligible for insurance. Data is from the DNB Household Survey and cover mortgages originated between 2001 and 2009.

	Insured		Eligible/not-insured		Non-eligible	
	Mean	N	Mean	N	Mean	N
Loan-to-value ratio						
Intermediated	98.5%	131	87.4%	115	100.0%	424
Direct written	91.8%	84	87.7%	98	88.0%	318
Debt-service ratio						
Intermediated	28.0%	109	28.4%	97	22.4%	549
Direct written	23.7%	70	25.6%	83	18.4%	395

Table 4.2 shows the mean values of the two main variables of interest: the loan-to-value and debt-service ratio across mortgage types and origination channels. Consistent with prior findings, LTV and DSR ratios are higher (6.7 percent and 4.3 percent, respectively) for insured mortgages when the loan is originated through a broker compared to direct written mortgage loans.

As expected, the differences become smaller – both in absolute and economic sense – for eligible mortgages that are not insured. Surprisingly, for non-eligible mortgages (which are consequently not insured), the table shows a difference in LTV and DSR ratios of 12 percent and 4.0 percent, respectively, between origination channel, while a negligible difference is expected if originators employ homogenous underwriting criteria. Of course, other factors such as borrower characteristics and underwriting heterogeneity are likely to be at play so a multivariate analysis is conducted in section four. We continue first by discussing the dataset.

4.3 Data and Descriptive Statistics

The dataset used is constructed from the Dutch Household Survey (DHS), a panel survey yearly administered by Centerdata among a representative sample of 2,000 Dutch households, starting from 1993 onwards. The survey is administered through the internet, and respondents do not receive (financial) compensation for participation in the survey. Participants fill out the internet questionnaires at home at their own convenience. Another advantage of this survey method is that households have access to their bank statements and other financial data, thereby

reducing report errors. Chang and Kronick (2003) showed that internet surveys are less sensitive to reporting biases than those administered by telephone.

However, reporting errors are an issue in self-reported survey data, so all numeric variables are winsorized at 10 percent of their respective distribution. Obvious outliers are excluded from the analysis or corrected whenever these could be logically inferred (for example, reporting income as 25,000 euros when asked to report income in thousands of euros).[36] After 2003, the Dutch guilder was replaced by the euro, so all monetary amounts reported before 2003 were converted to euro amounts. Only first-lien mortgages originated from 2001 onwards are used, yielding 1,732 and 1,538 suitable observations for the debt-service ratio and loan-to-value respectively.[37] Because the questionnaire did not ask whether a mortgage was originated through an intermediary prior to 2002, observations prior to 2001 were excluded from the analysis.[38] To ensure the sample is representative of the Dutch population, all observations are weighted by their population frequency.

Descriptive sample statistics are reported in Table 4.3 and split according to origination channel. Consistent with differential access to a branching network, banks are significantly more likely to engage in direct writing (86.7 percent) compared to insurers and other originators (for example, pension funds and insurers) (Hassink and Van Leuvensteijn, 2007). The group of directly written mortgages carries a 10 basis point rate premium over intermediated mortgages, which might indicate some form of yield-spread premium compensation (Rose, 2012). However, the percentage of insured mortgages is also substantially larger (36.8 percent versus 28.6 percent), and insured mortgages typically receive a 10–30 basis point discount on the contract rate from the originator. Consistent with incentives in Table 4.1, the descriptive statistics show that brokered mortgages are significantly more likely to be of the deferred amortization type, while directly written mortgages are predominantly of the amortizing or interest-only type. More importantly, brokered mortgages are significantly larger, while the value of the collateral shows no significant difference between channels. This implies that differences in LTV and DSR ratios are primarily driven by the amount of mortgage debt and not the value of the underlying property or the contract rate.

[36] LTV ratios above 150 percent and DSR ratios exceeding 40 percent were excluded from the sample (see Cunha, Lambrecht, and Pawlina, 2009).
[37] This condition excludes all second liens used to cash out home equity, finance home improvements or refinancing loans.
[38] Because the survey has an ex-post character, mortgages originated in 2001 end up in the 2002 survey-wave, thereby making them suitable to include in the analysis.

Table 4.3 ■ Descriptive statistics

This table shows descriptive statistics for directly written versus intermediated mortgages, including a t-test for the equality of means. Fixed-rate period, NHG-guarantee, Retired, Higher-vocational, University, Male, and Married are measured as dummy-variables. Data is from Dutch Household Survey (DHS) and cover all mortgages originated between 2001 and 2009. ***,**, and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively.

	Direct written			Intermediated			T-stat for
Variables	Mean	Std. Dev.	N	Mean	Std. Dev	N	mean diff.
Mortgage originator:							
Bank	86.7%	0.35	742	33.5%	0.47	1153	25.91***
Insurer	0.1%	0.09	742	7.7%	0.25	1153	-6.33***
Other	12.3%	0.32	742	56.6%	0.49	1153	-19.41***
Interest rate	4.7%	0.01	660	4.6%	0.01	1025	2.76***
Fixed rate period (1 = yes)	88.8%	0.32	741	90.3%	0.30	1151	-1.02
NHG-insured (1 = yes)	28.6%	0.45	742	36.8%	0.48	1153	-3.70***
Mortgagetype:							
Amortizing	32.3%	0.47	742	23.2%	0.42	1153	4.38***
Deferred amortization	14.0%	0.35	742	30.9%	0.46	1153	-8.50***
Interest-only	53.6%	0.50	742	45.9%	0.50	1153	3.30***
Log (propertyvalue)	4.87	0.68	737	4.85	0.63	1144	0.68
Log (household income)	10.50	0.43	742	10.40	0.46	1152	4.44***
Log (amount of mortgage)	4.86	0.66	589	5.01	0.53	865	-4.60***
Age	49.97	14.79	741	44.54	12.51	1152	8.58***
Retired (1 = yes)	21.5%	0.41	741	10.9%	0.31	1152	6.37***
Higher-vocational (1 = yes)	28.3%	0.45	741	27.9%	0.45	1152	0.22
University (1 = yes)	17.0%	0.38	741	16.5%	0.37	1152	0.29
Male (1 = yes)	90.0%	0.30	741	89.3%	0.31	1152	0.48
Married (1 = yes)	79.1%	0.41	741	79.1%	0.41	1152	0.00
Household size	2.60	1.31	741	2.76	1.37	1152	-2.63**
Household wealth:							
Quartile 1	22.5%	0.42	742	27.9%	0.45	1153	-2.63**
Quartile 2	14.4%	0.35	742	16.3%	0.37	1153	-1.10
Quartile 3	28.6%	0.45	742	30.4%	0.46	1153	-0.82
Quartile 4	34.5%	0.48	742	25.4%	0.44	1153	4.27***

Other demographic characteristics reveal that households with a direct written mortgage are on average 4.5 years older, more highly educated (measured as completed higher vocational or university studies), and smaller. Moreover, these households are significantly wealthier; 34.5 percent of them are in the fourth wealth quartile compared to only 25.4 percent for households with intermediated mortgage debt.[39] Wealthy households likely rely on a loan officer because they receive a wide array of other services (such as, for example, a brokerage account and personal banking) from their originator.

[39] Our measure of wealth is defined analogously to Van Rooij *et al.* (2011) and Morin and Suarez (1983) as the sum of checking and savings accounts, employer-sponsored savings plans, the value of life insurance, home equity, other real estate, and the value of holdings in financial assets minus total debt and is measured using quartile-dummies.

4.4 Empirical Analysis

The multivariate analysis is split into three parts. The first constitutes an OLS-analysis examining the impact of intermediaries on mortgage-debt ratios, using the following model:

$$Ratio_i = \alpha + \beta dIntermediary_i + \omega_t dYear_t + \gamma X_i + \eta_i \quad (4.1)$$

Where the dependent variable $Ratio_i$ denotes the loan-to-value and debt-service ratio of household *i's* mortgage. The main variable of interest is the dummy-variable $dIntermediary_i$, which equals 1 when the household's mortgage was originated through an intermediary and 0 when it was directly written. In order to control for unobserved time effects, year dummies are included in all models. The vector X_i contains both control variables for mortgage terms (interest rate, fixed-rate period and dummies for mortgage insurance and mortgage type) and household characteristics (log of property value and household income, age, household size and dummies for marital status, gender, education, labor market position, and wealth quartiles).

The second analysis examines whether a mortgage is suitable given the household's income and the value of the collateral. Intermediaries significantly increasing the likelihood that mortgages exceed generally accepted underwriting standards indicates that an agency conflict created through commissions leads to improper selling or predatory behavior (Inderst and Ottoviani, 2009; Ehrenberg, 2001). To examine this hypothesis, two indicators for suitability were defined. The first variable measures excessive mortgage debt levels relative to collateral value. The mortgage insurance threshold of 112 percent was used as the cut-off point to determine excessive indebtedness:

$$ExcessLTV_i = \begin{cases} 1 \; if \; LTV_i > 112 \; percent \\ 0 \; otherwise \end{cases} \quad (4.2)$$

Secondly, we evaluate whether households spend an excessive amount of income on mortgage payments by comparing the debt-service ratio (DSR) of household *i* to underwriting criteria yearly published by the Dutch National Institute for Household Budget Education (NIBUD). Since the debt-service ratio is dependent on prevailing market interest, average mortgage interest-rates for new-contracts reported by the Dutch Central Bank are used to determine the appropriate

norm for year *t*.[40] The resulting indicator equals 1 when the household's *i* debt-service ratio in year *t* exceeds the NIBUD-norm in year *t*, given interest-rate *r*:

$$ExcessDSR_{i,t,r} = \begin{cases} 1 \;\; if\ DSR_{i,t} > NIBUD - norm_{t,r} \\ 0\ otherwise \end{cases} \tag{4.3}$$

Because both variables are binary, a logit model is estimated including all aforementioned control variables. Based on the compensation structure (see Table 4.1) and the descriptive statistics (see Table 4.3), a significant effect of intermediaries on the type of mortgage that households have is expected. The commission structure favors sales of deferred amortization and interest-only mortgages over traditional amortizing contracts. In order to examine this hypothesis, a multinomial-logit model is estimated using $Mortgage\ type_i$ as the dependent variable. Mortgage type is herein defined as:

$$Mortgage\ type_i = \begin{cases} 1\ if\ amortizing\ mortgage \\ 2\ if deferred\ amortization\ mortgage \\ 3\ if\ interest - only\ mortgage \end{cases} \tag{4.4}$$

4.4.1 The impact of intermediaries

Table 4.4A shows regression results for the models of Equations 4.1–4.3. The first two regression equations constitute the base-line model. Most coefficients are consistent with standard economic intuition. An increase in interest rates decreases the amount of mortgage debt that households can obtain while increasing the level of payments (DSR ratio). Households with mortgage insurance tend to have significantly higher LTV ratios even after controlling for a wide variety of other characteristics such as age, house value and mortgage type.

[40] The interest rate for new mortgage contracts depends on the fixed-rate period. The DSR measures were computed using a rate of five percent. The number of excesses increases (or decreases) when a higher (or lower) interest rate is used, but the main findings remain unaffected.

Table 4.4A ■ Analysis of involvement of intermediaries on mortgage debt ratios

This table shows results of an OLS-model for involvement of intermediaries on mortgage-debt ratios (Model 1–4) and a logit-model explaining excessive debt levels (Model 5–6). Debt-service ratio (DSR) is calculated as the annual mortgage payments divided by annual household income. The loan-to-value ratio (LTV) is the value of the house relative to the amount of mortgage debt. Amortizing mortgages are the reference category for mortgage type. Data is from the Dutch Household Survey (DHS) and covers all mortgages originated between 2001 and 2009. Excesses are defined as exceeding the NHG (LTV) or NIBUD (DSR) underwriting norms. Robust t-statistics in brackets, ***,**, and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	LTV	DSR	LTV	DSR	ExcessLTV	ExcessDSR
Intermediated (1 = yes)			0.037**	0.000	0.331**	-0.235
			[2.21]	[0.02]	[2.15]	[-1.15]
Interest-rate	-1.654*	2.379***	-1.637*	2.339***	-2.740	31.46***
	[-1.76]	[7.22]	[-1.71]	[7.02]	[-0.32]	[2.86]
Fixed rate period (1 = yes)	-0.016	-0.005	-0.004	-0.002	0.124	0.118
	[-0.52]	[-0.54]	[-0.15]	[-0.24]	[0.46]	[0.33]
NHG-guarantee (1 = yes)	0.032**	-0.023***	0.029*	-0.023***	0.155	-0.474**
	[2.05]	[-3.99]	[1.86]	[-3.82]	[1.05]	[-2.20]
Mortgage type:						
Deferred amortization	0.116***	0.031***	0.109***	0.031***	0.788***	0.476*
	[6.26]	[4.03]	[5.48]	[3.79]	[3.92]	[1.86]
Interest-only	0.024	-0.006	0.0173	-0.005	0.536***	-0.006
	[1.18]	[-0.65]	[0.82]	[-0.60]	[2.80]	[-0.03]
Log(value of house)	-0.233***	0.065***	-0.232***	0.064***	-1.922***	1.809***
	[-15.29]	[12.27]	[-14.86]	[12.21]	[-11.68]	[7.92]
Log(household income)	0.084***	-0.229***	0.087***	-0.227***	0.584***	-3.310***
	[4.26]	[-17.67]	[4.24]	[-17.24]	[3.21]	[-12.39]
Age	-0.008***	-0.002***	-0.008***	-0.002**	-0.029***	-0.027***
	[-9.02]	[-5.08]	[-8.45]	[-4.81]	[-3.38]	[-2.73]
Retired (1 = yes)	0.035	0.004	0.035	0.005	0.110	-0.835*
	[0.94]	[0.35]	[0.92]	[0.42]	[0.36]	[-1.66]
Higher-vocational (1 = yes)	0.0426**	0.0307***	0.047**	0.032***	0.539***	0.371*
	[2.34]	[4.44]	[2.55]	[4.64]	[3.25]	[1.68]
University (1 = yes)	0.093***	0.046***	0.091***	0.044***	0.998***	0.360
	[4.50]	[5.98]	[4.29]	[5.68]	[4.85]	[1.38]
Male (1 = yes)	-0.0219	0.0220*	-0.0229	0.0209*	-0.321	0.343
	[-0.64]	[1.92]	[-0.64]	[1.79]	[-1.09]	[0.77]
Married (1 = yes)	0.069**	0.018*	0.073***	0.016*	0.218	1.010***
	[2.53]	[1.95]	[2.59]	[1.71]	[0.85]	[2.73]
Household size	-0.003	0.001	-0.003	0.002	0.147**	-0.237**
	[-0.51]	[0.54]	[-0.45]	[0.86]	[2.19]	[-2.46]
WealthQRT 2	-0.007	-0.014	0.001	-0.010	-0.007	-0.014
	[-0.30]	[-1.55]	[0.05]	[-1.21]	[-0.27]	[-1.05]
WealthQRT 3	-0.027	-0.013*	-0.031	-0.012	-0.023	-0.013
	[-1.46]	[-1.66]	[-1.59]	[-1.49]	[-0.88]	[-1.20]
WealthQRT 4	-0.047**	-0.010	-0.0418*	-0.008	-0.040	-0.011
	[-2.11]	[-1.20]	[-1.82]	[-0.93]	[-1.43]	[-1.01]
Constant	1.630***	2.192***	1.539***	2.235***	1.266***	1.929***
	[7.66]	[17.06]	[6.93]	[17.45]	[4.19]	[12.03]
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
N	1394	1586	1333	1521	1333	1521
R2-adj/Pseudo R2	0.302	0.512	0.303	0.509	0.164	0.303
Log-Likelihood	-	-	-	-	-700.6	-402.0

Moreover, those households with a higher income or higher education tend to have higher LTV-ratios. Although the result for income is intuitive (see, for example, Follain and Dunsky, 1997), for education the result is less obvious. The mechanism that is likely at play is originators willing to lend more to households with good future income prospects.[41] Moreover, the wealthiest households tend to have lower LTV-ratios, probably because they take a larger equity stake through a down-payment when buying a house.[42]

Adding the intermediary to the model leaves the coefficients on control variables largely unchanged. The regression results of model 3 show for the full sample that involvement of an intermediary tends to increase the LTV-ratio by 3.7 percent. These results support the idea that intermediaries tend to originate larger mortgages to households (volume incentive). However, the affordability of the mortgage remains unaffected because the coefficient of the intermediary is highly insignificant in the debt-service ratio. This result is explained by the tendency of intermediaries to sell AMPs rather than amortizing debt, thereby increasing leverage without proportionately increasing the (monthly) payments. Generally, the results provide limited support for that commission-compensation of intermediaries has adverse effects on levels of indebtedness and affordability.

Next, we examine whether intermediaries originate unsuitable mortgages as defined by Equation (4.2) and (4.3). Excessive underwriting constitutes a risk for the originator and insurer as well as the household (Qi and Yang, 2009; Clauretie, 1990). Because all loans in the sample were granted, the 'excesses' were acceptable to both originator and household at the time of origination. Results of the logit model in (5) show indeed that intermediated mortgage debt is significantly more likely to be 'excessive' in terms of debt level than directly written credit. An increase in excessive payment obligations is not observed because the presence of an intermediary is insignificant and high LTV debt is more likely to defer amortization.[43]

Consistent with the type-based compensation that intermediaries receive on these products (see Table 4.1), results in Table 4.4B show that mortgages originated through intermediaries are more than twice as likely to be of the deferred amortization or interest-only type. Moreover, older and higher income households

[41] Circumstantial evidence suggests that these practices occurred in The Netherlands as one of the largest mortgage banks was fined for improper underwriting to young and highly educated households.
[42] Dutch mortgage lenders in general do not require down payments. Even transaction costs can be financed with mortgage debt, with initial LTVs exceeding 100 percent.
[43] Originators do typically not grant interest-only debt in excess of 90 percent LTV. So the mortgage should be the 'deferred amortization' type to retain affordability. This is indeed the case: mortgages with LTV levels in excess of 90 percent are four times more often a deferred amortization type than those with LTV-ratios under 90 percent.

are, as expected, more likely to have an interest-only mortgage because the LTV-cap is less likely to be binding for them. The result that larger households are more likely to have a deferred amortization mortgage is also intuitive. As these households incur high costs for example for the upbringing of children, they benefit optimally from an affordability mortgage, while they are simultaneously less likely to qualify for interest-only debt.

The results of Table 4.4B do not necessarily reflect a misalignment of interest between households and brokers. A higher share of AMPs might also reflect the fact that intermediaries assist households in choosing the optimal mortgage in terms of affordability and tax benefits given their current income. Moreover, data from the National Mortgage Guarantee indicate that AMPs are no more likely to become delinquent than traditional mortgage types.

So far the results did not control for heterogeneity in underwriting among originators. The reported effect of intermediaries is expected to diminish if our hypothesis holds that the same lender does not employ differential acceptability criteria for brokered debt. In other words, LTV and DSR ratios do not systematically differ – controlling for other factors – between a direct written and brokered mortgage once the lender effect is taken into account.

Table 4.4B ■ Multinomial logit analysis of mortgage-type choice

This table shows multinomial logit results for mortgage type choice by households when intermediaries are involved. Amortizing mortgages are the reference category. Data is from Dutch Household Survey (DHS) and covers all mortgages originated between 2001 and 2009. Robust t-statistics in brackets, ***,**, and * indicate significance at the 1 percent, 5 percent and 10 percent level respectively.

	(1)		(2)	
	Deferred amor.	Interest-only	Deferred amor.	Interest-only
Intermediated (1 = yes)			1.365***	0.746***
			[7.86]	[4.86]
Interest-rate	-8.322	-48.04***	-3.078	-46.52***
	[-0.85]	[-5.32]	[-0.30]	[-4.95]
Fixed rate period (1 = yes)	-0.475	-0.209	-0.295	-0.157
	[-1.56]	[-0.67]	[-0.90]	[-0.48]
NHG-garuantee (1 = yes)	-0.646***	-1.327***	-0.660***	-1.384***
	[-4.12]	[-8.22]	[-4.02]	[-8.46]
Log(value of house)	0.0407	0.130	0.146	0.153
	[0.27]	[1.01]	[0.96]	[1.18]
Log(household income)	0.368**	-0.0337	0.484**	0.0895
	[1.96]	[-0.19]	[2.47]	[0.49]
Age	0.001	0.092***	0.008	0.098***
	[0.12]	[11.43]	[0.86]	[11.45]
Retired (1 = yes)	-0.556	-0.506*	-0.441	-0.487
	[-1.23]	[-1.69]	[-0.97]	[-1.61]
Higher-vocational (1 = yes)	-0.210	-0.158	-0.147	-0.158
	[-1.20]	[-0.93]	[-0.80]	[-0.90]
University (1 = yes)	-0.833***	-0.671***	-0.934***	-0.770***
	[-3.65]	[-3.22]	[-3.91]	[-3.73]
Male (1 = yes)	-0.884**	-0.608**	-0.745*	-0.535*
	[-2.33]	[-2.01]	[-1.87]	[-1.76]
Married (1 = yes)	0.371	0.343	0.368	0.395
	[1.22]	[1.28]	[1.16]	[1.44]
Household size	0.238***	-0.049	0.241***	-0.075
	[3.50]	[-0.65]	[3.34]	[-1.06]
WealthQRT 2	0.047	0.013	0.084	0.103
	[0.20]	[0.05]	[0.33]	[0.40]
WealthQRT 3	-0.165	-0.397**	-0.144	-0.321
	[-0.83]	[-2.00]	[-0.70]	[-1.58]
WealthQRT 4	-0.746***	-0.274	-0.786***	-0.244
	[-3.38]	[-1.38]	[-3.33]	[-1.18]
Constant	-2.109	-0.248	-5.709**	-2.126
	[-1.02]	[-0.13]	[-2.53]	[-1.03]
Year dummies	Yes		Yes	
N	1754		1677	
Pseudo R2	0.216		0.236	
Log-Likelihood	-1412.6		-1317.5	
Chi-Square	534.7		558.2	

4.4.2 Intermediaries and originators

Table 4.5 shows sample descriptive statistics split according to originator type. Given the oligopolistic structure, bank-lenders and non-bank lenders are distinguished, with the latter being primarily insurers and pension funds. In line with Table 4.2 and Table 4.3, mean LTV and DSR ratios are documented to be higher for intermediated credit than direct written debt conditional on the type of originator. This finding is counter to intuition as we would expect differences to be smaller per originator. Consistent with Table 4.3, the percentage of NHG-insured mortgages is substantially higher when the debt is originated through an intermediary. Conforming to the insurance terms increases the acceptability of the mortgage to the originator, thereby increasing the likelihood that the broker can close the deal.

With respect to household characteristics, those with directly written debt are on average older and wealthier, while those households using an intermediary tend to be larger.

The multivariate analysis in Table 4.6 Panel A confirms that, after controlling for the originator, the role of the broker is limited. The decreasing magnitude of the coefficients and the insignificance both confirm that the underwriting criteria do not vary between channels conditional on the originator. As such, prior significance of the intermediary is largely explained by heterogeneity in underwriting standards among originators. Underwriting heterogeneity is fueled by competition among lenders for market share and new entrants in the market who cater to riskier borrowers, irrespective of the involvement of a broker.

Table 4.5 ■ Descriptive statistics by lender type

This table shows mean values for directly written versus intermediated mortgages split according to mortgage originator (banks versus non-bank). Debt-service ratio (DSR) is calculated as the annual mortgage payments divided by annual household income. The loan-to-value ratio (LTV) is the ratio of property value to mortgage debt. Excesses are defined based on NHG (LTV) or NIBUD (DSR) underwriting criteria (see Equation 4.2 and 4.3). Data is from the Dutch Household Survey (DHS) and covers all mortgages originated between 2001 and 2009.

	Banks				Non-bank			
	Direct		Intermediated		Direct		Intermediated	
	Mean	N	Mean	N	Mean	N	Mean	N
Mortgage characteristics								
LTV	91.1%	521	102.8%	281	94.2%	72	101.4%	595
DSR	21.0%	551	24.3%	327	19.7%	104	23.2%	679
ExcessLTV	24.3%	521	38.7%	281	33.3%	72	36.8%	595
ExcessDSR	14.8%	551	15.6%	327	9.6%	104	14.7%	679
NHG-guarantee (1 = yes)	29.9%	632	34.6%	379	20.9%	110	37.9%	774
Mortgagetype:								
Amortizing	32.1%	632	22.2%	379	33.6%	110	23.8%	774
Deferred amortization	12.5%	632	32.5%	379	22.7%	110	30.1%	774
Interest-only	55.4%	632	45.4%	379	43.6%	110	46.1%	774
Household characteristics								
Log (household income)	10.50	632	10.43	378	10.45	110	10.39	774
Age	49.65	631	44.23	378	51.82	110	44.69	774
Retired (1 = yes)	21.1%	631	11.9%	378	23.6%	110	10.3%	774
Higher-vocational (1 = yes)	26.3%	631	26.7%	378	40.0%	110	28.4%	774
University (1 = yes)	17.6%	631	18.3%	378	13.6%	110	15.6%	774
Male (1 = yes)	89.7%	631	89.2%	378	91.8%	110	89.4%	774
Married (1 = yes)	77.8%	631	77.5%	378	86.4%	110	79.8%	774
Household size	2.58	631	2.66	378	2.72	110	2.82	774
Household wealth:								
Quartile 1	22.9%	632	33.5%	379	20.0%	110	25.2%	774
Quartile 2	14.2%	632	15.3%	379	15.5%	110	16.8%	774
Quartile 3	27.8%	632	27.7%	379	32.7%	110	31.7%	774
Quartile 4	35.0%	632	23.5%	379	31.8%	110	26.4%	774

Table 4.6 ■ Analysis of mortgage debt-ratios by lender

This table shows results for OLS-models (panel A) and Logit-models (panel B) explaining mortgage-debt ratios controlling for the involvement of intermediaries. Mortgages are originated by banks or non-banks. Debt-service ratio (DSR) is calculated as the annual mortgage payments divided by annual household income. The loan-to-value ratio (LTV) is the ratio of property value to mortgage debt. Excesses are defined based on NHG (LTV) or NIBUD (DSR) underwriting criteria (see Equation 4.2 and 4.3). Data is from the Dutch Household Survey (DHS) and covers all mortgages originated between 2001 and 2009. Robust t-statistics in brackets, ***,**, and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively.

Panel A: OLS analysis of debt-ratios

	Banks		Non-Banks	
	LTV	DSR	LTV	DSR
Intermediated (1 = yes)	0.019	0.008	0.045	-0.005
	[0.92]	[1.10]	[0.94]	[-0.32]
Controls (see Table 4.4A)	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
N	731	812	602	709
R2-adj	0.339	0.493	0.260	0.536

Panel B: Logit analysis of excessive debt-ratios

	Banks		Non-Banks	
	ExcessLTV	ExcessDSR	ExcessLTV	ExcessDSR
Intermediated (1 = yes)	0.334	-0.107	0.096	0.231
	[1.50]	[-0.36]	[0.24]	[0.46]
Controls (see Table 4.4A)	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
N	731	812	540	642
Pseudo R2	0.251	0.351	0.130	0.345
Log-Likelihood	-330.8	-202.6	-301.6	-156.7
Chi-Square	139.7	139.5	61.15	115.1

Panel B of Table 4.6 reports logit-results for excessive underwriting. Consistent with prior expectations, all coefficients are insignificant regardless whether the originator was a bank or non-bank. The lack of significance indicates that, despite that a proportion of the mortgages exceed either the LTV or DSR norms (see Table 4.5), no systematic relation with the involvement of an intermediary is observed. As such, no evidence is found for predatory behavior of intermediaries, and the exceptions are more likely to arise on a case-by-case basis rather than resulting from a systematic misalignment of interest between brokers

and households. These results also support the view that predatory lending in the Netherlands is virtually non-existent.

So far, the underwriting outcomes for the complete portfolio of mortgages are examined. However, brokers are expected to have more freedom to increase their income if the mortgage is insured because they need not to worry about acceptance by the originator. Furthermore, the fact that the mortgage is insured will also increase the probability that the household will not object. As discussed, these effects should be smaller or absent for non-insured mortgages because the credit risks faced by the originator. In Table 4.7, we repeat the analysis and include an interaction-term between the intermediary and mortgage insurance.

Intermediary coefficients for all originator-type subsamples show that their involvement increases the LTV-ratio for the household, but that the effect becomes statistically insignificant. A similar picture emerges from the DSR-ratio, as it shows that the economic and statistical magnitude of the effect becomes negligible. The interaction term in all specifications is insignificant; there is no marginal effect of the intermediary conditional on mortgages being insured, neither for the full sample nor for the lender type-based subsamples. As such we find no evidence that screening or broker monitoring by originators are lowered when mortgages are insured.

The negative effect of mortgage insurance on the DSR is likely caused by a rate discount that households receive upon insuring their mortgage (see Section 4.3). In an unreported regression we include an interaction between mortgage insurance and the interest-rate. The effect of the interaction term confirms this assertion as it is significantly negative, while main insurance effect becomes insignificant.

Table 4.7 ■ Analysis of debt ratios for the interaction intermediary and mortgage insurance

This table shows results of an OLS-model for involvement of intermediaries on mortgage-debt ratios when interacted with mortgage insurance. Columns 1 and 2 contain the full sample of mortgages while column 3 (5) and 4 (6) contain the subsample of bank (or non-bank) originated mortgages. Debt-service ratio (DSR) is calculated as the annual mortgage payments divided by annual household income. The loan-to-value ratio (LTV) is the value of the house relative to the amount of mortgage debt. Amortizing mortgages are the reference category for mortgage type. Data is from the Dutch Household Survey (DHS) and covers all mortgages originated between 2001 and 2009. Robust t-statistics in brackets, ***,**, and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively.

	Full sample		Banks		Non-banks	
	LTV	DSR	LTV	DSR	LTV	DSR
Intermediated (1 = yes)	0.035	-0.006	0.008	0.007	0.037	-0.016
	[1.61]	[-0.74]	[0.29]	[0.71]	[0.66]	[-0.85]
Mortgage insurance (1 = yes)	0.024	-0.036***	0.021	-0.038***	-0.010	-0.058**
	[0.90]	[-4.02]	[0.76]	[-4.03]	[-0.10]	[-2.07]
Intermediary*Mortgage insurance	0.009	0.021*	0.032	0.006	0.039	0.051*
	[0.27]	[1.78]	[0.81]	[0.39]	[0.38]	[1.76]
Interest-rate	-1.629*	2.359***	-0.012	2.819***	-3.850**	2.006***
	[-1.69]	[7.09]	[-0.01]	[5.81]	[-2.46]	[4.46]
Fixed rate period (1 = yes)	-0.005	-0.003	0.011	-0.005	-0.047	-0.001
	[-0.16]	[-0.28]	[0.28]	[-0.36]	[-0.94]	[-0.04]
Mortgage type:						
Deferred amortization	0.109***	0.031***	0.107***	0.028**	0.117***	0.036***
	[5.47]	[3.76]	[4.09]	[2.53]	[3.69]	[2.98]
Interest-only	0.017	-0.006	0.020	-0.006	0.034	-0.011
	[0.81]	[-0.65]	[0.70]	[-0.51]	[1.04]	[-0.67]
Log(value of house)	-0.232***	0.065***	-0.234***	0.055***	-0.230***	0.082***
	[-14.82]	[12.22]	[-11.47]	[8.29]	[-9.30]	[9.64]
Log(household income)	0.087***	-0.227***	0.109***	-0.197***	0.060**	-0.263***
	[4.25]	[-17.25]	[3.98]	[-12.56]	[1.97]	[-12.71]
Age	-0.008***	-0.002***	-0.008***	-0.002***	-0.008***	-0.002*
	[-8.41]	[-4.83]	[-7.40]	[-5.54]	[-5.20]	[-1.95]
Retired (1 = yes)	0.034	0.004	-0.001	0.005	0.095	0.005
	[0.92]	[0.36]	[-0.02]	[0.38]	[1.51]	[0.24]
Higher-vocational (1 = yes)	0.046**	0.032***	0.071***	0.034***	-0.001	0.023**
	[2.54]	[4.59]	[2.93]	[3.70]	[-0.01]	[2.20]
University (1 = yes)	0.090***	0.043***	0.141***	0.039***	-0.004	0.044***
	[4.23]	[5.55]	[5.08]	[3.20]	[-0.14]	[4.29]
Male (1 = yes)	-0.022	0.0212*	-0.0325	0.046***	-0.018	-0.004
	[-0.64]	[1.82]	[-0.66]	[2.95]	[-0.36]	[-0.23]
Married (1 = yes)	0.072**	0.015	0.084**	-0.002	0.050	0.032**
	[2.56]	[1.63]	[2.15]	[-0.16]	[1.32]	[2.50]
Household size	-0.003	0.002	-0.006	0.004	0.003	0.001
	[-0.44]	[0.90]	[-0.61]	[0.96]	[0.29]	[0.12]
WealthQRT 2	0.001	-0.013	-0.006	-0.014	0.006	-0.006
	[0.06]	[-1.14]	[-0.25]	[-1.04]	[0.17]	[-0.46]
WealthQRT 3	-0.030	-0.011	-0.020	-0.013	-0.034	-0.009
	[-1.56]	[-1.40]	[-0.77]	[-1.16]	[-1.08]	[-0.76]
WealthQRT 4	-0.041*	-0.007	-0.038	-0.011	-0.029	0.002
	[-1.80]	[-0.84]	[-1.34]	[-0.96]	[-0.75]	[0.13]
Constant	1.538***	2.236***	1.256***	1.927***	1.986***	2.531***
	[6.91]	[17.48]	[4.14]	[12.07]	[6.10]	[13.37]
N	1333	1521	731	812	602	709
R2-adjusted	0.303	0.509	0.339	0.492	0.259	0.538

4.4.3 Robustness analysis

A potential concern with the preceding analysis is that households might actually endogenously choose to obtain a mortgage through an intermediary (see Collins, 2010; Elliehausen et al., 2007) because, for example, they anticipate to obtain a larger mortgage, or because they can better negotiate with a broker than directly with the lender. On the lender side, endogeneity might arise if lenders leave certain groups of borrowers to brokers, for example, for reputational reasons.

To examine whether the results are driven by endogeneity, an instrumental variables approach is presented in Table 4.8 where the intermediary is instrumented by the region where the household lives. The motivation for this instrument is that the presence of intermediaries varies to a larger extent with the degree of urbanization in the country than (bank) branches. The accessibility of the intermediary is related to the probability that households use an intermediary while it is exogenous to the outcome of the underwriting process. Unlike the U.S., where considerable regional variation exists in the housing market, the Dutch housing market is more homogenous. The correlation of local variations with the outcome of the underwriting process (e.g. local house price appreciation rates) is low and unlikely to be the main driver of our results.[44] The first stage regression (Table 4.8, Column 1) confirms that the instrument is significant in explaining intermediary choice with the second stage results remaining quantitatively similar. Intermediaries do have a marginally positive impact on LTV-ratios of mortgages but the effect on affordability remains insignificant. We also re-estimated the model and instrumented the interaction effect between intermediaries and mortgage insurance. Again, we find no statistical evidence that there is an effect of intermediary involvement conditional on the mortgage being insured.

[44] In unreported analysis, we rerun all models including region-dummies in the specification to examine the effect of regional variation in housing market conditions on the outcomes. The results are unaffected and the involvement of the intermediary and its interaction with mortgage insurance remain insignificant.

Table 4.8 ■ Instrumental variable analysis of mortgage debt ratios

This table shows results of a 2SLS IV-model where the intermediary-dummy is instrumented by the region where the household lives: one if it lives in the western part of the Netherlands and zero otherwise. Columns 1 shows estimation results from the first-stage and column 2 and 3 second-stage results with the LTV and DSR ratio as the dependent variable. Debt-service ratio (DSR) is calculated as the annual mortgage payments divided by annual household income. The loan-to-value ratio (LTV) is the value of the house relative to the amount of mortgage debt. Amortizing mortgages are the reference category for mortgage type and non-bank lenders are the reference category to the bank-lender dummy. Data is from the Dutch Household Survey (DHS) and covers all mortgages originated between 2001 and 2009. Robust t-statistics in brackets, ***,**, and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively.

	First stage	LTV	DSR
Instrument: western	0.073***		
	[2.95]		
Intermediated (1 = yes)	n.a.	0.600*	-0.009
		[1.71]	[-0.10]
Interest-rate	-2.869*	-0.509	2.366***
	[-1.69]	[-0.29]	[5.06]
Fixed rate period (1 = yes)	-0.032	-0.009	0.009
	[-0.63]	[-0.22]	[0.80]
NHG-guarantee (1 = yes)	0.097***	-0.038	-0.007
	[-2.93]	[-1.03]	[-0.69]
Mortgage type:			
Deferred amortization	0.289***	-0.039	0.026
	[6.66]	[-0.38]	[0.89]
Interest-only	0.199***	-0.094	-0.002
	[4.76]	[-1.29]	[-0.10]
Log(value of house)	0.026	-0.254***	0.108***
	[0.93]	[-10.28]	[14.59]
Log(household income)	-0.060	0.142***	-0.243***
	[-1.43]	[3.64]	[-15.41]
Age	-0.009***	-0.002	-0.002**
	[-5.97]	[-0.64]	[-2.16]
Retired (1 = yes)	0.008	0.022	-0.005
	[0.13]	[0.48]	[-0.38]
Higher-vocational (1 = yes)	-0.053	0.059*	0.032***
	[-1.49]	[1.81]	[3.11]
University (1 = yes)	0.044	0.053	0.039***
	[1.07]	[1.45]	[4.21]
Male (1 = yes)	0.052	-0.047	0.019
	[0.85]	[-0.84]	[1.37]
Married (1 = yes)	-0.068	0.104**	0.014
	[-1.35]	[2.19]	[1.19]
Household size	-0.018	0.011	0.001
	[-1.23]	[0.79]	[0.05]

Table 4.8 continued

WealthQRT 2	-0.027	0.034	-0.013
	[-0.54]	[0.89]	[-1.30]
WealthQRT 3	0.081**	-0.069*	-0.015
	[2.14]	[-1.65]	[-1.39]
WealthQRT 4	-0.015	-0.034	-0.013
	[-0.32]	[-0.95]	[-1.21]
Bank lender (1 = yes)	-0.543	0.270*	0.846
	[-21.84]	[1.68]	[0.87]
Constant	1.466	0.503	1.622*
	[3.33]	[0.81]	[1.79]
Yeardummies	Yes	Yes	Yes
N	1152	1152	1152
(Pseudo) R-square	0.399	0.312	0.343
Chi-square		311.43	880.69

Another explanation is that households are heterogeneous in their risk preference and that those more willing to take risks opt for larger mortgages, rather than brokers pushing higher debt levels. The dataset contains survey questions on the respondents' willingness to make risky investments.

To examine whether differences in risk aversion can confound previous the results, the analysis in Table 4.7, are repeated and controlled for risk preferences and are reported in Table 4.9. Again, we find no effect of intermediaries and/or the interaction with mortgage insurance on LTV or DSR-ratios, except for the subsample of mortgages originated by banks. In this case, the involvement of an intermediary - conditional on mortgage insurance - raises the LTV-ratio by 10 percent. Consistent with economic intuition, risk aversion has a negative effect on the LTV-ratio. Households with less appetite for risks opt for lower mortgages, although the effects are insignificant for the models with debt-service ratio as the independent variable. Furthermore, brokers might have an adverse impact on the price of credit as noted in LaCour-Little (2009), but (unreported) analysis of this hypothesis returns no evidence that broker involvement affects the interest rates on the mortgage contract.

Table 4.9 ■ Results after controlling for risk aversion of the household

This table shows results for OLS-models explaining mortgage-debt ratios controlling for the involvement of intermediaries and risk aversion of the household. Risk aversion is measured using a set of six survey questions that are combined in one scale. Debt-service ratio (DSR) is calculated as the annual mortgage payments divided by annual household income. The loan-to-value ratio (LTV) is the ratio of property value to mortgage debt. Data is from the Dutch Household Survey (DHS) and covers all mortgages originated between 2001 and 2009. Robust t-statistics in brackets, ***,**, and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively.

	Full sample		Banks		Non-banks	
	LTV	DSR	LTV	DSR	LTV	DSR
Intermediated (1 = yes)	0.034	-0.004	-0.004	0.010	0.014	-0.025
	[1.32]	[-0.51]	[-0.15]	[0.89]	[0.22]	[-1.14]
Mortgage insurance (1 = yes)	0.024	-0.029***	0.023	-0.030***	-0.164	-0.064*
	[0.80]	[-3.02]	[0.74]	[-2.97]	[-1.30]	[-1.88]
Intermediary*Mortgage insurance	0.033	0.014	0.102**	0.018	0.207	0.055
	[0.86]	[1.12]	[2.12]	[0.90]	[1.62]	[1.56]
Risk aversion	-0.004***	-0.001	-0.005***	-0.001	-0.003	0.001
	[-3.13]	[-0.72]	[-2.95]	[-1.56]	[-1.30]	[0.35]
Control variables (see Table 4.4A)	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
N	992	1153	550	623	442	530
R2-adjusted	0.316	0.497	0.384	0.473	0.239	0.543

Some limitations apply to the extent that we can control for all determinants of the outcome of the underwriting process. The most obvious limitation to this study is that it cannot control for the credit history of the household by means of a FICO-type credit score. The credit score of the household possibly acts as an omitted variable. Unlike the U.S., no uniform credit score data is available and transparency on how these measures are constructed is lacking (see also Cocco, 2011). Household income and its wealth position (which subtracts all debts from the assets it possesses) are likely to be highly correlated to the credit score and these are already included in all models. Moreover, the effect of a credit-score variable should prevail for non-insured credit because application screening is most important to lenders for mortgages where they have credit risk exposure. In this case we would expect to find a significant effect of the intermediary caused by an omitted credit score variable if riskier borrowers get matched to a lender with lower credit standards. The inclusion of lender fixed effects in the analysis should reasonably proxy for this heterogeneity among lenders and the intermediary should as a result be insignificant. Similarly, for insured mortgages, the mortgage-insurance dummy captures the effect of the omitted credit score variable, leaving

again our main variable of interest (the dummy for intermediary involvement) insignificant.

Furthermore, we do not observe default or delinquency rates on loans, as these data are not publicly available in the Netherlands. Foreclosure rates are, despite high initial LTV-ratios and low amortization rates, low in the Netherlands (in 2009, around 0.06 percent of the insured loans defaulted). Analysis of the data of the mortgage insurer, revealed that most of the actual defaults where clustered in the Southern part of Rotterdam (the second largest city in the Netherlands), where housing boards have been selling off houses to their renters. The dataset does not contain information on the involvement of mortgage brokers in this process, but the region controls should reasonably control for this particular case in Rotterdam.

Finally, we use self-reported data for a relatively low amount of respondents. Naturally, the amount of new mortgage loans that enter the survey each year is relatively low. This hinders the establishment and inference of a causal relationship between broker involvement and underwriting outcomes. However, the availability of a wide variety of background information on borrowers and the fact that we can compare brokered loans funded by the same lender while simultaneously controlling for heterogeneity *among* lenders, adds to our understanding of lending behavior despite us not being able (in the strictest sense) to establish causality. Moreover, the Dutch context provides, through the absence of co-insurance between lenders and mortgage insurers and low securitization rates, a quasi-experimental setting to examine the impact of mortgage insurance on lender's screening incentives.

4.5 Conclusion

This paper examines whether commission-based pay leads to a misalignment of interest between households and intermediaries. We expect that lenders have an incentive to screen mortgage applications and monitor intermediaries when they are exposed to credit risks. Consequently, we hypothesize that intermediaries have limited freedom to maximize commission income at the expense of households. Defining the loan-to-value and debt-service ratios as outcome variables for the underwriting process, we find that there is an effect of brokers on these ratios. However, inclusion of lender fixed-effects shows that this effect is largely explained by heterogeneity in lending standards among lenders, rather than the involvement of the intermediary. We do find that the involvement of intermediaries

increases the likelihood that borrowers have an alternative mortgage product, but argue that this in itself is not necessarily to the disadvantage of borrowers.

We continue by examining whether there is an effect of intermediaries on the LTV- or DSR ratio when mortgages are insured. Mortgage insurance transfers the credit risk from the originator to the mortgage insurer and reduces the incentive for the lender to monitor the broker and screen mortgage applications. Our results do not lend support for this hypothesis, even after accounting for endogenous selection, regional variations and risk preferences of borrowers.

Although the compensation structure of brokers is up for debate, including decreasing incentives for sales volume, it is not clear which problem it solves. Alternative compensation structures come with their own challenges (see Robinson, 2007), while the effectiveness of licensing requirements for brokers has not received uniform support (Todd and Kleiner, 2007). Based on the results of this paper, regulation and monitoring of lending institutions seems to be the effective route towards preventing over-levering households. Furthermore, it is advisable to redesign the mortgage insurance policy in this paper, towards a coinsurance-structure with the lender. This ensures that screening and monitoring incentives remain present even if the lender funds an insured mortgage. Though no evidence was found that either lenders or brokers take advantage of this caveat in the current structure, the U.S. securitization market has shown, in hindsight, the importance of lenders keeping a position in their credit portfolio.

Chapter 5
The Demand for Mortgage Insurance[45]

5.1 Introduction

Financial leverage of households' increased markedly over the past decade in developed economies across the world. Mortgage debt used to finance homeownership is generally the largest liability on the households balance sheet (Guiso and Sodini, 2012; Tufano, 2009; Campbell, 2006), and the indivisibility of housing leads to asset holdings concentrated in real estate (Flavin and Yamashita, 2011; Yao and Zhang, 2005).

When house prices start to decline, households' wealth is put at risk due to the evaporation of home equity. Negative equity arises when the mortgage liability exceeds the market-value of the property, while recourse mortgage debt holds households liable for repayment beyond what is recovered from sales- or foreclosure proceeds.[46] Households can avoid incurring these losses by adopting a 'wait-and-see' strategy when selling their property (Shiller, 2009). However, an adverse income shock caused by a divorce, involuntary unemployment, or death can trigger foreclosure and entitle the lender to be instantly repaid. In that case, households can no longer delay repayment and the shortfall has to be covered out of personal wealth (e.g. savings).

This paper examines whether households insure this wealth risk with mortgage insurance (Bourassa *et al.,* 2009). Although the undiversified nature of the households' portfolio suggests that it is wise to have mortgage insurance

[45] This chapter is based on a working paper by Cox (2012, *under review*). I would like to thank Dion Bongaerts, Dirk Brounen, Roger Brown, Zhao Daxuan, Peter Neuteboom, Melissa Porras Prado, Henri Servaes, Jim Shilling, Mark Van Achter, Maarten van Rooij, Dominik Rosch, Manuel Vasconcelos and seminar participants at the European Retail Investment Conference (2013), AsRES-AREUEA International Meeting 2012, ERES Annual Meeting 2012, ARES Annual Meeting 2012 and Rotterdam School of Management for helpful comments. This project was partially executed during the author's research visit at National University of Singapore.

[46] Although legally this opportunity absent for recourse debt, the stigma, reduced access to credit, cost of relocation and moral issues prevent households from strategic defaulting or just walking away from their home when mortgage debt is non-recourse (see Guiso, Sapienza and Zingales, 2012).

(Englund *et al.,* 2002), we are not aware of empirical research that examines which factors distinguish households with mortgage insurance from those who are uninsured. Potential explanations for these differences are unawareness of the risk, pricing of the insurance policy, or liquidity motives (e.g. the ability to pay the insurance premium) (Rampini and Vishnawathan, 2010; Johnson *et al.,* 1993; Slovic *et al.,* 1977).[47] However, Cole *et al.* (2012) demonstrate that also non-price factors such as behavioral traits play a significant role on insurance demand.

Based on an extensive Dutch panel dataset, we document results consistent with the 'overconfidence' hypothesis. This hypothesis states that households underestimate risk exposure with respect to driving, health and finances and subsequently do not take precautionary action such as insuring - reflected in low demand for these policies - or holding precautionary savings against those risks.[48] Prior work documented that the demand for unemployment and life insurance policies (longevity risk) can be partially explained by overconfidence (Sandroni and Squintani, 2004). Using an overconfidence proxy derived from self-evaluated financial knowledge (Greenwald, 1980) and one based on expressed propensity to spend current income (Wilcox, 2007; Ludvigson, 2004), we find that a one standard deviation increase in overconfidence lowers mortgage insurance adoption rates by 11 to 13 percent. In contrast to earlier empirical work by Barber and Odean (2001), we find no difference of overconfidence across gender or marital status. These results are robust to alternative model specifications such as the inclusion of regional dummies and non-linear functions of income and age.

We consider a variety of alternative explanations. We extend our model by including prior homeownership to examine the impact of an awareness, familiarity or experience-related explanation for insurance demand. One could expect that households who owned their previous house have an increased level of awareness of the risks associated with homeownership.[49] This can affect demand for mortgage insurance, although we do not find evidence for this. We also allow for the interaction between overconfidence and housing market experience but find no systematic effect. This suggests that overconfidence is not varying with experience consistent with previous empirical findings (Jonsson and Allwood, 2003). Optimistic expectations regarding house price developments potentially lowers insurance demand as those decrease expected payouts. A specification that includes

[47] We come back to the importance of these explanations for this paper in the next section where we discuss the institutional background in this paper at length.
[48] In general this literature is concerned with underinsurance against low-probability/large consequence risks such as natural disasters or disability risk.
[49] Strictly speaking, a prior mortgage default would be a better proxy for experience and awareness of the risk and policy, but our dataset does not contain this information. Moreover, the low foreclosure rates in the Netherlands during our sample period limit the effect of survivorship bias.

house price expectations yields the anticipated negative effect on insurance demand (albeit marginally insignificant), but it does not affect earlier findings.

We continue by testing the robustness of our results against alternative measures for the households' risk profile. Instead of using the loan-to-value ratio as an indicator for the short-fall risk, we define alternative proxies based on the loan-to-income ratio, debt-service ratio, and mortgage-debt-to-wealth ratio. These measures intend to control for the ability to pay and the degree of portfolio diversification but are not found to materially alter the results. In addition, we examine whether the household head has a permanent employment contract and whether his/her partner has paid employment, but again our results remain unaffected. Inclusion of the length of marriage as a proxy for marital stability and the number of children living at home does not yield different findings either.

Next, we consider the role of peer and advisory effects. Cole *et al.* (2012) and Guiso *et al.* (2008) show that trust is an important factor in the decision process especially when households are unfamiliar with the product or its vendor. Learning via trusted peers about the features of the product can decrease the hurdle to purchase insurance thereby raising adoption rates, while financial advisors can raise awareness by actively recommending such a policy. No effect of peers where found, and the involvement of a professional financial advisor decreases insurance adoption, This might either indicate the outcome of the advisory process (recommendation to remain uninsured) or households mistrusting financial advisors and acting contrarily to what is recommended to them (see Bhattacharya *et al.,* 2012).

Our results contribute to two literature streams. First, we contribute to the behavioral and household finance literature. Campbell (2006) argues that households make serious mistakes when it concerns the diversification of risky portfolios. Although the degree of diversification in investment portfolios has received empirical attention (for example in Goetzmann and Kumar, 2008), hedging behavior with respect to real estate assets has received limited attention so far. This is surprising given their weight in the asset portfolio for the average household (Guiso and Sodini, 2012; Campbell, 2006). Moreover, the richness of our dataset also allows us to shed more light on the influence of peer (Hong *et al.,* 2004) and advisory effects on household decision making.

Second, our empirical evidence is based on an extensive survey data-set. We show that diffusion of insurance products is affected by overconfidence of households. This offers additional insight in the longstanding 'insurance-puzzle', which postulates that households fail to purchase coverage for low-probability/high-consequence events (Kunreuther, 1978). Empirical evidence found

that households overinsure on air travel (Eisner and Trotz, 1961) while they underinsure on disaster-type risks (Kunreuther, 1978). This is surprising, because the consequences of a disaster (e.g. flooding) are far more severe and far-reaching than the insolvency of a flight carrier, both in monetary and non-monetary terms. Much theoretical and *experimental* work has aimed to explain this behavior, but *survey* based evidence has as of yet been scarce.[50]

Our results have implications for policy makers. Underinsurance can be countered by pursuing originators and regulators to adopt it as an industry standard. Leaving the decision to households, adoption rates can be raised by educating (prospective) homeowners on the risks and availability of hedging products. However, as Willis (2008) argues, this strategy might have limited effect if basic education just raises the level of confidence without substantially increasing the ability to make informed decisions. Selling insurance policies in bundles as proposed for example in Kunreuther and Pauly (2004) is often forbidden and as such ineffective in increasing adoption rates. It also impedes the freedom of choice for households to choose to insure risks as they wish. As a final way to raise adoption, one could simply make insuring the default-option.

We continue this paper with an in-depth discussion of mortgage insurance in the Netherlands in Section 5.2. Section 5.3 discusses the dataset and construction of measures. Section 5.4 presents our results and robustness checks, while Section 5.5 concludes.

5.2 Mortgage insurance in the Netherlands

The Netherlands offers a unique institutional setting to analyze mortgage insurance demand. In this section we discuss the organization and governance of the mortgage market, the characteristics of the insurance policy, and the general economic development of the Netherlands during our period of analysis.

[50] See for example the experimental evidence in: Laury *et al.,* 2009; Hsee and Kunreuther, 2000 McClelland *et al.,* 1993; Hogarth and Kunreuther, 1995; Ganderton *et al.,* 2000; and theoretical work by Kunreuther and Pauly, 2004; Kunreuther *et al.,* 2001; and Gollier, 2003; Meyer and Meyer, 1998.

5.2.1 The Dutch mortgage market

The Dutch mortgage market is well developed and, measured as a percentage of national GDP, one of the largest in the world. Dutch mortgage lenders have full recourse on their borrowers and actively pursue them to get repaid in case of default. The recourse provision and the priority in bankruptcy claims create a strong position for mortgage lenders, and limits the customer's bargaining (or credible threatening) power to renegotiate on the mortgage terms in case of financial distress. When an originator decides to foreclose the property and a household is unable to fully repay, then the household faces the risk of personal bankruptcy. Upon entering bankruptcy, outstanding debt has to be repaid in three years while living on welfare level. Households typically have to reduce consumption levels during this period and are forced to relinquish control over their finances to a trustee.[51] Despite these institutional settings, Dutch mortgages are characterized by high initial loan-to-value (LTV) ratios − often exceeding 100 percent − and low amortization rates (Charlier and Bussel, 2003). The increasing popularity of mortgage products that defer amortization since the mid-90's, further increased the outstanding mortgage debt balance. Moreover, neither a down-payment, nor mortgage insurance is required by lenders for high LTV-loans.[52] Low amortization rates and high initial leverage ratios increase the risk that households have negative equity even if house prices decrease only modestly and warrants for mortgage insurance. Nevertheless, mortgage default rates in the Netherlands are low as will be discussed in Section 2.3, but we first continue with a discussion of the mortgage insurance policy and its provider.

5.2.2 The mortgage insurer and insurance policy

Mortgage insurance for shortfall risk has been available in the Netherlands for over fifty years, and is since 1995 sold under the National Mortgage Guarantee (henceforth NHG) label. The insurance is in essence a standard indemnity contract, with NHG as its sole vendor. Although private alternatives have tried to gain ground over the years, none of them achieved or sustained a meaningful market share. Competition-related explanations for adoption-rates caused by differences in pricing and contract features (e.g. deductible levels), or adverse selection on the insurer's side such as insuring 'good' risks are irrelevant to our study. Another

[51] This type of bankruptcy is similar to filing bankruptcy under "Chapter 13" in the U.S.
[52] This makes the system fundamentally different from the U.S. or Canada where it is either the 'industry standard' or legally required to have mortgage insurance for loans that have a LTV-ratio exceeding 80 percent.

distinguishing feature is that NHG is financially backed by the Dutch government and local municipalities. This limits the risk that NHG will not be able to honor its obligations in case that the payout-ratios are unexpectedly high and financial reserves become depleted (Doherty and Schlesinger, 1990).

The policy sold by NHG is in some aspects comparable to mortgage insurance provided by the Federal Housing Administration (FHA) in the U.S. For example, NHG targets the lower and middle price range of the housing market where it intends to lower barriers to homeownership for households. A second similarity to FHA is that NHG does not originate mortgages but that it insures the lender against a loss of principal and the household against a wealth loss in case of foreclosure. After deduction of foreclosure proceeds, a shortfall is covered provided that the reason for default is outside the household's control (e.g. loss of income due to involuntary unemployment, divorce and death). The credit record of the household will reflect a foreclosure for five years, but the impairment of access to future credit is not as severe as in a personal bankruptcy. Following a foreclosure, households are again eligible to obtain mortgage insurance, although in practice, access to credit is dependent on the willingness and internal credit standards of the originator to lend to a borrower that has been previously foreclosed.

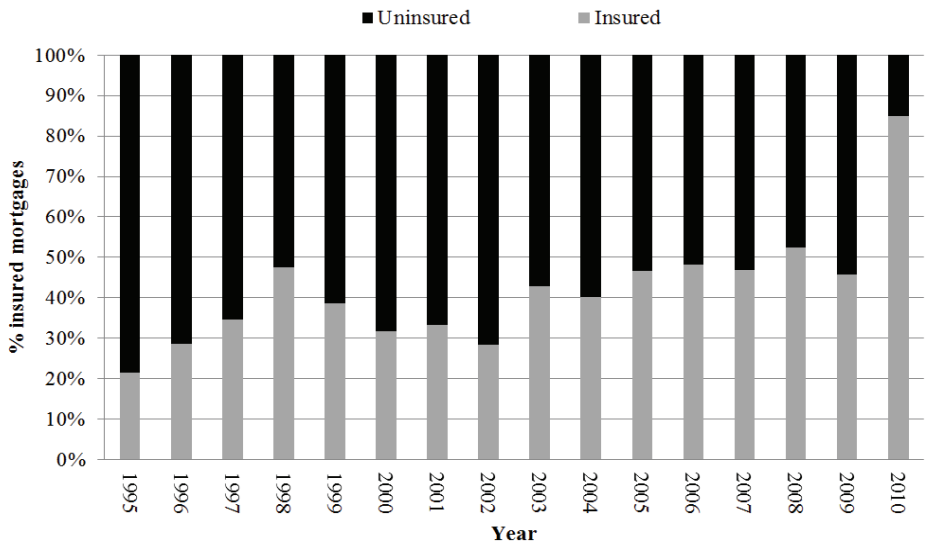
Mortgages must meet several criteria in order to qualify for insurance and can only be insured at origination.[53] NHG imposes restrictions on the size of the mortgage (not to exceed 265.000 euro), the initial LTV ratio (not to exceed 112 percent),[54] usage of the mortgage (only first liens on the primary residence), and amortization type (no more than 50 percent non-amortizing debt) in order to be eligible for the policy.

Provided that mortgages meet these criteria, households can purchase insurance for a one-time fee of 0.55 percent of the outstanding balance. This fee is irrespective of the initial LTV-ratio with no other subsequent fees being charged. Upon insuring, households receive a rate discount averaging 30 basis points from the lender, which is enjoyed over the entire mortgage term. The insurance premium is tax-deductible at the marginal income tax-rate in the year the property is acquired, and financeable within the mortgage.

[53] All numbers mentioned are applicable in 2009. The eligible mortgage size and insurance premium both show an increasing pattern during the analysis period (1995-2009), but we account for this in our analysis.
[54] Household can purchase a house worth 236,000 euro and finance 28,000 euro of transaction costs (notary fees, taxes, etc.) for a total of 264,000 euro with an initial loan-to-value ratio of 112 percent.

Figure 5.1 ■ Mortgage insurance adoption rates

This figure shows the percentage of insured mortgage insurance adoption rates as a fraction of the mortgages *eligible* for insurance between 1995 and 2010. Data are from the DNB Household Survey.



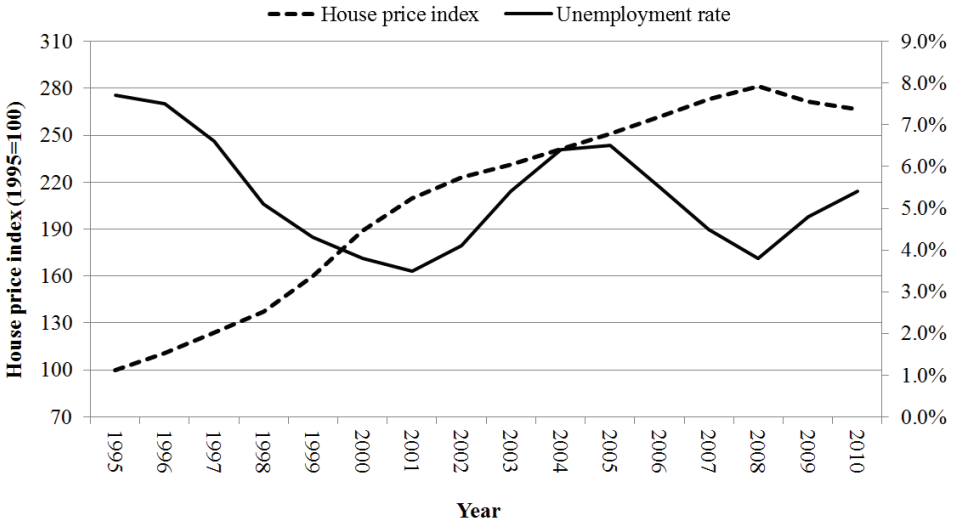
These attractive financial terms decrease the likelihood that price or liquidity related factors are explanations for (low) adoption rates (see also Cole *et al.,* 2012; Rampini and Vishwanathan, 2010). [55] Market research reveals that among *uninsured* households; 8 percent mention 'costs' as a reason not to insure, while 40 percent indicates this is due to 'other reasons' (Authority of Financial Markets, 2010). Roughly 50 percent of the respondents indicate that they are not eligible for mortgage insurance. Awareness of the policy's existence is also widespread, as 97 percent of the uninsured households indicate to be aware of the availability of mortgage insurance.

Figure 5.1 illustrates the percentage of insured mortgages relative to the pool of eligible mortgages over time. Even after allowing for a diffusion period in the first years that the policy was sold under the NHG label, only half of the *eligible* mortgages are insured. Although we defer the discussion and development of our overconfidence measures to Section 5.3.2, it is worth mentioning that we do not find a time pattern in overconfidence and only a slight decrease in intended spending after 2008.

[55] There is an opportunity cost to obtaining mortgage insurance as financing with interest-only debt maximizes the (present) value of the mortgage interest tax-deductibility. However, this effect is partially countered by down payments that banks demand on such loans leading to a lower LTV-ratio and a loss on interest-income that savings yield.

Figure 5.2 ■ House price index and unemployment rate development

This figure shows the house price index and unemployment rate development in the Netherlands between 1995 and 2010. Source: Bureau of Census Statistics.



5.2.3 General economic development in the Netherlands

To put Figure 5.1 in more perspective, the development of unemployment rates and house prices in the Netherlands during 1995-2010 is shown in Figure 5.2 as these directly affect the probability of default and the shortfall risk. Figure 5.2 indicates that house prices in the Netherlands almost tripled from 1995 until 2008, while unemployment rates were amongst the lowest in Europe. As a consequence, foreclosure rates are low compared to for example the U.S. In 2009 for example only 0.04 percent of the Dutch properties were foreclosed compared to 2.21 percent in the U.S. (RealTrac, 2012), with the average shortfall being 22,500 euros.[56] The favorable economic climate of the nineties made originators exert little pressure to insure on households as the value of the collateral was stable. This limited the risk that losses occurred in their mortgage portfolio.[57]

[56] The average amount of savings a household had in 2009 was 46,100 euros. However, households use them to avoid default on their loans or mortgages. Once they enter foreclosure, savings are often depleted and a shortfall immediately creates negative net worth.

[57] We thank employees from mortgage lenders in the Netherlands for sharing insights in the origination process. NHG-insurance was not actively sold up to 2009, when both the crisis struck global capital markets and national regulators increased oversight and criteria for mortgage lending and advising. Consequently, adoption rates went up to 85 percent in 2010 and 2011.

However, in itself these macroeconomic factors affect all homeowners, and as such they provide no direct answer why certain households insure and others do not. Moreover, in contrast to the rural Indian sample of Cole *et al*. (2012), our Dutch sample is from a developed Western economy where residents receive a high level of education and consequently exhibit high levels of literacy and numeracy (see United Nations Development Programme). This increases the likelihood that they have the basic capability to evaluate financial products. Finally, Dutch households are risk-averse given that they take the second place worldwide in the amount of income they spent on insurance premiums. We can therefore expect familiarity with the basic mechanics of insurance products.[58] Evaluated as a whole, this leads us to believe that decision maker traits, especially confidence, are an important factor in insurance decisions. Before presenting the empirical evaluation, we continue with a discussion of the data and the derivation of our measures.

5.3 Data description and measurements

We use data from the DNB Household Survey (DHS), which is sponsored by the Dutch Central Bank (DNB) and administered by CentERdata. CentERdata is an institute affiliated to Tilburg University and specialized in the collection and dissemination of datasets used in socio-economic research. The DHS started in 1993 and is yearly administered among a representative sample of 2,000 Dutch households. It contains a wide variety of information on household characteristics such as income and employment status as well as psychological constructs.[59] Participation takes place on a voluntary basis and involves no monetary compensation. CentERdata recruits participants by phone and keeps the panel representative of the Dutch population to limit attrition bias.

An advantage of the DHS is that households can fill out the survey at home via internet, where they have all relevant information with respect to their finances such as mortgages, insurances and account balances available. This reduces reporting errors, while the absence of an interviewer reduces response-biases (Duffy *et al.,* 2005). In order to reduce the impact of reporting errors, income and wealth related variables are winsorized at 10 percent of their distribution. Imposing the eligibility criteria for insurance on our dataset, we obtain a sample of 3,069

[58] A Dutch household has on average eight different policies. Excluding mandatory insurance policies, Dutch households come in second on the world-ranking with respect to the amount they spend on insurance policies, after the Swiss.
[59] See Van Rooij *et al.* (2011) and Guiso *et al.* (2008) for other applications of this dataset.

newly originated mortgages between 1995 (when NHG mortgage insurance become available) and 2009 that are suitable for the analysis.

5.3.1 Descriptive statistics

We show an overview of sample statistics for insured and uninsured households, including *t*-tests for the equality of means between them in Table 5.1. Definitions of the control variables are reported in Table II.1 in Appendix II.

Households in the insured-group have a LTV-ratio that is on average 12 percent higher than those in the non-insured sample and this is significant. Part of this difference is explained by the proportion of first-time home buyers in the insured subsample. They often include transaction costs and notary fees in their mortgage because of limited wealth. This is also supported in the descriptive statistics as the percentage new entrants to the homeownership market is higher for the group that has mortgage insurance (14 percent) than the non-insured group (9 percent) and this difference is significant (p=0.000).

Furthermore, it appears that differences in interest-rates are insignificant, with the group-means being only 5 basis points apart. This seems inconsistent with insured households receiving a rate-discount as was previously discussed. However, as LTV-ratios are significantly higher for the insured group, it is likely that households would have to pay an even higher interest rate in the absence of mortgage insurance. Interest-rates therefore actually reflect a discount on a risk-adjusted base.

Demographically, uninsured households are more often retired (19 percent), older (50.1 years old) and higher educated (15.4 percent holds a university degree). The wealth-distribution shows that households with mortgage-insurance are significantly more likely to be in the third quartile, while those that are uninsured are more likely to be in the top quartile.[60] This appears to be consistent with the theory that external insurance is less appealing for wealthier households as they are able to 'self-insure' (Ganderton *et al.,* 2004; Gollier, 2003).

[60] Wealth is defined as the sum of all assets (checking- and savings accounts, savings plans, life-insurance, employee-sponsored savings plans) minus all liabilities (debt) analogously to Van Rooij *et al.* (2011). As wealth and income increased over the sample period, the quartiles are computed year-by-year to account for trending.

Table 5.1 ■ Sample descriptive statistics

This table shows weighted means and standard deviations (SD) for the complete sample split into households that did and did not insurance their mortgage. T-test assumes equality of variances conditional on a F-test. Data are from the DNB Household Survey and cover all eligible mortgages originated between 1995 and 2009. Variable definitions are contained in Table II.1 in Appendix II.

	Non-insured households			Insured households			t-test for equality in means		
	Mean	SD	N	Mean	SD	N	t-statistic	p-value	N
Mortgage characteristics									
Interest-rate	5.42	1.14	1978	5.47	1.18	824	-1.15	0.124	2802
Interest-only mortgage	0.43	0.50	2121	0.21	0.41	910	11.69	0.000	3031
Endowment mortgage	0.07	0.26	2121	0.13	0.34	910	-5.35	0.000	3031
LTV	0.77	0.27	2147	0.89	0.23	922	-11.85	0.000	3069
Demographic characteristics									
New entrant	0.09	0.28	2147	0.14	0.35	922	-4.47	0.000	3069
Retired	0.19	0.39	2133	0.07	0.26	920	8.45	0.000	3053
Self employed	0.02	0.13	2133	0.02	0.13	920	-0.10	0.459	3053
Higher vocational	0.30	0.46	2131	0.33	0.47	920	-2.05	0.020	3051
University	0.15	0.36	2131	0.12	0.32	920	2.39	0.008	3051
Male	0.89	0.31	2133	0.87	0.34	920	1.99	0.022	3053
Married	0.79	0.41	2133	0.74	0.44	921	2.93	0.001	3054
Age	50.11	14.12	2131	42.54	12.03	920	14.19	0.000	3051
Children	0.37	0.48	2147	0.43	0.50	922	-3.44	0.000	3069
Median income	0.60	0.49	2144	0.59	0.49	922	0.56	0.287	3066
Double median income	0.10	0.30	2147	0.07	0.25	922	2.97	0.001	3069
Wealth									
Quartile 1	0.30	0.46	2147	0.29	0.45	922	0.80	0.209	3069
Quartile 2	0.09	0.29	2147	0.10	0.30	922	-1.18	0.117	3069
Quartile 3	0.27	0.45	2147	0.34	0.48	922	-3.90	0.000	3069
Quartile 4	0.33	0.47	2147	0.26	0.44	922	3.80	0.000	3069

5.3.2 Description of overconfidence measures

The empirical literature distinguishes broadly four alternatives to operationalize and measure overconfidence: hubris, overoptimistic self-evaluations, miscalibration, and attribution bias. Overconfidence in the form of hubris is sometimes referred to as the 'better-than-average' effect. A well-known example of hubris is found in the assessment of driving skills. Svenson (1981) shows that individuals overrate their skill if asked to compare their skill level relative to a group. The majority indicates their skill level to be above the group-average, while realistic assessments imply that about fifty percent of the respondents are to be expected to rate themselves *below* the group-average.

Related to hubris are overoptimistic self-evaluations (Greenwald, 1980), with the difference being that self-evaluations typically do not involve performance judgments with reference to a peer-group. Typically, this type of bias is characterized by a discrepancy between an individual's self-rated level of skill

versus the level that is objectively obtained from example test results (Johnson *et al.,* 2006). Further, it is documented that men overestimate and women underestimate their performance on tasks, especially when those are in the masculine domain, such as finance (Barber and Odean, 2001; Byer, 1990). It is also found that individuals are less accurate in evaluating their own than their peer's skill (John and Robins, 1994). By and large, this literature shows that the overconfidence bias in assessments is highest for a male respondent that evaluates his own skill in the masculine (e.g. finance) domain.

Thirdly, it is found that people overestimate the precision of their knowledge, leading to 'miscalibration'. Typically this bias manifests itself in too narrowly estimated confidence intervals by respondents. (Deaves *et al.,* 2009; Biais *et al.*, 2005). For example, participants are asked to predict a value-range such that an actual value will fall within the predicted range 90 percent of the time. Miscalibrated individuals predict intervals that are too narrow, such that the actual value will fall outside their predicted interval *more* than 10 percent of the time. It is also documented that miscalibration is not confined to areas or tasks where respondents are known to have limited expertise, but also emerges in domains where they are knowledgeable.

Finally, individuals tend to take too much credit for their contributions to positive outcomes in the past, known as attribution bias (Barber and Odean, 2001; Miller and Ross, 1975). An individual learns about his ability through the outcomes of his actions, which is either a success or a failure. Overconfidence arises in this case if an individual attributes successes to his ability while failures are attributed to bad luck (Gervais and Odean, 2001).

It should be noted that different types of overconfidence do not exclude each other (Daniel *et al.,* 1998) and that the presence of one type of overconfidence is not a sufficient condition that other types are also present (Acker and Duck, 2008; Glaser and Weber, 2007). Overconfidence is a relatively stable personal characteristic (Jonsson and Allwood, 2003; Klayman *et al.,* 1999), although the level of overconfidence is expected to decrease with age and/or experience as people become better able to assess themselves (Gervais and Odean, 2001). Moreover, men are in general more overconfident about their abilities than women, especially when tasks are in the domain of finance (Barber and Odean, 2001; Beyer and Bowden, 1997; Lundeberg *et al.,* 1994; Prince, 1993).

To identify whether the demand for mortgage insurance is affected by overconfidence, we develop two indicators.

Our first indicator is constructed from self-evaluations using a two-stage approach similar to the one adopted by Grinblatt and Keloharju (2009). In the first stage, we observe the respondent's self-assessment of financial knowledge (Appendix I). We assume, as discussed above, that these scores partially reflect the *true* level of financial ability and partially contain an under- or overestimation. To parse out a measure for overconfidence, we regress these responses on objective determinants of financial literacy and obtain the residuals as a proxy for overconfidence. This proxy is included in the second stage model that explains insurance adoption.

Measurement of financial literacy is a rapidly developing field on its own, but empirical evidence indicates that in general financial literacy relates closely to wealth, education, income, participation in financial markets, and financial experience (Calvet *et al.,* 2011; Van Rooij *et al.,* 2011; Goetzmann and Kumar, 2008). As these characteristics are observed in the data, we estimate the following model for respondent *i* in year *t,* on aforementioned variables and demographic controls:

$$Self-assessed\ financial\ literacy_{it} = f(literacy-determinants, demographic\ controls)_{it} + \varepsilon_{it} \quad (5.1)$$

The residuals of the regression (ε_{it}) contain the over- and under prediction of the respondents' financial knowledge, while the fitted value corresponds to the 'true' level of financial knowledge. A positive residual can be interpreted as an indicator for overconfidence (the response exceeds the fitted value) relative to the average respondent, and a negative residual as an indicator for underconfidence (the fitted value exceeds the response). An advantage of this approach is that the time difference between the insurance decision and the self-assessment is short by construction (less than a year). This alleviates the concern that experience contaminates the self-assessment as it is likely that the self-assessment reflects a learning-effect the longer the time between the decision and the self-assessment.

Table 5.2 ■ Explaining self-assessed financial knowledge

This table shows results for a first stage OLS regression explaining self-assessed financial knowledge by households. Robust *t*-statistics are reported. ***,**,* indicates significance at the 1%, 5% and 10% level respectively. Data are from the DNB Household Survey and cover 1995 and 2009. Variable definitions are contained in Table II.1 in Appendix II.

	Dependent variable: Self-assessed financial knowledge	
	Coefficient	*t* -value
Holding financial assets	0.311***	[9.62]
Self employed	0.069	[0.55]
Higher vocational	0.026	[0.81]
University	0.036	[0.83]
Married	0.150***	[4.10]
Age	-0.011***	[-10.00]
Children	-0.124***	[-3.62]
Median income	0.044	[1.38]
Double median income	0.177***	[2.76]
Wealthquartile 2	-0.013	[-0.23]
Wealthquartile 3	-0.017	[-0.40]
Wealthquartile 4	0.024	[0.54]
Constant	2.411***	[22.56]
Number of observations	2252	
Adjusted R2	0.094	

Results of the first-stage regression are reported in Table 5.2. Our sample shrinks by almost 800 observations to 2252 observations because the self-assessment data is missing. Coefficients for income (reference category are households with income below the median level), marital status, and participation in financial markets are highly significant with their signs according to expectation.[61] The insignificance of other control variables and low R-squares raise concerns about the adequacy of the specification. We examine the sensitivity of the specification in Section 5.4.2, but note here that our explanatory power and results are similar to those obtained in comparable studies (Van Rooij *et al.,* 2011; Grinblatt and Keloharju, 2009). Although this measure is noisy, it typically biases second stage coefficients downwards, thereby working against us finding any effect. If our measure relates to an overconfidence trait and if insurance decisions are indeed affected by overconfidence then we expect the mean residual to be positive for the non-insured and male subgroups.[62] Inspection of the residuals over time

[61] Participation in financial markets is computed as a dummy equal to 1 if households hold at least one of the asset classes stated in Appendix I and zero otherwise.

[62] Uninsured versus insured (0.013 versus -0.031, p = 0.007); men versus women (0.013 versus -0.105, p = 0.003).

does not reveal a particular pattern, which agrees with the literature that overconfidence is a stable trait (Jonsson and Allwood, 2003; Klayman *et al.,* 1999).

As a second indicator, we measure the household's inclination towards spending (see Section 5.6, Appendix I). Consumer spending relates to consumer sentiment, which is typically defined as the household's confidence in the past and future development of the economy (Van Raaij and Gianotten, 1990). Wilcox (2007) and Ludvigson (2004), show that these sentiment indicators are able to explain growth in consumption of services and non-durable goods. Households exhibiting more confidence about their future prospects are arguably more likely to spend current income, rather than save for precautionary reasons. The poles of the answer-scale are rather extreme: with a '1' indicating that the household wants to spend *all* his money directly, while a '7' indicates that the household wants to save as much as possible. We therefore expect this indicator, albeit it not exactly similar to self-overconfidence, to show a similar pattern as our overconfidence indicator: households willing to aggressively spend their income are less likely to insure their mortgage; because they are less concerned that an adverse event will occur (it decreases precautionary behavior). Of course these effects need to be adjusted for the level and volatility of current and future income and spending needs (e.g. children's education) which we capture with control variables for labor market position, age, household composition and level of education.

Given a level of household confidence, differences in insurance rates might reflect varying degrees of risk aversion. We therefore include a proxy for risk aversion in all analyses which we construct from six survey questions (see Appendix I). The statements intend to reveal how willing the household is to make risky investments. Scores on the third, fifth and sixth item were reversed and subsequently added to one resulting scale ranging from 6 (very risk tolerant) to 42 (very risk averse).

5.4 Multivariate analysis

The dependent variable is measured as a dummy equal to one if the mortgage is insured and zero otherwise, so the multivariate analysis is performed with a logit-model. The regression includes control variables for the risk profile of the household through the level and volatility of household income (self-employment and retirement status), level of indebtedness (loan-to-value ratio), ability to self-insure (wealth quartiles), and risk aversion. These factors capture the risk exposure which typically increases in the LTV-ratio (Qi and Yang, 2009) and volatility of

income, and typically decreases in wealth as those households are better able to sustain an adverse shock and self-insure. Furthermore, we control in the regression for gender, age, level of education, marital status, household composition, region, and year effects through the inclusion of dummy variables. We include the mortgage balance as a proxy for the price of the policy and add dummies for the type of originator to control for supply side heterogeneity.[63] All models are estimates using household-weights to ensure representativeness for the population and report heteroskedasticity robust standard errors.

5.4.1 Mortgage insurance adoption

Table 5.3 shows evidence in favor of our hypothesis that overconfidence (Model (1)) and spending propensity (Model (2)) reduce the likelihood of mortgage insurance adoption. Moreover, Model (3) reveals, perhaps not surprisingly, that both measures are separate explanations for mortgage insurance adoption. However, we find as hypothesized that they both influence the decision in the same direction and that both have an economically sizeable effect. A one standard deviation increase in household overconfidence (spending propensity) decreases the likelihood of insurance by 11 percent (12.7 percent).

Again, similar to Table 5.2, many control-variables are insignificant, but the multiple F-test at the bottom of Table 5.3 confirms that their explanatory power is jointly significant. Risk aversion is insignificant in all models, raising concerns that the measure might not adequately elicit the true risk aversion parameter of the household. Guiso and Sodini (2012) review the literature and compare whether qualitative and quantitative risk preference measures yield similar results. They conclude that both have predictive power for financial choices.

[63] In the Netherlands, mortgage lending is highly concentrated within banks, with the 5 largest banks accounting for over 80 percent of the mortgage market.

Table 5.3 ■ Insurance adoption and the impact of overconfidence

This table shows results for a logit-model. Panel A includes only mortgage and demographic characteristics, while Panel B augments the model with confidence measures. Data are from the DNB Household Survey and cover mortgages eligible for insurance originated between 1995 and 2009 except Model (7) which includes observations from 1998 or later. Robust t-statistics are reported in brackets. ***,**,* indicates significance at the 1%, 5% and 10% level respectively. Variable definitions are contained in Table II.1 in Appendix I.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Dependent variable: mortgage insurance (1 = yes)						
Overconfidence	-0.217**		-0.253**	-0.244**	-0.231**	-0.210*	-0.191*
	[-2.18]		[-2.41]	[-2.32]	[-2.07]	[-1.84]	[-1.65]
Spending propensity		-0.091*	-0.099*	-0.102*	-0.180***	-0.191***	-0.204***
		[-1.68]	[-1.71]	[-1.73]	[-2.65]	[-2.74]	[-2.83]
Mortgage balance					-0.293*	-0.302*	-0.227
					[-1.77]	[-1.79]	[-1.28]
Originator: bank						-0.218	-0.194
						[-1.36]	[-1.19]
Originator: insurer						-0.427	-0.376
						[-1.35]	[-1.13]
Risk aversion	0.012	0.008	0.004	0.006	0.005	0.004	0.0024
	[1.25]	[0.90]	[0.40]	[0.54]	[0.42]	[0.35]	[0.20]
Interest-rate	0.053	0.094	0.114*	0.123*	0.085	0.066	0.085
	[0.83]	[1.44]	[1.72]	[1.85]	[1.11]	[0.83]	[1.04]
LTV-ratio	1.690***	1.528***	1.847***	2.007***	2.415***	2.303***	2.279***
	[5.68]	[4.87]	[5.69]	[6.04]	[5.99]	[5.71]	[5.54]
Interest-only mortgage	-0.840***	-0.851***	-0.867***	-0.850***	-0.819***	-0.837***	-0.874***
	[-4.98]	[-5.15]	[-4.85]	[-4.78]	[-4.18]	[-4.26]	[-4.37]
Endowment mortgage	0.175	0.021	0.025	0.055	0.366	0.398	0.371
	[0.79]	[0.10]	[0.10]	[0.23]	[1.33]	[1.44]	[1.35]
Retired	-0.204	-0.031	-0.051	-0.042	-0.089	-0.036	-0.021
	[-0.79]	[-0.12]	[-0.19]	[-0.15]	[-0.28]	[-0.11]	[-0.06]
Self employed	0.223	0.433	0.217	0.286	0.470	0.466	0.535
	[0.48]	[0.97]	[0.45]	[0.58]	[0.90]	[0.88]	[0.99]
Higher vocational	0.193	0.118	0.190	0.246*	0.462***	0.495***	0.420**
	[1.38]	[0.86]	[1.30]	[1.66]	[2.69]	[2.82]	[2.31]
University	-0.416**	-0.298	-0.365*	-0.311	0.0688	0.102	0.122
	[-2.06]	[-1.55]	[-1.67]	[-1.41]	[0.28]	[0.40]	[0.48]
Male	-0.085	-0.222	-0.180	-0.142	-0.273	-0.295	-0.369
	[-0.36]	[-0.97]	[-0.74]	[-0.57]	[-1.03]	[-1.09]	[-1.32]
Married	-0.446**	-0.525***	-0.466**	-0.490**	-0.543***	-0.487**	-0.463**
	[-2.40]	[-2.89]	[-2.40]	[-2.46]	[-2.59]	[-2.30]	[-2.12]
Age	-0.018**	-0.026***	-0.024***	-0.023***	-0.031***	-0.033***	-0.032***
	[-2.44]	[-3.56]	[-2.97]	[-2.87]	[-3.49]	[-3.50]	[-3.28]
Children	-0.042	0.014	-0.032	0.019	0.171	0.189	0.098
	[-0.27]	[0.09]	[-0.19]	[0.11]	[0.89]	[0.96]	[0.49]
Median income	-0.503***	-0.370**	-0.545***	-0.556***	-0.707***	-0.738***	-0.744***
	[-3.24]	[-2.42]	[-3.25]	[-3.30]	[-3.77]	[-3.86]	[-3.75]
Double median income	-1.006***	-0.922***	-1.015***	-0.994***	-1.234***	-1.157***	-0.866**
	[-3.49]	[-3.16]	[-3.32]	[-3.23]	[-3.43]	[-3.13]	[-2.23]

Table 5.3 continued

Wealthquartile 2	-0.227	0.091	-0.096	-0.110	-0.025	0.026	0.180
	[-0.79]	[0.34]	[-0.32]	[-0.36]	[-0.07]	[0.07]	[0.49]
Wealthquartile 3	0.379*	0.547***	0.294	0.303	0.455*	0.455*	0.585**
	[1.74]	[2.94]	[1.26]	[1.28]	[1.75]	[1.69]	[2.05]
Wealthquartile 4	0.275	0.528***	0.263	0.290	0.310	0.355	0.465
	[1.24]	[2.81]	[1.12]	[1.23]	[1.21]	[1.33]	[1.63]
Constant	-1.617**	-2.477**	-1.795**	-2.130**	-0.257	1.214	0.611
	[-2.05]	[-2.23]	[-2.09]	[-2.36]	[-0.18]	[0.91]	[0.46]
Yeardummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region controls	No	No	No	Yes	Yes	Yes	Yes
Number of observations	1663	1788	1543	1539	1313	1278	1206
Pseudo-R2	0.146	0.144	0.154	0.160	0.202	0.205	0.207
Log-Likelihood	-851.7	-897.5	-777.5	-767.9	-612.3	-593.9	-560.1
Chi2-statistic	201.8	220.6	205.1	220.5	239.0	235.4	229.3
Joint test control variables (p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000

However, households face other non-insurable background risks such as health and income risk that can affect their risk aversion (Guiso *et al.,* 1996). Risk aversion might therefore be collinear with age and employment status leading to the insignificance. If these variables proxy for health and income risk, we expect risk aversion to become significant once we exclude them. Unreported results show that this is not the case. Risk aversion is marginally significant with the expected sign if the overconfidence proxies are excluded.

In line with common intuition, we find that the LTV-ratio has a positive and highly significant effect on insurance adoption. Mortgage insurance becomes more valuable when more debt is taken out keeping the amount of collateral constant. The negative effect of the interest-only dummy reflects that those mortgages are not always eligible for insurance (see Section 5.2.2).[64]

We also find a negative age effect, consistent with older households having smaller mortgages and having accumulated more wealth and home equity. Moreover, married households are less likely to insure their mortgage despite the divorce risk. However, these couples also enjoy diversification of unemployment risk and higher levels of income, thereby reducing the need for insurance.[65] We examine this income diversification hypothesis in more detail in Section 5.4.2. The net worth of households is generally insignificant, except for Model (2), where households in the second and third wealth quartile were found more likely to insure. This seems counterintuitive assuming that wealthier households can take more risks

[64] Hybrid mortgages are reported as two separate mortgages in the survey. Mortgages are classified by type based on the type reported for the first mortgage, which can be an interest-only mortgage.
[65] The average difference in annual household income between singles and couples in our sample is 3000 euro.

themselves. However, if wealthy households have other risky assets in their portfolio *besides* their property (Guiso and Sodini, 2012; Campbell, 2006), than mortgage insurance can serve as a cheap external alternative to hedge part of the overall risks (Grace *et al.,* 2004).

Heterogeneity in local conditions such as for example price appreciation- and unemployment rates are found to affect the probability that default occurs (Archer *et al.,* 2002) and can therefore alter the insurance decision. We include region dummies in Model (4) to test for this effect, but find that the (unreported) coefficients are insignificant and the main results unchanged.

Finally, we include the initial mortgage balance in Model (5) as a proxy for the before-tax cost of insuring. We further append the specification with two dummies for the type of originator of the mortgage (reference group is 'other originators' which are primarily pension funds) to examine the impact of supply factors (Model (6)).[66] In Model (7) we analyze only post-1998 observations to account for low general awareness during the earlier years the policy was available. All these extensions leave our main results unchanged, but we do find that adoption rates decrease as insurance premiums increase (Model (5)).

In Table 5.4, we continue by analyzing whether new entrants to the homeownership market – defined as households that did not own their previous house – affect our results.[67] A negative sign for new entrants is indicative that they are either unaware of the risk or of the existence of mortgage insurance, compared to experienced households. If new entrants hold an undiversified portfolio tilted towards real estate, a positive effect may be expected if they insure their exposure to real estate. Model (1) includes a dummy for new entrants and an interaction term with overconfidence (Panel A) and spending propensity (Panel B), but none of these hypotheses receives empirical support. In unreported analysis, we find that these results are also robust to multicollinearity with respect to age.

[66] We also estimated the models with lender fixed-effects which is a more refined control for the supply side, but our results are unaffected to this alternative specification.

[67] This excludes the possibility that the household switches from homeownership to renting and subsequently back to homeownership. However, households in the Netherlands are very unlikely to be active in the rental market again, once they become homeowners.

Table 5.4 ■ Analysis of insurance adoption

This table shows estimation results for the logit-model. 'New entrant' is a dummy variable equal to 1 if the household if new on the homeownership market. 'Price expectations' is a dummy variable equal to 1 if the household expects that his/her property will appreciate over the next two years. Panel A shows results for overconfidence (OC), Panel B for spending propensity (SP) and Panel C for both measures. Data are from the DNB Household Survey and cover mortgages eligible for insurance originated between 1995 and 2009. Constant term is included but not reported. Robust t-statistics are reported in brackets. ***,**,* indicates significance at the 1%, 5% and 10% level respectively. Variable definitions are contained in Table II.1 in Appendix II.

Panel A model with Overconfidence

	(1)	(2)	(3)	(4)
	Dependent variable: mortgage insurance (1 = yes)			
Overconfidence	-0.253**	-0.446	-0.212**	-0.247**
	[-2.37]	[-1.40]	[-2.13]	[-1.98]
New entrant	0.157			
	[0.73]			
New entrant*OC	0.398			
	[1.31]			
Male*OC		0.261		
		[0.78]		
Married*Male			0.816	
			[1.30]	
Price expectations				-0.262
				[-1.50]
Control variables (see Table 5.3)	Yes	Yes	Yes	Yes
Number of observations	1659	1659	1659	1155
Pseudo-R2	0.151	0.150	0.150	0.170
Log-Likelihood	-842.3	-843.3	-842.8	-591.8
Chi2-statistic	211.1	211.5	212.0	191.9

Panel B model with Spending propensity

	(1)	(2)	(3)	(4)
	Dependent variable: mortgage insurance (1 = yes)			
Spending propensity	-0.089*	-0.337**	-0.104*	-0.091
	[-1.88]	[-2.27]	[-1.87]	[-1.38]
New entrant	-0.208			
	[-0.27]			
New entrant*SP	-0.076			
	[-0.50]			
Male*SP		0.272*		
		[1.71]		
Married*Male			0.746	
			[1.18]	
Price expectations				-0.249
				[-1.51]
Control variables (see Table 5.3)	Yes	Yes	Yes	Yes
Number of observations	1783	1783	1783	1213
Pseudo-R2	0.148	0.149	0.148	0.164
Log-Likelihood	-887.9	-886.8	-887.6	-616.0
Chi2-statistic	230.2	230.1	230.9	195.5

Table 5.4 continued

Panel C model with Overconfidence and Spending propensity				
	(1)	(2)	(3)	(4)
	Dependent variable: mortgage insurance (1 = yes)			
Overconfidence	-0.244**	-0.244**	-0.250**	-0.275**
	[-2.32]	[-2.31]	[-2.37]	[-2.11]
Spending propensity	-0.102*	-0.102*	-0.108*	-0.100
	[-1.73]	[-1.73]	[-1.82]	[-1.40]
New entrant		0.159		
		[0.71]		
Married*Male			0.941	
			[1.48]	
Price expectations				-0.252
				[-1.41]
Control variables (see Table 5.3)	Yes	Yes	Yes	Yes
Number of observations	1539	1539	1539	1088
Pseudo-R2	0.160	0.160	0.161	0.176
Log-Likelihood	-767.9	-767.6	-766.9	-548.6
Chi2-statistic	220.5	221.4	224.3	188.3

As argued in Section 5.3.2, evidence suggests that men and women exhibit different degrees of overconfidence, with men being more overconfident on financial decision tasks. To test this hypothesis, Model (2) in Table 5.4, includes an interaction term between gender and overconfidence (Panel A) and spending propensity (Panel B), but no evidence is found that the effect of overconfidence is larger for a male decision maker. The marginal effect of spending propensity is about one fifth in size for males (-0.065 = -0.337 + 0.272) compared to females (-0.337).

In Table II.2 of Appendix II (Section 5.7), we rerun the analysis for gender-based subsamples. The coefficients indicate that among men overconfidence is significant in decision making, while for women the spending-measure is significant. These results might be indicative of different 'money'-styles between men and women (Prince, 1993). However, one should not read too much in the results for the female subsample because of the low number of observations. Future research could shed more light to what extend decisions are affected by gender-based differences, because the evidence so far is not conclusive (see also Deaves *et al.,* 2005).

It is also conceivable that couples influence each other's financial decisions, thereby reducing the explanatory power of individual traits in the decision making process. Barber and Odean (2001) argue, assuming gender being a reasonable proxy for overconfidence, that married males should be less affected by overconfidence then single men. We test for this effect by including an interaction

term between gender and marital status but, although it has the expected sign, it is insignificant in all specifications (Model (3)).

Finally, we consider the impact of price expectations on mortgage insurance adoption. Decision makers that expect property prices to increase, expect a lower risk of becoming underwater. Model (4) in Table 5.4, includes a dummy variable that takes the value of one if the household expects their property to appreciate in value over the next two years and zero otherwise (see Appendix I for the original survey question). Although having the expected negative sign, the effect of the expectation variable is insignificant in all models.

5.4.2 Robustness checks

In this section we analyze the sensitivity of the results to alternative specifications of our model. The decision to insure a risk is depending on the household's exposure to it. Therefore, we examine the sensitivity to alternative risk proxies in Table 5.5. The loan-to-value ratio measures the amount of debt relative to the underlying collateral, but is not necessarily a good indicator of risk if it is a high-income household (Archer *et al.,* 2002) or one with a well-diversified portfolio.

We define two alternative risk indicators based on income: the loan-to-income ratio (LTI) and debt-coverage-ratio (DSR). LTI is measured as size of mortgage divided by yearly income, while DSR is defined as mortgage expenses over income. Both measure the affordability of the mortgage for households, by taking into account the income available to serve mortgage obligations. Replacing the LTV-ratio by the LTI-ratio in Model (1) or DSR in Model (2) does not materially alter previously reported results: overconfident households are still less likely to insure although the effect is only marginally significant. Spending propensity loses significance in the presence of income-based risk proxies. The coefficients on LTI/DSR ratios have the proper sign: an increase in mortgage obligations relative to income raises the likelihood of obtaining mortgage insurance.

From a diversification perspective, we expect that higher relative exposure to real-estate risk increases the likelihood of insuring. Therefore we compute a 'mortgage-wealth'-ratio defined as mortgage debt to net worth plus mortgage debt. A value equal to one indicates that the household's portfolio consists entirely out of real estate (mortgage debt) and a value close to zero implies that there are substantial amounts of other assets. We use the mortgage liability instead of the property value because the mortgage liability is the exposure covered by mortgage

insurance. Model (3) shows that including this proxy does not lead to different conclusions with respect to the overconfidence effect. The mortgage-wealth ratio has the expected sign as households with more real estate assets are more likely to have mortgage insurance..

We also add alternative proxies for (future) income-risk and income diversification. A permanent employment contract increases income stability as termination of a permanent employment contract is costly to employers. Households where one or both of the spouses have a permanent contract are less likely to face adverse income shocks and have greater certainty about their future income path, thereby reducing the need to purchase mortgage insurance. In Model (4) of Table 5.5 we include a dummy equal to one if the respondent has a permanent employment contract. The results show that this variable has little effect in explaining insurance decisions. Our overconfidence hypothesis continues to receive empirical support, while the spending variable becomes marginally insignificant. This latter result is expected as spending and savings behavior are correlated to expectations about future income and the volatility thereof. Model (5) includes a dummy equal to one if also the respondent's spouse has paid employment. This dummy captures the diversification of income risk as it is less likely that both partners lose income at the same time, but we do not find that this materially affects our result.

Finally, we examine how robust our results are against the inclusion of control variables for marital stability. In Model (6) we control for the number of years the households has been married while in Model (7) we include dummy variables for the number of children living at home. It is argued that both longer marriages and having more children raise the stakes of getting divorced. A divorce normally leads to a loss of income and can trigger payment problems. Hence, we expect that lower divorce risk creates lower demand for mortgage insurance, and this is indeed what our results suggest. Note that we exclude the respondents age in Model (6) to avoid multicollinearity

Table 5.5 ■ Robustness analysis of insurance adoption

This table contains robustness analysis for the insurance adoption model. 'Loan-to-income' ratio is measured as total mortgage debt over yearly household income (Model 1). 'Debt-service ratio' is defined as yearly mortgage payments over household income (Model 2). 'Mortgage-wealth-ratio' is defined as mortgage debt over net wealth plus mortgage debt (Model 3). 'Permanent contract' is a dummy that takes the value 1 if the respondent has a permanent employment contract (Model 4). 'Spouse income' is a dummy that takes the value 1 if the respondent's spouse has paid employment (Model 5). 'Years being married' is measured as the survey-year minus the year of marriage (Model 6). The children dummies indicate the number of children that are living at home (Model 7). The data are from the DNB Household Survey and cover mortgages eligible for insurance originated between 1995 and 2009. Constant term is included but not reported. Robust t-statistics are reported in brackets. ***,**,* indicates significance at the 1%, 5% and 10% level respectively. Variable definitions are contained in Table II.1 in Appendix II.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Dependent variable: mortgage insurance (1 = yes)						
Overconfidence	-0.198*	-0.195*	-0.186*	-0.178*	-0.241**	-0.500***	-0.241**
	[-1.86]	[-1.80]	[-1.69]	[-1.72]	[-2.31]	[-3.15]	[-2.28]
Spending propensity	-0.081	-0.067	-0.168**	-0.072	-0.102*	0.022	-0.103*
	[-1.38]	[-1.14]	[-2.57]	[-1.25]	[-1.75]	[0.28]	[-1.76]
Loan-to-income-ratio	0.038						
	[0.79]						
Debt-service-ratio		1.050					
		[1.63]					
Mortgage-wealth-ratio			0.549				
			[1.22]				
Permanent contract dummy				0.160			
				[0.91]			
Spouse income dummy					0.167		
					[1.15]		
Years being married						-0.043***	
						[-3.27]	
Dummy # of Children = 1							0.052
							[0.22]
Dummy # of Children = 2							0.214
							[1.09]
Dummy # of Children = 3							-0.512*
							[-1.76]
Dummy # of Children >= 4							-0.507
							[-0.57]
Control variables (see Table 5.3)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	1460	1449	1313	1539	1539	957	1539
Pseudo-R2	0.131	0.130	0.173	0.137	0.157	0.197	0.163
Log-Likelihood	-746.8	-734.7	-634.7	-788.5	-770.2	-417.5	-764.2
Chi2-statistic	192.4	183.2	223.1	208.2	219.6	153.5	229.8

We construct our measure for overconfidence as the residual of a regression explaining self-assessed financial literacy. Therefore we now examine the sensitivity of the results against alternative specifications for this regression model.[68]

[68] We also replicated all analysis in this paper using residuals obtained from an ordered-logit model. In general our results remain similar, and in some cases become even stronger compared to the OLS-results.

Table 5.6 ■ Analysis of alternative specifications for financial knowledge

This table shows results for first stage OLS regressions explaining the self-assessment of financial knowledge by households. Robust t-statistics are reported. ***,**,* indicates significance at the 1%, 5% and 10% level respectively. Data are from the DNB Household Survey and cover mortgages eligible for insurance originated between 1995 and 2009. Variable definitions are contained in Table II.1 in Appendix II.

	(1)	(2)	(1)	(2)
	Dependent variable: Self-assessed financial knowledge			
	Coefficients		*t*-values	
Age	-0.031***	-0.012***	[-4.08]	[-8.04]
Age^2	0.001***		[2.69]	
Household income	-4.206***		[-3.33]	
Household income^2	0.209***		[3.40]	
Peers income 16K-28K		0.097		[1.15]
Peers income >28K		0.047		[0.51]
Peers highschool		0.183***		[3.31]
Peers college/university		0.165**		[2.50]
Holding financial assets	0.300***	0.283***	[9.25]	[7.07]
Self employed	0.070	0.062	[0.56]	[0.39]
Higher vocational	0.027	0.011	[0.85]	[0.25]
University	0.019	-0.029	[0.44]	[-0.46]
Married	0.033	0.06	[0.73]	[1.09]
Children	-0.111***	-0.104**	[-3.19]	[-2.36]
Median family income		0.004		[0.12]
Double median income		0.168**		[2.05]
Wealthquartile 2	0.031	0.049	[0.57]	[0.64]
Wealthquartile 3	0.002	0.079	[0.05]	[1.34]
Wealthquartile 4	0.034	0.135**	[0.77]	[2.26]
Constant	24.03***	2.032***	[3.71]	[11.70]
Yeardummies	Yes	Yes		
Number of observations	2252	1397		
Adjusted R2	0.094	0.111		

In Model (1) of Table 5.6, we include continuous measures and second-order polynomials for income and age. Financial literacy might be a non-linear function of age and income, for example because literacy increases at a decreasing rate with age due to cognitive aging (Korniotis and Kumar, 2011). The results in Model (1) lend some support for this explanation although the first order coefficient for age is insignificant. The coefficients for income are a bit puzzling: the first order effect of income is negative while the second order effect is positive. This seems to suggest that financial literacy is a decreasing function of income, inconsistent with prior findings.

Table 5.7 ■ Analysis using alternative overconfidence measures

This table shows results for a logit-model. The confidence measures are obtained as the residual of the regressions of Model (1) and (2) in Table 5.6. Data are from the DNB Household Survey and cover mortgages eligible for insurance originated between 1995 and 2009. Constant term is included but not reported. Robust t-statistics are reported in brackets. ***,**,* indicates significance at the 1%, 5% and 10% level respectively. Variable definitions are contained in Table II.1 in Appendix II.

	(1)	(2)	(3)	(4)
	Dependent variable: mortgage insurance (1 = yes)			
Overconfidence Alt. 1	-0.214**	-0.249**		
	[-2.14]	[-2.36]		
Overconfidence Alt. 2			-0.225*	-0.247**
			[-1.94]	[-2.11]
Spending propensity		-0.100*		-0.150**
		[-1.71]		[-2.21]
Control variables (see Table 5.3)	Yes	Yes	Yes	Yes
Number of observations	1663	1543	1118	1109
Pseudo-R2	0.146	0.154	0.124	0.126
Log-Likelihood	-851.8	-777.6	-594.9	-587.1
Chi2-statistic	202.8	205.6	142.2	140.3

One explanation for this effect is that households assess their financial knowledge with respect to different categories of financial products. For example: lower-income households rate their knowledge as being high because they only consider mortgage products and no other financial assets such as stocks and bonds. Higher-income households rate their knowledge lower because they are aware of their limited knowledge with respect to other financial assets (e.g. stocks). This difference leads to a lowering of their rating relative to the low-income group.

Financial literacy of households can also be affected through interaction with peers, defined as close friends of the household, because they can learn from them or copy their actions. In Model (2) of Table 5.6, we include measures for education and income levels of peers (reference categories are education below the high-school level and income below 16.000 euro per year) to proxy for their level of financial sophistication. The coefficients indicate that peer-education has indeed a significant effect on self-assessments while proxies for the income of peers are insignificant. This is indicative of a spill-over effect from the peer's education level to the respondent's self-assessed knowledge.

Table 5.7 presents second stage results for the first (second) overconfidence alternative in Model (1) and (2) (Model (3) and (4)), but all coefficients for overconfidence and spending propensity remain similar in sign, size and significance.

5.4.3 Alternative explanations

This section tests for a number of alternative hypotheses that are consistent with our findings. First, households that face complex financial decisions are likely to seek advice prior to or during the purchase of a financial product (Bhattacharya *et al.*, 2012; Hackethal *et al.,* 2012). If financial advice alters household behavior than omitting financial advice from the model biases the results. This option is examined in Table II.3 (contained in Section 5.7, Appendix II). It is important to note that advisors do not receive (additional) compensation for selling *insured* mortgages. The financial advisor can create awareness of the insurance product and correct biases in risk assessments of households. However, reception of (credible) advice might also enforce overconfidence of households if it confirms their prior thoughts (e.g. confirmation bias) (Willis, 2008). Model (1) to (3), reveal that there is a negative effect of financial advice on the likelihood of insurance adoption. If an advisor corrects a biased risk assessment of a household than a positive effect is expected, but it is possible that advisors were as unaware of the risks in the housing market as the households they advised. Another explanation is that households fail to act according to what is advised to them because of a lack of trust (Bhattacharya *et al.*, 2012), or because they think that the policy being sold to them is overpriced. We lack data to examine which of these alternative hypotheses holds, but our results are robust against inclusion of the advisor. Moreover, we do not find that financial advisors alter the effect of overconfidence as the interaction terms in Model (4) and (5) are insignificant.

In Section 5.4.2, the education level of peers was found to affect self-assessed financial knowledge. It is also conceivable that the interaction with peers affects the decision making directly (see Hong *et al.,* 2004). In Table II.4 of Appendix II, we show that this is not the case and although we do not directly observe whether the household's peer is a homeowner, it is documented that both income and education are positively related to homeownership (Lauridsen and Skak, 2007). Combining the result of Table 5.6 and Table A.4 suggests that learning from peers influences the perceived level of financial knowledge rather than the decision process directly. However, the exact role of peer interaction in decision processes asks for additional research.

We continue by examining the financial situation of the household and its perception thereof on the insurance decision. We test for financial literacy (Van Rooij *et al.,* 2011), precautionary savings motives (Dynan, 1993), liquidity constraints (Cole *et al.,* 2012), industry of employment (Grinblatt and Keloharju, 2009), and perceived control over future outcomes (Goetzmann and Kumar, 2008;

Baumann and Sims, 1978) in Table II.5. All of these factors are potential explanations for insurance adoption. We use the fitted value of the regression in Table 5.2 as a proxy for financial literacy in Model (1) of Table II.5 but find no significant result. In Model (2) we include a proxy for precautionary savings motives. However, overconfident households still remain less likely to insure, although spending propensity becomes insignificant. This result is not surprising as spending propensity and precautionary savings are two sides of the same coin.[69] The current liquidity position might be an important consideration in financial decision making if decision-makers are primarily concerned with the present. Inclusion of a dummy variable that equals 1 if the current budget-situation of the household is tight (e.g. if it is liquidity-constrained) and zero otherwise does not affect our previous findings as is shown in Model (3) (see the Appendix, Section A for the exact questions). Similarly, we do not find support that perceived control over future outcomes in Model (4) and (5) affects mortgage insurance decisions. It should be noted that statistical power is weakened by the reduced sample size.

Finally, we consider whether the industry where the respondent is occupied matters. Employment in the financial sector can increase risk awareness and familiarity with financial products. We determine the sector of employment based on the pension fund in which the respondent participates, since this choice is not voluntary in the Netherlands. A dummy variable equal to one is included in the regression if a respondent participates in a bank's pension fund and zero otherwise.[70] The inclusion of this dummy is insignificant and leaves our main results quantitatively and qualitatively unchanged: confident households and those with a higher inclination towards spending are still less likely to insure their mortgage irrespective of being employed in the financial industry. Again our sample decreases significantly, thereby reducing statistical power.

5.5 Conclusion

We analyze the demand for mortgage insurance. Mortgage insurance covers wealth risks from mortgage-financed homeownership. These risks emerge when households are liable for repayment of a shortfall in case of default. We document

[69] The question for precautionary savings puts emphasis on the motive to save for future unforeseen events. This also implicitly captured by the spending-measure, but its more aggressive wording makes it a better proxy to elicit confidence. Including both measures separately yields significant results consistent with expectations.

[70] Unfortunately, we do not observe data for employment in other sectors of the financial industry such as insurers and brokers.

that overconfidence is able to explain adoption rates. Overconfidence biases a household's risk assessment and reduces the likelihood that it takes precautionary action. The effect is sizeable as a one standard deviation increase in overconfidence decreases the likelihood of mortgage insurance adoption by 11 to 13 percent. Our results are robust against various functional forms and alternative explanations.

The implications of the results in this paper are twofold. From an academic perspective, one could argue that households should receive more information or education on financial matters. This is intended to raise risk awareness and reducing overconfidence thereby enabling them to make informed (insurance) decisions. However, the effectiveness of such a policy is debatable when households have limited capability to process information (Willis, 2008). Moreover, the precise influence of peers and financial advisors on the decision process asks for additional research. Understanding these issues is much needed as the responsibility for financial planning and decisions is increasingly delegated to households with governments reducing their intervention in retail markets. The increasing availability of panel data and the development of protocols to measure behavior allow for more insights in the decision process of households.

From a practical perspective, our results provide input to the question whether policy makers should make mortgage insurance mandatory. In the aftermath of the crisis, adoption rates in the Netherlands rose to levels over 90 percent in 2011. Financial regulators started warning originators for being too generous in their underwriting behavior for mortgages. Consumer authorities are worried about the financial risks many households face, because of their debt overload. Apparently, the wake-up call caused by deteriorating (housing) market conditions proved to be an important trigger for both households and originators to demand and/or require insurance. This also points to a limitation of our study, as our data covers large a stable or booming housing and labor market. The changing economic prospects altered the interplay between the supply and the demand side of the mortgage insurance market. As mentioned before, since 2011 the supply-side is predominantly affecting insurance adoption rates as lenders started requiring it. This indicates that the behavioral explanations provided in this paper are only part of the story and that the policy recommendations are dependent on the economic climate and institutional background.

This brings us to a question that remains open: do households and mortgage originators collectively default towards non-insurance again in stable economic times? If this is the case, than the government could enforce it as an industry standard in mortgage lending (as in the U.S.) through the bodies that oversee and regulate the financial markets. Another way to raise adoption-rates is selling

insurance policies in bundles. However, cross-selling is prohibited in many countries including the Netherlands, thereby making this strategy infeasible. It also impedes the freedom of households to purchase insurance products on a stand-alone basis thereby tailoring their insurance-portfolio to their own needs and risk preferences.

Finally, we analyze insurance behavior in a unique setting. Besides the many advantages that it has for our study, one can argue to what extend our results generalize to other contexts and insurance products. Given the limited amount of survey evidence and heterogeneity in insurance products and markets, this question is largely an empirical one. Compared to the documented behavior of households with respect to insuring for disaster-type (flood and earthquake insurance) and income risks (see Cole *et al.,* 2012), it seems that the adoption of mortgage insurance is affected in a similar way due to similar reasons. Consequently, we expect our results to generalize to different policies in a context where the decision to insure is voluntary and where pricing of the policy is actuarially fair.

5.6 Appendix I Data description

Self-assessed financial knowledge
Statement:
"How knowledgeable do you consider yourself with respect to financial matters?"

Answer scale:

1. *not knowledgeable*
2. *more or less knowledgeable*
3. *knowledgeable*
4. *very knowledgeable*

Spending propensity
Statement:
"Some people spend all the money that they receive. Other people want to have some reserves. Can you indicate on a scale of 1 to 7 what you do with your money after you paid for food, rent and first necessities of life?"

Answer scale:

1	2	3	4	5	6	7
I want to save as much money as possible					*I want to spend all my money immediately*	

Holdings of financial assets
Questions:

1. *"Did you, on 31 December [year], have investments with MUTUAL FUNDS? Do not include investments in growth funds, investments (shares, bonds) in companies, or insured saving (i.e. saving through a life-insurance) here."*
2. *"Did you, on 31 December [year], have any BONDS and/or MORTGAGE BONDS? Do not include bonds through mutual funds here. These have already been reported on."*
3. *"Did you, on 31 December [year], own any SHARES? Do not include shares of your own private limited company here, nor bonds through MUTUAL FUNDS. These have already been reported."*
4. *"Did you, on 31 December [year], have one or more PUT-OPTIONS?"*
5. *"Did you have any written PUT-OPTIONS outstanding on 31 December [year]?"*

6. *"Had you, on 31 December [year], bought one or more CALL-OPTIONS, FALCONS, or WARRANTS?"*
7. *"Did you have any written CALL-OPTIONS, FALCONS or WARRANTS outstanding on 31 December [year]?"*

Answer scale for each item:
1 = yes, 0 = no

Risk Aversion
Statements:

1. *"I think it is more important to have safe investments and guaranteed returns, than to take a risk to have a chance to get the highest possible returns"*
2. *"I would never consider investments in shares because I find this too risky"*
3. *"If I think an investment will be profitable, I am prepared to borrow money to make this investment"*
4. *"I want to be certain that my investments are safe"*
5. *"I get more and more convinced that I should take greater financial risks to improve my financial position"*
6. *"I am prepared to take the risk to lose money, when there is also a chance to gain money"*

Answer scale for each item:

1	2	3	4	5	6	7
Totally disagree					*totally agree*	

House price expectations
Statement:

"Do you expect your own house to increase, decrease or remain stable in value, the next two years?"

Answer scale:

1. *increase*
2. *stay more or less the same*
3. *decrease*
4. *don't know*

Financial Situation

Statement:

"How do you assess the financial situation of your household at the moment?"

Answer scale:

1. *debts are increasing*
2. *need to draw upon savings*
3. *it is just about manageable*
4. *some money is saved*
5. *a lot of money can be saved*

Locus of control

Statements:

1. *"Saving money and making thoughtful investments are the most important factors to become rich"*
2. *"The chance of me becoming rich is predominantly driven by my own skill"*
3. *"People who are careful with their financial situation are the ones who stay rich"*
4. *"Generally, it is my own fault if I become poor"*
5. *"I am normally capable of protecting my own interest"*
6. *"Whenever I got what I want, this is predominantly because I worked hard for it"*
7. *"My life is determined by my own actions"*
8. *"There is little one can do to protect himself against poverty"*
9. *"Becoming rich has nothing to do with being lucky"*
10. *"In monetary terms, there is not much you can do when you are poor"*
11. *"It is not also wise for me to save money, because a number of things has to do with (bad) luck"*
12. *"Becoming rich or poor is predominantly a matter of fate"*
13. *"Only those who inherit or win money can become rich"*

Answer scale for each item:

1 2 3 4 5 6 7

Totally disagree *totally agree*

5.7 Appendix II Additional analysis

Table II.1 ■ Control variables definitions

Variable name	Definition
Mortgage balance	The mortgage balance in Euros at time of origination
Originator: bank	Dummy equal to 1 if the mortgage lender is a bank
Originator: insurer	Dummy equal to 1 if the mortgage lender is an insurance company
Interest-rate	Yearly interest rate percentage at time of origination
LTV-ratio	Ratio of mortgage debt to property value at origination
Interest-only mortgage	Dummy equal to 1 if the mortgage is an interest-only type
Endowment mortgage	Dummy equal to 1 if the mortgage is an endowment type
New entrant	Dummy equal to 1 if the respondent has not owned his previous residence
Retired	Dummy equal to 1 if the respondent is retired
Self employed	Dummy equal to 1 if the respondent is self-employed
Higher vocational	Dummy equal to 1 if the respondent has completed higher vocational education
University	Dummy equal to 1 if the respondent has completed university education
Male	Dummy equal to 1 if the respondent is male
Married	Dummy equal to 1 if the repondent is married
Age	Age of the respondent in years
Children	Dummy equal to 1 if the respondent has one or more children
Below median income	Dummy equal to 1 if the annual household income is below the median household income
Median income	Dummy equal to 1 if the annual household income is between median and double median household income
Double median income	Dummy equal to 1 if the annual household income is more than twice median household income
Wealthquartile 1	Dummy equal to 1 if household wealth is in the first quartile of the distribution
Wealthquartile 2	Dummy equal to 1 if household wealth is in the second quartile of the distribution
Wealthquartile 3	Dummy equal to 1 if household wealth is in the third quartile of the distribution
Wealthquartile 4	Dummy equal to 1 if household wealth is in the fourth quartile of the distribution

Table II.2 ■ Insurance adoption analyzed by gender subsamples

This table shows results for a logit-model. Model (1) and (2) analyze the impact for the subsample of respondents that are male and Model (3) and (4) for females. Data are from the DNB Household Survey and cover mortgages eligible for insurance originated between 1995 and 2009. Robust t-statistics are reported in brackets. ***,**,* indicates significance at the 1%, 5% and 10% level respectively. Variable definitions are contained in Table II.1 in the Appendix.

	(1)	(2)	(3)	(4)
	Dependent variable: mortgage insurance (1 = yes)			
Overconfidence	-0.192*		-0.401	
	[-1.82]		[-1.27]	
Spending propensity		-0.052		-0.511**
		[-0.92]		[-2.45]
Risk Aversion	0.010	0.004	0.074*	0.090**
	[0.99]	[0.41]	[1.69]	[2.18]
Interest-rate	0.070	0.148**	-0.207	-0.245
	[1.04]	[2.21]	[-0.86]	[-1.15]
LTV	1.420***	1.216***	3.099***	3.298***
	[4.36]	[3.57]	[2.90]	[4.07]
Interest-only mortgage	-0.800***	-0.770***	-1.391*	-2.067***
	[-4.42]	[-4.30]	[-1.80]	[-2.58]
Endowment mortgage	0.220	0.084		
	[0.97]	[0.38]		
Retired	-0.252	-0.028	-1.070	-0.528
	[-0.91]	[-0.10]	[-1.03]	[-0.55]
Self employed	0.267	0.269		
	[0.58]	[0.60]		
Higher vocational	0.099	-0.017	1.172*	1.216**
	[0.67]	[-0.12]	[1.91]	[2.02]
University	-0.718***	-0.732***	3.793***	4.129***
	[-3.20]	[-3.36]	[3.21]	[4.19]
Married	-0.379*	-0.494**	-0.553	-0.450
	[-1.91]	[-2.53]	[-0.41]	[-0.29]
Age	-0.025**	-0.037***	0.047	0.055
	[-2.98]	[-4.44]	[1.26]	[1.47]
Children	-0.138	-0.095	-0.438	-0.262
	[-0.87]	[-0.61]	[-0.33]	[-0.18]
Median income	-0.582***	-0.512***	-0.227	-0.146
	[-3.45]	[-3.06]	[-0.48]	[-0.30]
Double median income	-0.989***	-0.929***		
	[-3.32]	[-3.09]		
Wealthquartile 2	-0.195	0.126	-1.253	-0.417
	[-0.64]	[0.44]	[-1.24]	[-0.47]
Wealthquartile 3	0.369	0.522***	0.166	0.845
	[1.59]	[2.62]	[0.18]	[0.96]
Wealthquartile 4	0.303	0.578***	0.270	1.087
	[1.29]	[2.91]	[0.31]	[1.30]
Constant	-1.620*	-1.731*	-5.315	-6.096***
	[-1.70]	[-1.71]	[-1.33]	[-2.75]
Yeardummies	Yes	Yes	No	No
Number of observations	1478	1572	176	208
Pseudo-R2	0.147	0.151	0.323	0.395
Log-Likelihood	-746.7	-766.9	-80.14	-84.8
Chi2-statistic	173.9	192.4	38.5	51.2

Table II.3 ■ Mortgage insurance adoption and the involvement of financial advisors

This table shows results for a logit-model. 'Financial advisor' is a dummy-variable equal to 1 if households make use of professional financial advisors in their decision making process. Model 4 and 5 contain interaction terms between Financial advisor (Fin. Adv) and Overconfidence (OC) and Spending propensity (SP) respectively. Data are from the DNB Household Survey and cover mortgages eligible for insurance originated between 1995 and 2009. Constant term is included but not reported. Robust t-statistics are reported in brackets. ***,**,* indicates significance at the 1%, 5% and 10% level respectively. Variable definitions are contained in Table II.1 in the Appendix.

	(1)	(2)	(3)	(4)	(5)
	Dependent variable: mortgage insurance (1 = yes)				
Overconfidence	-0.247**		-0.272**	-0.276**	
	[-2.35]		[-2.48]	[-2.23]	
Spending propensity		-0.135**	-0.123**		-0.115
		[-2.28]	[-2.05]		[-1.64]
Financial advisor	-0.331**	-0.289**	-0.359**	-0.324**	-0.628
	[-2.40]	[-2.11]	[-2.49]	[-2.34]	[-1.01]
Fin.Adv*OC				0.107	
				[0.45]	
Fin. Adv*SP					-0.066
					[-0.56]
Control variables (see Table 5.3)	Yes	Yes	Yes	Yes	Yes
Number of observations	1599	1611	1488	1599	1611
Pseudo-R2	0.149	0.146	0.157	0.149	0.146
Log-Likelihood	-821.2	-818.6	-754.8	-821.1	-818.4
Chi2-statistic	201.0	205.2	201.1	200.9	205.0

Table II.4 ■ Mortgage insurance adoption and peer effects

This table shows results for a logit-model. Peer income dummies measure the income position of the household's peers (Income <16K annually is the reference category) and peer education dummies measure the education level of the household's peers (Elementary school education is the reference category). Data are from the DNB Household Survey and cover mortgages eligible for insurance originated between 1995 and 2009. Constant term is included but not reported. Robust t-statistics are reported in brackets. ***,**,* indicates significance at the 1%, 5% and 10% level respectively. Variable definitions are contained in Table II.1 in the Appendix.

	(1)	(2)	(3)
	Dependent variable: mortgage insurance (1 = yes)		
Overconfidence	-0.229**	-0.244**	-0.249**
	[-1.98]	[-2.29]	[-2.13]
Spending propensity	-0.149**	-0.110*	-0.149**
	[-2.20]	[-1.85]	[-2.20]
Peers income 16K-28K	0.062		0.022
	[0.18]		[0.06]
Peers income >28K	0.040		-0.031
	[0.10]		[-0.08]
Peers highschool		0.187	0.368
		[0.88]	[1.50]
Peers college/university		0.242	0.394
		[0.99]	[1.38]
Control variables (see Table 5.3)	Yes	Yes	Yes
Number of observations	1109	1522	1109
Pseudo-R2	0.125	0.152	0.127
Log-Likelihood	-587.4	-768.3	-586.1
Chi2-statistic	140.9	200.7	142.2

Table II.5 ■ Alternative explanations for mortgage insurance adoption

This table shows results for a logit-model. 'Financial literacy' is the fitted value of the model in Table 5.2. 'Tight budget' and 'Finance professional' (FP) are dummy variables. Model 5 and 7 contain interaction terms between FP, Locus of control (LOC) and Overconfidence (OC) respectively. Data are from the DNB Household Survey and cover mortgages eligible for insurance originated between 1995 and 2009. Constant term is included but not reported. Robust t-statistics are reported in brackets. ***,**,* indicates significance at the 1%, 5% and 10% level respectively. Variable definitions are contained in Table II.1 in the Appendix.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Dependent variable: mortgage insurance (1 = yes)						
Overconfidence	-0.247**	-0.238**	-0.241**	-0.283	-0.241	-0.539*	-0.499*
	[-2.34]	[-2.25]	[-2.28]	[-1.62]	[-1.16]	[-1.90]	[-1.73]
Spending propensity	-0.105*	-0.090	-0.106*	-0.145	-0.147	-0.408**	-0.402**
	[-1.79]	[-1.51]	[-1.79]	[-1.55]	[-1.56]	[-2.30]	[-2.24]
Financial literacy (ŷ)	-0.509						
	[-1.02]						
Precautionary savings		0.056					
		[1.36]					
Tight budget			0.232				
			[1.26]				
Locus of control				-0.294	-0.288		
				[-1.20]	[-1.17]		
LOC*OC					-0.120		
					[-0.33]		
Finance professional						0.787	1.161
						[1.38]	[1.47]
FP*OC							-1.163
							[-0.87]
Control variables (see Table 5.3)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	1539	1536	1539	644	644	350	350
Pseudo-R2	0.160	0.161	0.161	0.168	0.169	0.273	0.274
Log-Likelihood	-767.4	-765.3	-767.1	-321.9	-321.9	-136.7	-136.4
Chi2-statistic	221.7	221.4	221.0	96.99	100.7	75.88	76.92

Chapter 6
Summary and Concluding Remarks

This dissertation contains four studies that cover aspects of homeownership in the Netherlands. We examine the effects of homeownership and the decision making process by households regarding mortgage type. Furthermore, the functioning of the mortgage origination process including the effect of brokers is studied. The last paper examines which factors characterize household demand for mortgage insurance. This dissertation distinguishes itself in that it provides empirical analysis for the Netherlands, as opposed to the existing empirical evidence which is largely based on the housing market in the United States.

In the first study (chapter two), we examine the rationale for stimulating homeownership from a socio-economic perspective. A large literature suggests that homeownership creates so-called 'positive externalities' leading to improvements in neighborhood safety, residential satisfaction and outcomes of children at school. Using a panel dataset over the period 2000-2008, we examine whether neighborhoods with high homeownership-levels in Rotterdam exhibit higher levels of safety and residential satisfaction. The results indicate that this is indeed the case, although it is recognized in the extant empirical literature (Haurin *et al.,* 2003) that these effects might be driven by endogenous selection of homeowners. That is, safer neighborhoods are more likely to attract prospective home buyers, rather than homeowners increasing the safety of the neighborhood. We use various techniques to examine the causal direction of the effect, including a difference-in-difference approach as well as dynamic panel data specifications, and find support for the proposition that homeownership induces positive effects. A natural follow-up question is whether these effects emerge regardless of the current homeownership-levels in the neighborhood. More specifically, we examine whether the size of these externalities diminishes once homeownership-levels come higher. Specifying external effects as a classical production externality, we find that marginal increases in neighborhood safety and satisfaction become very small once ownership levels reach levels around 55 percent. Our findings match prior findings

in the U.S. market, and provide insights for the redesign of housing market policies. The diminishing effects of homeownership question in which range homeownership subsidies are effective as opposed to direct investments in neighborhood safety and residential satisfaction. Moreover, negative effects of homeownership such as a reduction in labor market mobility are also documented. Fruitful directions for future study are a more in-depth examination of these negative externalities as well as the payoff of investing in rental stability. Furthermore, additional research in other markets is needed to shed more light on the importance of contextual factors such as cultural and institutional differences and the generalizability of the documented effects.

The second study (chapter three) examines the importance of risk aversion and financial literacy in the choice process for a mortgage type by households. Recent evidence shows that these factors have significant explanatory power for stock market participation of households (see Gerardi 2010a, Van Rooij *et al.*, 2011). Evidence with respect to the choice of mortgage type has not been provided yet, even though twice as many households are active on the housing market than in the stock market. In this study we fill this gap in the literature. Using an extensive Dutch panel data-set over the period 1994-2009, we examine the impact of financial literacy and risk aversion on the choice of mortgage type that households make. We report that households who are less risk-averse and those who are more literate are more likely to choose an interest-only mortgage. Because mortgages constitute a significant long-term financial obligation for households, it is likely that they rely on financial advice during the decision-making process. We examine whether advice received by acquaintances or professional financial advisors alters our main results, but the findings remain unchanged. It is also found that the presence of professional advisors increases the probability that households choose deferred amortization mortgages. This supports the idea that advisors can assist households in comparison shopping and maximizing the tax-benefits of interest deductibility through recommending alternative mortgage products. We test for other factors that might influence the decision process such as learning from peers, experience from prior homeownership, price expectations, availability of mortgage insurance and the financial position of the households. Our main findings are robust against all of these alternative explanations. Moreover, our results indicate that households who purchase alternative mortgage products are in general also more likely to have an understanding of these products. However, the data does not permit us to directly examine what households know with respect to mortgage products, which is an interesting path for future research. Also the exposition of product features is likely to be essential to create understanding among households of mortgage features. Interesting questions to explore in future

work are the marketing of financial products as well as the influence and effectiveness of financial education programs (Willis, 2008). Finally, our analysis provide input for the debate on the allocation of responsibilities between households, lenders and financial advisors.

The central question in the third study (chapter four) is concerned with the question whether there is evidence for a misalignment of interest between financial intermediaries and their clientele. Studies on the role of mortgage brokers in the U.S. show that the objectives of mortgage brokers and their clientele are not necessarily aligned. This occurs when they are not responsible for, or compensated conditional on loan performance. Moreover, commission-based pay can induce them to recommend and sell those products that are most profitable to them (Hassink and Van Leuvensteijn, 2010). There is, however, a counteracting force because credit risk exposure creates an incentive for the originator to monitor the underwriting behavior of intermediaries and screen applications. In the presence of reputation and credit risks, it is unlikely that they will employ different underwriting standards for credit that is originated through an intermediary compared to what they would originate directly (so-called direct-written). Using the loan-to-value and debt-service ratio as outcomes for the underwriting process, I indeed find that the general impact of intermediaries becomes insignificant once the model accounts for heterogeneity in underwriting among lenders. Moreover, no systematic violation of underwriting standards was found when intermediaries are involved in the origination process. Next, I examine whether the conflict is able to materialize if mortgages are insured without coinsurance between the lender and the insurer. This diminishes the incentives for lenders to monitor brokers and screen loan applications but I do not find evidence that lenders alter their screening standards. Consequently, there is no systematic effect of intermediaries on the outcome of the underwriting process. Proposals to alter the compensation structure of intermediaries, for example to hourly billing, are probably ineffective in reducing conflicting interests and come with their own incentive problems (Robinson, 2007). Also the effectiveness of broker regulation to avoid interest-misalignments has received mixed empirical evidence (Todd and Kleiner, 2007). The results indicate that the regulation of lenders is more important. Moreover, the current absence of coinsurance between the mortgage insurer and the lender, is a potential source of concern and warrants a change of the structure of the insurance contract. Directions for future research include an examination of the factors that determine whether households rely on intermediaries and to what extent these households act in accordance with their advisors recommendations (see Bhattacharya *et al.,* 2012).

In the final study of this dissertation (chapter five), I explore the determinants of mortgage insurance demand. Mortgage insurance covers repayment of mortgage principal in case that foreclosure proceeds are insufficient to cover the outstanding loan balance. In the Netherlands, mortgage insurance is provided by Nationale Hypotheek Garantie (NHG), which is well-known among Dutch homeowners. However, only 50 percent of the eligible mortgages are uninsured, despite the low cost of doing so. I use the DNB Household panel over the period 1995-2009 to examine which factors explain the insurance decision. Consistent with economic intuition, I find that adoption rates increase with the risk exposure of the household. I continue by examining whether decision-maker traits have explanatory power. Specifically, it is tested whether overconfidence can explain insurance adoption rates. The first overconfidence measure is constructed from a regression that explains self-assessed financial knowledge of the household based on observable determinants. It is universally documented that individuals tend to overestimate their own skills (Greenwald, 1980). Consequently, I argue that the under- and overestimation of the households financial knowledge, obtained as the residual of the regression, is correlated to the overconfidence trait. The second measure is based on savings propensity and is taken from survey data that questions to what extend the household is inclined to save money for future events. The findings indicate that a one standard deviation increase in overconfidence decreases adoption rates by 11 to 13 percent. However, in contrast to earlier findings, I do not find that the effect is different across gender (Barber and Odean, 2001). I test for an extensive array of alternative specifications and explanations, but find the main results to be unaffected. The findings provide a reason to change the default-option currently offered, in which households voluntary choose to insure, towards a mode in which mortgages are standard insured. Directions for future work include a more in-depth examination of how overconfidence develops over time in conjunction with the business cycle. Furthermore, Dutch households are in general risk-averse and tend to have many insurance policies. Additional research can explore in greater detail the importance of contextual variables on the households' willingness to insure, its risk-literacy and risk-attitude, and the way its insurance portfolio develops over time.

Samenvatting (Summary in Dutch)

De studies in dit proefschrift concentreren zich op de Nederlandse woning- en hypotheekmarkt en het gedrag dat de participanten in deze markten vertonen. Ondanks dat hier de afgelopen decennia een groot aantal onderzoeken naar verricht is, heeft het merendeel van deze studies de Verenigde Staten als basis voor de analyse. Ondanks dat een wetenschappelijke theorie universeel van aard poogt te zijn, is het aannemelijk dat de postulaten die voortkomen uit bestaand vastgoed-onderzoek niet per definitie één-op-één overdraagbaar zijn naar een andere context (Souza, 2005). Daarnaast is de afgelopen decennia, naar aanleiding van het werk door Daniel Kahneman en Amos Tversky (1979), een nieuwe stroom onderzoek binnen de economische wetenschap ontstaan die het handelen van actoren en hun besluitvorming vanuit een ander perspectief bekijkt. De gedragseconomie onderzoekt de psychologische aspecten van het menselijk handelen en is daarbij minder gericht op de vraag of dat handelen irrationeel is.

Het tweede hoofdstuk van dit proefschrift stelt ter discussie in hoeverre er positieve effecten – zogenoemde externaliteiten – van eigenwoningbezit zijn. De discussie omtrent de hypotheekrenteaftrek en hervormingen in de woningmarkt behoeft een antwoord op de vraag *waarom* eigenwoningbezit eigenlijk gestimuleerd zou moeten worden. Amerikaans bewijs toont aan dat eigenwoningbezit een positief effect heeft op de schoolprestaties van kinderen (Jensen en Harris, 2008) en dat huizenbezitters meer relaties onderhouden met de buurt (DiPasquale en Glaeser, 1999). Wij onderzoeken of buurten in Rotterdam veiliger zijn en of de buurttevredenheid in die wijken hoger is als het gevolg van het percentage eigenwoningbezit in die buurt. Een grote methodologische uitdaging in dit type onderzoek is of buurten veiliger worden omdat er huizenbezitters wonen of dat een huishouden ervoor kiest om een woning te kopen in een veiligere buurt. Uit onze resultaten blijkt dat de buurtveiligheid en buurttevredenheid significant positief samenhangen met het percentage eigenwoningbezit. Een stijging van het eigenwoningbezit in de wijk met 10 procent, hangt samen met een stijging in buurtveiligheid van 0.6 procent en in buurttevredenheid van 0.7 procent en blijkens onze analyses is dit effect causaal. Een natuurlijke vraag gegeven deze resultaten is

of meer altijd beter is: is stimulering van eigenwoningbezit altijd wenselijk en effectief of is dit effect afhankelijk van het huidige niveau van eigenwoningbezit in de wijk? De analyse van de relatie tussen eigenwoningbezit en externaliteiten duidt op het bestaan van een niet-lineair verband. Het effect op buurtveiligheid en –tevredenheid van een verhoging van het percentage eigenwoningbezit met 10 procent, wanneer het huidige niveau 5 procent is, is tweeënhalve keer zo groot, dan wanneer 50 procent van de huidige bewoners in de wijk al huiseigenaar is.

In het derde hoofdstuk wordt de hypotheekkeuze door consumenten aan de orde gesteld. De afgelopen twintig jaar is het aantal beschikbare hypotheekvormen aanmerkelijk gegroeid. Was voorheen de annuïteiten- of lineaire hypotheek de meest gangbare vorm, anno 2009 is meer dan 60 procent van de Nederlandse hypotheken een aflossingsvrije- of spaarhypotheek. Ondanks dat deze nieuwe hypotheekvormen voordelen bieden in termen van betaalbaarheid, zijn veel consumenten zich niet bewust van de risico's die deze producten met zich meebrengen zoals het restschuld-risico. De vraag die aldus in dit hoofdstuk centraal staat is wat de invloed van financiële deskundigheid en risico-aversie is op de hypotheekkeuze door huishoudens. Hierbij verlaten wij de literatuur die op basis van theoretische modellen de optimale hypotheekkeuze analyseert (Campbell en Cocco, 2003) en nemen het gedrag economisch perspectief. Op basis van een uitgebreide Nederlandse panel-dataset, laten de resultaten zien dat financiële kundigheid en risicoaversie significante verklarende factoren zijn in de hypotheekkeuze van huishoudens. Huishoudens die in een hogere mate risico-avers zijn en huishoudens met geringe financiële deskundigheid hebben een 55 tot 97 procent lagere kans om een aflossingsvrije hypotheek te kiezen. Omdat de hypotheek een verregaande en langdurige impact heeft op het financiële plaatje van het huishouden, is het aannemelijk dat advies wordt ingewonnen bij een hypotheekadviseur of familie. Uit de resultaten blijkt echter dat de gedragsfactoren een belangrijke factor blijven in hypotheekkeuze. We onderzoeken verder of hypotheekkeuze verklaard kan worden door eerdere ervaringen met eigenwoningbezit, verwachtingen met betrekking tot huizenprijzen, en de financiële situatie van het huishouden. Deze variabelen doen geen afbreuk aan de impact van financiële deskundigheid en risico aversie op de hypotheekkeuze van het huishouden.

De discussie wordt vervolgd in het vierde hoofdstuk met een analyse van het hypotheekverstrekkingproces in Nederland. De centrale vraag in dit hoofdstuk is of tussenpersonen in de hypotheekmarkt acteren in het belang van hun clientèle. Compensatie op provisiebasis en concurrentie in de hypotheekmarkt kunnen leiden tot een zogenaamd *agency*-conflict, waarbij de tussenpersoon zijn eigen belangen

boven die van zijn cliënt stelt. Indicatoren voor deze tegenstelling in belangen zijn het verstrekken van grotere hypotheken en aanbeveling van bepaalde hypotheekvormen (zoals aflossingsvrije hypotheken), omdat deze het profijtelijkst zijn vanuit provisie oogpunt. Er is echter een tegengestelde kracht die dit gedrag kan voorkomen, aangezien de hypotheek uiteindelijk acceptabel moet zijn voor de hypotheekverstrekker. Nederlandse hypotheekverstrekkers houden het merendeel (85 procent) van de hypotheken op hun balans en hebben daardoor een economische prikkel om het risico in deze portefeuille aanvaardbaar te houden en tussenpersonen te monitoren. Deze prikkel is zwakker wanneer de hypotheek verzekerd is omdat het kredietrisico dan niet langer door de verstrekker wordt gedragen. De resultaten laten zien dat de invloed van de intermediair inderdaad insignificant is als het kredietrisico gedragen wordt door de verstrekker. Er blijkt echter geen effect op te treden wanneer de hypotheek verzekerd wordt; de rol van de tussenpersoon blijft insignificant. Uit de analyse blijkt dat de meeste variatie in uitkomsten van het hypotheekverstrekking proces toe te rekenen zijn aan verschillen tussen hypotheekverstrekkers onderling. In termen van regelgeving is het waarschijnlijk dan ook effectiever om de aandacht te richten op de regulering van hypotheekverstrekkers in plaats van die van tussenpersonen.

Tenslotte wordt in het vijfde hoofdstuk de vraag naar hypotheekverzekeringen onderzocht. Een hypotheekverzekering keert uit in het geval een huishouden dat gedwongen de woning moet verkopen blijft zitten met een restschuld. Het restschuldrisico kan, onder voorwaarden, worden afgedekt door middel van een hypotheekverzekering bij de Nationale Hypotheek Garantie (NHG). Ondanks dat het overgrote deel van de Nederlandse huishoudens op de hoogte is van het bestaan van NHG, kiest (tot 2009) ongeveer 50 procent ervoor om de hypotheek niet te verzekeren, ondanks dat zij in aanmerking komen. De onderzoeksresultaten in dit hoofdstuk laten zien dat huishoudens met een hoger risico profiel meer geneigd zijn een hypotheekverzekering te kopen. De analyses tonen bovendien de rol van gedrag economische factoren aan: huishoudens zonder hypotheekverzekering zijn overmoediger en minder geneigd te sparen. In tegenstelling tot eerdere onderzoeken (Barber en Odean, 2001) is het effect niet verschillend tussen mannelijke en vrouwelijke beslissers. Het is aannemelijk dat een gedeelte van de overmoedigheid wordt veroorzaakt en versterkt door de gunstige economische en woningmarkt condities gedurende de analyse-periode. De resultaten worden niet verklaard door eerdere ervaring als eigenaar-bewoner, de invloed van financiële adviseurs of aanbodfactoren. Overigens is sinds de uitbraak van de subprime crisis in de Verenigde Staten het percentage verzekerde huishoudens in Nederland aanmerkelijk gestegen.

Bibliography

Aalbers, M. (2008) The Financialization of Home and the Mortgage Market Crisis, *Competition and Change*, 12(2), 148-166.

Aaronson, D. (2000) A Note on the Benefits of Homeownership, *Journal of Urban Economics*, 47, 356-369.

Acker, D., Duck N. (2008) Cross-cultural overconfidence and biased self-attribution, *Journal of Socio-Economics*, 37, 1815-1824.

Agarwal, S., Amromim G., Ben-David, I., Chomsisengphet, S. (2012) Predatory Lending and the Subprime Crisis, *Charles A. Dice Center of Financial Economics working paper WP 2012-8.*

Anderson, D. (1974) The National Flood Insurance Program. Problems and Potential, *Journal of Risk and Insurance*, 41(4), 579-599.

Alba, R., Logan, J., Bellair, P. (1994) Living with crime the racial/ethnic differences in suburban location, *Social Forces*, 73, 395-434.

Alexander, W., Grimshaw, S., McQueen, G., Slade, B. (2002) Some Loans are More Equal than Others: Third-Party Originations and Defaults on the Subprime Mortgage Industry, *Real Estate Economics,* 30(4), 667-697.

Apgar, W., Bendimerad, A., Essene, R. (2007) Mortgage Market Channels and Fair Lending: An Analysis of HMDA Data, *Joint Center for Housing Studies Harvard University.*

Archer, W., Elmer, P., Harrison, D., Ling, D. (2002) Determinants of Multifamily Mortgage Default, *Real Estate Economics*, 30(3), 445-473.

Arellano, M., Bond, S. (1991) Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations, *Review of Economic Studies*, 58, 277-279.

Arrondel, L., Lefebvre, B. (2001) Consumption and Investment Motives in Housing Wealth Accumulation: A French Study, *Journal of Urban Economics*, 50 (1), 112-137.

Authority of Financial Markets (2011) Consumenten Monitor Hypotheken, najaar 2010 [in Dutch], *online available from* www.afm.nl.

Authority of Financial Markets. (2008) AFM Consumenten Monitor Q3 2008 [in Dutch], *online available from* http://www.afm.nl/.

Authority of Financial Markets (2007) Kwaliteit Advies en Transparantie bij Hypotheken, Orientatiepunt voor een geode Adviespraktijk [in Dutch].

Avery, R., Bostic, R., Calem, P., Canner, G. (2006) Credit Risk, Credit Scoring and the Performance of Home Mortgages, *Federal Reserve Bulletin,* 621-648.

Baltagi, B. (2008) Econometric Analysis of Panel Data, 4th edition, John Wiley & Sons Ltd.

Barber, B., Odean, T. (2001) Boys Will be Boys: Gender, Overconfidence and Common Stock Investment, *Quarterly Journal of Economics*, 116(1), 261-292.

Barwick, P., Pathak, P. (2011) The Costs of Free Entry: An Empirical Study of Real Estate Agents in Greater Boston, *NBER Working paper 17227.*

Baumann, D., Sims, J. (1978) Flood Insurance: Some Determinants of Adoption, *Economic Geography*, 54(3), 189-196.

Beckhoven van, E., Kempen van, R. (2003) Social effects of urban restructuring: a case study in Amsterdam and Utrecht, the Netherlands, *Housing Studies* 18(6), 853-875.

Bernanke, B. (2007) The Subprime Mortgage Market. Speech delivered at the FRB of Chicago's 43th Annual Conference on Bank Structure and Competition. Chicago, IL.

Berndt, A., Hollifield, B., Sandas, P. (2010) The Role of Mortgage Brokers in the Subprime Crisis, *NBER Working Paper 16175*.

Beyer, S., Bowden, E. (1997) Gender Differences in the Accuracy of Self-Evaluations of Performance, *Personality and Social Psychology Bulletin*, 23, 157-172.

Beyer, S. (1990) Gender Differences in the Accuracy of Self-Evaluations of Performance, *Journal of Personality and Social Psychology*, 59(5), 960-970.

Bhattacharya, U., Hackethal, A., Kaesler, S., Loos, B., Meyer, S. (2012) Is Unbiased Advice to Retail Investors Sufficient? Answers from a Large Field Study, *forthcoming in Review of Financial Studies*.

Biais, B., Hilton, D., Mazurier, K., Pouget, S. (2005) Judgmental Overconfidence, Self-Monitoring, and Trading Performance in an Experimental Financial Market, *The Review of Economic Studies*, 72(2), 287-312.

Blundell, R., Bond, S. (1998) Initial Conditions and Moment Restrictions in Dynamic Panel Data Models, *Journal of Econometrics*, 87, 115-143.

Boehm, T. (1981) Tenure Choice and Expected Mobility- A Synthesis, *Journal of Urban Economics,* 10, 375-389.

Bourassa, S., Hoesli, M. (2010) Why Do the Swiss Rent? *Journal of Real Estate Finance and Economics*, 40, 286-309.

Bourassa, S., Haurin, D., Haurin, J., Hoesli, M., Sun, J. (2009) House Price Changes and Idiosyncratic Risk: The Impact of Property Characteristics, *Real Estate Economics*, 37(2), 259-278.

Brown, J., Ivkovic, Z., Smith, P. (2008) Neighbors Matter: Causal Community Effects and Stock Market Participation, *Journal of Finance*, 63, 1509-1531.

Browning, M., Lusardi, A. (1996) Household Saving: Micro Theories and Micro Facts*, Journal of Economic Literature*, 34(4), 1797-1855.

Brueckner, J., Follain, J. (1988) The Rise and Fall of the ARM: An Econometric Analysis of Mortgage Choice, *Review of Economics and Statistics*, 70(1), 93-102.

Bucks, B., Pence, K. (2006) Do Homeowners Know Their House Values and Mortgage Terms? *Working paper*, Federal Reserve Board of Governors.

Calvet, L., Campbell, J., Sodini, P. (2009) Measuring Financial Sophistication of Households, *American Economic Review Papers and Proceedings*, 99(2), 1-4.

Campbell, J. (2006) Household Finance, *Journal of Finance*, 61(4), 1551-1604.

Campbell, J., Cocco, F. (2003) Household Risk Management and Optimal Mortgage Choice, *The Quarterly Journal of Economics,* 118(4), 1449-1494.

Carr, J., Kolluri, L. (2001) Predatory Lending: An Overview. Fannie Mae Foundation.

Chang, L., Krosnick, J. (2003) National surveys via RDD telephone interviewing versus the Internet: Comparing sample representativeness and response quality, Ohio State University.

Chang, Y., Yavas, A. (2009) Do Borrowers Make Rational Choices on Points and Refinancing? *Real Estate Economics*, 37(4), 635-659.

Charlier, E., Bussel van, A. (2003) Prepayment Behavior of Dutch Mortgagors: An Empirical Analysis, *Real Estate Economics,* 31(2), 165-204.

Chase, A. (2010) Rethinking the homeownership society: rental stability alternative, *Available on SSRN*: http://ssrn.com/abstract=1567147.

Clauretie, T. (1990) A Note on Mortgage Risk: Default vs. Loss Rates, *AREUEA Journal*, 18(2), 202-206.

Cocco, J. (2011) Understanding the Trade-offs of Alternative Mortgage Products, *working paper accessible on SSRN.*

Cocco, J. (2005) Portfolio Choice in the Presence of Housing, *Review of Financial Studies*, 18(2), 535-567.

Cocco, J., Gomes, F., Maenhout, P. (2005) Consumption and Portfolio Choice over the Life Cycle, *Review of Financial Studies,* 18(2), 491-533.

Cole, R. (1998) The importance of relationships to the availability of credit, *Journal of Banking and Finance*, 22, 959-977.

Cole, S., Gine, X., Tobacman, J., Townsend, R., Topalova, P., Vickery, J. (2012) Barriers to Household Risk Management: Evidence from India, *forthcoming in American Economic Journal: Applied Economics.*

Collins, M. (2010) A Review of Financial Advice Models and the Take-Up of Financial Advice, working paper WP10-5, Center for Financial Security, University of Wisconsin-Madison.

Coulibaly, B., Li, G. (2009) Choice of Mortgage Contracts: Evidence from the Survey of Consumer Finances, *Real Estate Economics,* 37(4), 659-674.

Cox, R., Brounen, D., Neuteboom, P. (2012) Safe and Satisfied? External Effects of Homeownership in Rotterdam, *Urban Studies,* 49(12), 2669-2691.

Cox, R., Brounen, D., Neuteboom, P. (2012) Financial Literacy, Risk Aversion and Choice of Mortgage Type by Households. Working paper*,* Rotterdam School of Management.

Cox, R. (2012) Screening Incentives in the Presence of Mortgage Insurance. Working paper*,* Rotterdam School of Management.

Cox, R. (2012) The Demand for Mortgage Insurance. Working paper*,* Rotterdam School of Management.

Cunha, R., Lambrecht, B., Pawlina, G. (2009) Determinants of Outstanding Loan to Value Ratios: Evidence from the Netherlands, *working paper accessible on SSRN.*

Cunningham, D., Capone, C. (1990) The Relative Termination Experience of Adjustable to Fixed-Rate Mortgages, *Journal of Finance*, 45(5), 1687-1703.

Daglish, T. (2009) What motivates a subprime borrower to default? *Journal of Banking and Finance*, 33, 681-693.

Deaves, R., Lueders, E., Luo, G. (2009) An Experimental Test of the Impact of Overconfidence and Gender on Trading Activity, *Review of Finance*, 13, 555-575.

De Haan, L., Sterken, E. (2011) Bank-Specific Interest Rate Adjustment in the Dutch Mortgage Market, *Journal of Financial Services Research*, 39, 145-159.

Demyanyk, Y., Hemert Van, O. (2011) Understanding the Subprime Mortgage Crisis, *Review of Financial Studies,* 24(6), 1848-1880.

Dietz, R., Haurin D. (2003) The social and private micro-level consequences of homeownership, *Journal of Urban Economics*, 54, 401-450.

DiPasquale, D., Glaeser, E. (1999) Incentives and Social Capital: Are Homeowners Better Citizens, *Journal of Urban Economics,* 45, 354-384.

Dirkx-Westerhof, S. (2009) Moody's Updated Approach to NHG Mortgages in Rating Dutch RMBS, *Moody's Investors Service.*

Doherty, N., Schlesinger, H. (1990) Rational Insurance Purchasing: Consideration of Contract Nonperformance, *Quarterly Journal of Economics*, 105(1), 243-253.

Dohmen, T., Falk., A., Huffman, D., Sunde, U. (2010) Are Risk Aversion and Impatience Related to Cognitive Ability? *American Economic Review*, 100, 1238-1260.

Donker, B., Van Soest, A. (1999) Subjective measures of household preferences and financial decisions, *Journal of Economic Psychology*, 20, 613-642.

Duca, J., Rosenthal, S. (1994) Do Mortgage Rates Vary Based on Household Default Characteristics? Evidence on Rate Sorting and Credit Rationing, *Journal of Real Estate Finance and Economics,* 8, 99-113.

Duffy, B., Smith, K., Terhanian, G., Bremer, J. (2005) Comparing data from online and face-to-face surveys, *International Journal of Market Research,* 47(6), 615-639.

Duncan, G., Russell, H. (1998) Unemployment and life satisfaction: A cross-cultural comparison, *European Journal of Psychology*, 39, 248-280.

Dynan, K. (1993) How Prudent are Consumers? *Journal of Political Economy*, 101(6), 1104-1113.

Ecorys (2004) Marktwerking op de markt voor hypothecaire kredietverlening [in Dutch], report written for the Dutch Ministry of Finance.

Ehrenberg, D. (2001) If the Loan Doesn't Fit, Don't Take it: Applying the Suitability Doctrine to the Mortgage Industry to Eliminate Predatory Lending, *Journal of Affordable Housing*, 10(2), 117-133.

Eisner, R., Strotz, R. (1961) Flight Insurance and the Theory of Choice, *Journal of Political Economy*, 69(4), 355-368.

El-Anshasy, A., Elliehausen, G., Shimazaki, Y. (2005) The Pricing of Subprime Mortgages by Mortgage Brokers and Lenders. Credit Research Center, Georgetown University.

Elliehausen, G., Lundquist, C., Staten, M. (2007) The Impact of Credit Counseling on Subsequent Borrower Behavior, *Journal of Consumer Affairs*, 41(1), 1-28.

Elmerick, S., Monalta, C., Fox, J. (2002) Use of Financial Planners by U.S. Households, *Financial Services Review*, 11, 217-231.

Engelhardt, G., Eriksen, M., Gale, W., Mills G. (2010) What are the social benefits of homeownership? Experimental evidence for low-income households, *Journal of Urban Economics*, 67, 249-258.

Englund, P., Hwang, M., Quigley, J. (2002) Hedging Housing Risk, *Journal of Real Estate Finance and Economics*, 24(1/2), 167-200.

European Mortgage Federation (2011) Hypostat 2010: A Review of Europe's Mortgage and Housing Markets, *online available from www.hypo.org.*

Eurostat (2009) Unemployment rates, *online available from www.eurostat.eu.*

Federal Reserve Board (2007) Testimony of Roger T. Cole, Division of Banking, Housing and Urban Affairs, United States Senate, March 22, Washington DC.

Finaccord (2012) Consumer mortgage and non-mortgage lending markets in Europe, *online available from http://www.finaccord.com/press-release_2012_consumer-mortgage-and-non-mortgage-lending-markets-in-europe.htm.*

Flavin, M., Yamashita, T. (2011) Owner-Occupied Housing: Life-Cycle Implications for the Households Portfolio, *American Economic Review: Papers & Proceedings*, 101(3), 609-614.

Follain, J., Dunsky, R. (1997) The Demand for Mortgage Debt and the Income Tax, *Journal of Housing Research,* 8(2), 155-199.

Fratantoni, M. (1999) Reverse Mortgage Choices: A Theoretical and Empirical Analysis of the Borrowing Decisions of Elderly Homeowners, *Journal of Housing Research,* 10(2), 189-208.

Galster, G., Quercia, R., and Cortes, A. (2000) Identifying Neighborhood Thresholds: An Empirical Investigation, *Housing Policy Debate*, 11(3), 701-732.

Galster, G. (1987) Homeowners and Neighborhood Reinvestment. Durham. NC: Duke University Press.

Ganderton, P., Brookshire, D., McKee, M., Stewart, S., Thurston, H. (2000) Buying Insurance for Disaster-Type Risks: Experimental Evidence, *Journal of Risk and Uncertainty*, 20(2), 271-289.

Gerardi, K., Rosen, H., Willen, P. (2010a) The Impact of Deregulation And Financial Innovation On Consumers: The Case of the Mortgage Market, *Journal of Finance*, 65(1), 333-360.

Gerardi, K., Goette, L., Meijer, S. (2010b) Financial Literacy and Subprime Mortgage Delinquency: Evidence from a Survey Matched to Administrative Data, *Federal Reserve Bank of Atlanta*, working paper 2010-10.

Gervais, S., Odean, T. (2001) Learning to be Overconfident, *Review of Financial Studies*, 14(1), 1-27.

Gibbons, S. (2004) The Costs of Urban Property Crime, *The Economic Journal*, 114, 441-463.

Glaeser, E., Sacerdote, B. (2000) The Social Consequences of Housing, *Journal of Housing Economics*, 9, 1-23.

Glaeser, E., Sacerdote, B. (1999) Why is there more crime in cities? *Journal of Political Economy*, 107, 225-258.

Glaser, N., Weber, M. (2007) Overconfidence and trading volume, *Geneva Risk and Insurance Review*, 32(1), 1-36.

Goetzmann, W., Kumar, A. (2008) Equity Portfolio Diversification, *Review of Finance*, 12, 433-463.

Gollier, C. (2003) To Insure or Not to Insure?: An Insurance Puzzle, *The Geneva Papers on Risk and Insurance Theory*, 28, 5-24.

Grace, M., Klein, R., Kleindorfer, P. (2004) Homeowners Insurance With Bundled Catastrophe Coverage, *Journal of Risk and Insurance*, 71 (3), 351-379.

Green, R., Hendershott, P. (2001) Home-ownership and Unemployment in the U.S., *Urban Studies,* 38 (9), 1509-1520.

Green, R., White, M. (1997) Measuring the benefits of homeowning: Effects on children, *Journal of Urban Economics*, 41, 441-461.

Greenwald, A. (1980) The Totalitarian Ego, Fabrication and Revision of Personal History, *American Psychologist*, 35(7), 603-618.

Grinblatt, M., Keloharju, M., Linnainmaa, J. (2011a) IQ and Stock Market Participation, *forthcoming in Journal of Finance.*

Grinblatt, M., Keloharju, M., Linnainmaa, J. (2011b) IQ, Trading Behavior, and Performance, *forthcoming in Journal of Financial Economics.*

Grinblatt, M., Keloharju, M. (2009) Sensation Seeking, Overconfidence, and Trading Activity, *Journal of Finance*, 64(2), 549-578.

Guiso, L., Sodini, P. (2012) Household Finance: An Emerging Field: in Constantinidis, G., Harris, M. and Stulz, R. (Eds) *Handbook of the Economics of Finance*, Elsevier Science.

Guiso, L., Sapienza, P., Zingales, L. (2012) The Determinants of Attitudes towards Strategic Default on Mortgages, *forthcoming in Journal of Finance.*

Guiso, L., Sapienza, P., Zingales, L. (2008) Trusting the Stock Market, *Journal of Finance*, 63(6), 2557-2600.

Guiso, L., Japelli, T. (2005) Awareness and Stock Market Participation, *Review of Finance*, 9, 537-567.

Guiso, L., Jappelli, T., Terlizzesse, D. (1996) Income Risk, Borrowing Constraints, and Portfolio Choice*, American Economic Review*, 86(1), 158-172.

Hackethal, A., Halliassos, M., Jappelli, T. (2012) Financial Advisors: A case of babysitters? *Journal of Banking and Finance*, 36, 509-524.

Harding, J., Rosenthal, S., Sirmans, C. (2007) Depreciation of housing capital, maintenance, and house price inflation: Estimates from a repeat sales model, *Journal of Urban Economics*, 61(2), 193-217.

Harkness, J., Newman, S. (2002) Homeownership for the Poor in Distressed Neighborhoods: Does This Make Sense?, *Housing Policy Debate*, 13(2), 597-630.

Harrison, D., Noordewier, T., Yavas, A. (2004) Do Riskier Borrowers Borrow More? *Real Estate Economics,* 32(3), 385-411.

Hassink, W. and Van Leuvensteijn, M. (2007) Measuring Transparency in the Dutch MortgageMarket, *De Economist*, 155(1), 23-47.

Haurin, D., Dietz, R., Weinberg, B. (2003) The Impact of Neighborhood Homeownership Rates: A Review of the Theoretical and Empirical Literature, *Journal of Housing Research*, 13(2), 119-151.

Hemert van, O. (2010) Household Interest Rate Risk Management, *Real Estate Economics,* 38(3), 467-506.

Hendershott, P., Villani, K. (2012) The Politically Incorrect View of What Made the Financial Crisis Systemic: Government Housing Policy, *Journal of Housing Research*, 21(1), 15-48.

Hilber, C. (2005) Neighborhood externality risk and the homeownership status of properties, *Journal of Urban Economics*, 57, 213-241.

Hilgert, M., Hogarth, J., Beverly, S. (2003) Household financial management: the connection between knowledge and behavior. Federal Reserve Bulletin July, 309-322.

Hogart, R., Kunreuther, H. (1995) Decision Making Under Ignorance: Arguing with Yourself, *Journal of Risk and Uncertainty*, 10(1), 15-36.

Hong, H., Kubik, J., Stein, J. (2004) Social interaction and stock-market participation*, Journal of Finance*, 59, 137-163.

Howden, D., Bagus, P. (2009) Book Review "The Subprime Solution: How Today's Global Financial Crisis Happened, and What to Do About It" by Robert J. Shiller (2008), *The Quarterly Journal of Austrian Economics*, 12(1), 81-87.

Hsee, C., Kunreuther, H. (2000) The Affection Effect in Insurance Decisions, *Journal of Risk and Uncertainty*, 20(2), 141-159.

Inderst, R., Ottaviani, M. (2009) Misselling through Agents, *American Economic Review*, 99(3), 883-908.

Ioannides, Y., Rosenthal, S. (1994) Estimating the Consumption and Investment Demands for Housing and Their Effect on Housing Tenure Status, *The Review of Economics and Statistics*, 76(1), 127-141.

Jensen, B., Harris, M. (2008) Neighbourhood Measures: Quantifying the Effects of Neighbourhood Externalities, *The Economic Record,* 84(264), 68-81.

Jiang, W., Nelson, A., Vytlacil, E. (2009) Liar's Loan? Effect of Origination Channel and Information Falsification on Mortgage Delinquency, *working paper accessible at SSRN.*

John, O., Robins, R. (1994) Accuracy and Bias in Self-Perception: Individual Differences in Self-Enhancement and the Role of Narcissism, *Journal of Personality and Social Psychology*, 66(1), 206-219.

Johnson, D., McDermott, R., Barrett, E., Cowden, J., Wrangham, R., McIntyre, M., Rosen, S. (2006) Overconfidence in wargames: Experimental evidence on expectations, aggression, gender and testosterone, *Proceedings of the Royal Society B,* 273, 2513-2520.

Johnson, E., Hershey, J., Mezaros, J., Kunreuther, H. (1993) Framing, Probability Distortions and Insurance Decisions, *Journal of Risk and Uncertainty*, 7, 35-51.

Jonsson, A., Allwood, C. (2003) Stability and variability in the realism of confidence judgments over time, content domain, and gender, *Personality and Individual Differences* 34, 559-574.

Kahneman, D., Tversky, A. (1979) Prospect Theory: An Analysis of Decision under Risk, *Econometrica*, 47(2), 263-292.

Kau, J., Keenan D. (1987) Taxes, Points and Rationality in the Mortgage Market, *Real Estate Economics,* 15(3), 168–184.

Kerste, M., Risseeuw, P., Baarma, B., Rosenboom, N. (2011) Publieke belangen en hypotheek Regulering [in Dutch], *report for the Dutch Association of Banks, SEO Economic Research, Amsterdam.*

Keys, B., Mukherjee, T., Seru, A., Vig, V. (2010) Did Secutarization Lead to Lax Screening? Evidence from Subprime Loans, *Quarterly Journal of Economics*, 125(1), 307-362.

Keys, B., Mukherjee, T., Seru, A., Vig, V. (2009) Financial regulation and securitization: Evidence from subprime loans, *Journal of Monetary Economics*, 56(5), 700-720.

Kiff, J., Mills, P. (2007) Money for Nothing and Checks for Free: Recent Developments in U.S. Subprime Mortgage Markets, *IMF Working Paper WP/07/188.*

Klayman, J., Soll, J., Gonzales-Vallejo, C., Barlas, S. (1999) Overconfidence: It Depends on How, What, and Whom You Ask, *Organizational Behavior and Human Decision Processes*, 79, 216-247.

Kleiner, M., Todd, R. (2007) Mortgage Broker Regulations that Matter: Analyzing Earnings, Employment, And Outcomes for Households, *NBER Working Paper 13684.*

Kleiner, M. (2006) Licensing Occupations: Enhancing Quality or Restricting Competion? *Upjohn Institute for Employment Research, Kalamazoo, Michigan.*

Kleinhans, R., Priemus, H., Engbersen G. (2007) Understanding Social Capital in Recently Restructured Urban Neighborhoods: Two Case Studies in Rotterdam, *Urban Studies*, 44(5/6), 1069-1091.

Koijen, R., Van Hemert, O., Van Nieuwerburgh, S. (2009) Mortgage Timing, *Journal of Financial Economics,* 93(2), 292-324.

Korniotis, G., Kumar A. (2011) Do Older Investors Make Better Investment Decisions? *The Review of Economics and Statstics*, 93(1), 244-265.

Kunreuther, H., Pauly, M. (2004) Neglecting Disaster: Why Don't People Insure Against Large Losses? *Journal of Risk and Uncertainty*, 28(1), 5-21.

Kunreuther, H., Novemsky, N., Kahneman, D. (2001) Making Low Probabilities Useful, *Journal of Risk and Uncertainty*, 23(2), 103-120.

Kunreuther, H. (1978) Disaster Insurance Protection: Public Policy Lessons. New York: Wiley.

LaCour-Little, M., Yang, J. (2010) Pay Me Now or Pay Me Later: Alternative Mortgage Products and the Mortgage Crisis, *Real Estate Economics,* 38(4), 687-732.

LaCour-Little, M. (2009) The Pricing of Mortgages by Brokers: An Agency Problem? *Journal of Real Estate Research*, 31(2), 235-263.

LaCour-Little, M. and Chun, G. (1999) Third Party Originators and Mortgage Prepayment Risk" An Agency Problem? *Journal of Real Estate Research*, 17(1/2), 55-70.

Lauridsen, J., Skak, M. (2007) Determinants of Homeownership in Denmark, *Discussion Papers on Business and Economics 2/2007*, University of South Denmark.

Laury, S., McInnes, M., Swarthout, T. (2009) Insurance decisions for low-probability losses, *Journal of Risk and Uncertainty*, 39, 17-44.

Lee, J., Hogarth, J. (1999) The Price of Money: Consumers' Understanding of APRs and Contract Interest Rates, *Journal of Public Policy and Marketing,* 18(1), 66-76.

Leuvensteijn van, M., Koning, P. (2004) The effect of home-ownership on labor mobility in the Netherlands, *Journal of Urban Economics*, 55, 580-596.

Ludvigson, S. (2004) Consumer Confidence and Consumer Spending, *Journal of Economic Perspectives*, 18(2), 29-50.

Lundeberg, M., Fox, P., Punccohar, J. (1994) Highly Confident but Wrong: Gender Differences and Similarities in Confidence Judgments, *Journal of Educational Psychology*, 86, 114-121.

Lusardi, A., Mitchell, O. (2008) Planning and Financial Literacy: How do Women Fare? *American Economic Review*, 98(2), 413-417.

Lusardi, A., Mitchell, O. (2007a) Baby Boomer Retirement Security: The Role of Planning, Financial Literacy and Housing Wealth, *Journal of Monetary Economics*, 54, 205-224.

Lusardi, A., Mitchell, O. (2007b) Financial Literacy And Retirement Preparedness: Evidence And Implications For Financial Education, *Business Economics*, 42, 35-44.

Mandell, L., Klein, L. (2009) The Impact of Financial Literacy Education on Subsequent Financial Behavior, *Journal of Financial Counseling and Planning,* 20(1), 15-23.

Manturuk, K., Lindblad, M., Quercia, R. (2009) Homeownership and Local Voting In Disadvantaged Urban Neighborhoods, *Cityscape*, 11 (3), 213-230.

Mayer, C., Pence, K., Sherlund, S. (2009) The Rise in Mortgage Defaults, *Journal of Economic Perspectives*, 23(1), 27-50.

McClelland, G., Schulze, W., Coursey, D. (1993) Insurance for Low-Probability Hazards: A Bimodal Response to Unlikely Events, *Journal of Risk and Uncertainty*, 7, 95-116.

Megbolugbe, I., Linneman, P (1993) Home Ownership, *Urban Studies,* 30(4/5), 659-682.

Meijer, F. (1993) Maintenance and improvement activities of homeowners in the Netherlands, *Journal of Housing and the Built Environment*, Volume 8, Number 3, 327-346.

Meyer, D., Meyer, J. (1998) Changes in Background Risk and the Demand for Insurance, *The Geneva Papers on Risk and Insurance Theory*, 23, 29-40.

Miles, D. (2004) The UK Mortgage Market: Taking a Longer-Term View, final report for the UK Treasury Department.

Moore, D. (2003) Survey of financial literacy in Washington State: Knowledge, behavior, attitudes and experiences. Technical report: 03-39, Social and Economic Sciences Research Center, Washington State University.

Morin, R., Suarez, F. (1983) Risk Aversion Revisited, *Journal of Finance*, 38(4), 1201-1216.

Mullainathan, S., Nöth, M., Schoar, A. (2010) The Market for Financial Advice: An Audit Study, *working paper accessible CEPR.*

Neuteboom, P. (2008) On the rationality of borrowers' behavior. Comparing risk attitudes of homeowners, Delft University Press.

Nosić, A., Weber, M. (2010) How Riskily Do I Invest? The Role of Risk Attitudes, Risk Perceptions, and Overconfidence, *Decision Analysis*, 7(3), 292-301.

Nunnally, J. (1978) Psychometric Theory. New York: McGraw-Hill Publishing Company.

Perry, V., Morris, M. (2005) Who Is in Control? The Role of Self-Perception, Knowledge, and Income in Explaining Consumer Financial Behavior, *Journal of Consumer Affairs*, 39(2), 299-313.

Petersen, M. (2009) Estimating Standard Errors in Finance Panel Data Sets: Comparing Approaches, *Review of Financial Studies*, 22(1), 435-480.

Prince, M. (1993) Women, men, and money styles, *Journal of Economic Psychology*, 14, 175-182.

Puri, M., Rocholl, J. (2008) On the importance of retail banking relationships, *Journal of Financial Economics*, 89, 253-267.

Qi, M., Yang, X. (2009) Loss given default of high loan-to-value residential mortgages, *Journal of Banking and Finance*, 33, 788-799.

Quercia, R., Spader, J. (2008) Does Homeownership Counseling Affect the Prepayment and Default Behavior of Affordable Mortgage Borrowers? *Journal of Policy Analysis and Management*, 27(2), 304-325.

Quigley, J. (2006) Real estate portfolio allocation, The European consumers' perspective, *Journal of Housing Economics*, 15(3), 169-188.

Rampini, A., Viswanathan, S. (2010) Collateral, Risk Management and the Distribution of debt Capacity, *Journal of Finance*, 65, 2293-2322.

RealTrac (2012) 2011 Year-End Foreclosure Report: Foreclosures on the Retreat, *online available from* www.realtrac.com.

Rohe, W., Van Zandt, S., McCarthy, G. (2001) The Social Benefits and Costs of Homeownership: A Critical Assessment of the Research, *Joint Center of Housing Studies of Harvard University*, working paper series.

Rohe. W., Basolo, V. (1997) Long-Term Effects of Homeownership on the Self Perceptions and Social Interaction of Low-Income Persons, *Environment and Behavior*, 29(6), 793-819.

Rohe, W., Stewart, L. (1996) Homeownership and Neighborhood Stability, *Housing Policy Debate*, 7(1), 37-81.

Rohe, W., Stegman, M. (1994) The impact of homeownership on the social and political involvement of low income people, *Urban Affairs Quarterly*, 30, 152-172.

Rooij van, M., Lusardi, A., Alessie, R. (2011) Financial Literacy and Stock Market Participation, *Journal of Financial Economics*, 101, 449-472.

Rossi, P., Weber, W. (1996) The Social Benefits of Homeownership: Empirical Evidence from National Surveys, *Housing Policy Debate,* 7(1), 1-35.

Sa-Aadu, J., Sirmans C. (1995) Differentiated Contracts, Heterogeneous Borrowers and the Mortgage Choice Decision, *Journal of Money, Credit and Banking*, 27(2), 498-510.

Sandroni, A., Squintani, F. (2004) A Survey on Overconfidence, Insurance and Self-Assessment Training Programs, *available from* http://www2.warwick.ac.uk/fac/soc/economics /staff/academic/squintani/research/.

Schober, M. Conrad, F. (1997) Does Conversational Interviewing Reduce Survey Measurement Error? *Public Opinion Quarterly*, 61, 576-602.

Schooley, D., Worden, D. (1996) Risk Aversion Measures: Comparing Attitudes and Asset Allocation, *Financial Services Review*, 5(2), 87-99.

Shiller, B. (2009) Derivative Markets for Home Prices: in Glaeser, E., and Quigley, J. (Eds) *Housing markets and the Economy, Risk Regulation and Policy: Essays in Honor of Karl E. Case*, Lincoln Institute of Land Policy, Cambridge, MA.

Shiller, R. (2008) The Subprime Solution: How Today's Global Financial Crisis Happened, and What to Do About It. Princeton, NJ: Princeton University Press.

Shiller, B., Weiss, A. (1999) Home Equity Insurance, *Journal of Real Estate Finance and Economics*, 19(1), 21-47.

Shlay, A. (2006) Low-income Homeownership: American Dream or Delusion? *Urban Studies,* 43(3), 511-531.

Shum, P., Faig, M. (2006) What explains household stock holdings? *Journal of Banking and Finance*, 30, 2579-2597.

Slovic, P., Fischhoff, B., Lichtenstein, S., Corrigan, B., Combs, B. (1977) Preference for Insuring Small Losses: Insurance Implications, *Journal of Risk and Insurance*, 44 (2), 237-258.

Souza, L. (2005) Comparative Welfare States. Housing Policy in North America and Europe: Institutional Analysis and Welfare State Regimes, *working paper*.

Stanton, R., Wallace N. (1998) Mortgage Choice: What's the Point? *Real Estate Economics,* 26, 173-205.

Stanton, R., Wallace N. (1999) Anatomy of an ARM: The Interest Rate-Risk of Adjustable Rate Mortgages, *Journal of Real Estate Finance and Economics*, 19, 49-67.

Statistics Netherlands (2009) Nationale Rekeningen 2009: Macro-economische Gegevens (National Accounts 2009: Macro-economic data), *Online available at* www.cbs.nl.

Sterken, E. (2007) Competition in the Dutch Mortgage Market, *De Economist*, 154(4), 587-600.

Svenson, O. (1981) Are We All Less Risky and More Skillful Than Our Fellow Drivers? *Acta Psychologica*, 47, 143-148.

Toolsema, L., Jacobs, J. (2007) Why do prices rise faster than they fall? With an application to mortgage rates, *Managerial and Decision Economics,* 28(7), 701-712.

Toolsema, L. (2002) Competition in the Dutch consumer credit market, *Journal of Banking and Finance*, 26, 2215-2229.

Tufano, P. (2009) Consumer Finance, *Annual Review of Financial Economics,* 1, 227-247.

U.S. Government Accountability Office (2006) Alternative Mortgage Products. Report to the Chairman, Subcommittee on Housing and Transportation, Committee on Banking, Housing and Urban Affairs, U.S. Senate. GAO-06-1021, Washington DC.

Van Raaij, W., Gianotten, H. (1990) Consumer Confidence, Expenditure, Saving and Credit, *Journal of Economic Psychology*, 11, 269-290.

Vissing-Jorgensen, A. (2003) Perspectives on Behavioral Finance: Does "Irrationality" Disappear with Wealth? Evidence from Expectations and Actions, *NBER/Macroeconomics Annual*, 18(1), 139-194.

Voigtländer, M. (2009) Why is the German Homeownership Rate so Low? *Housing Studies*, 24(3), 355-373.

Watson, D., Webb, R. (2009) Do Europeans View their Homes as Castles? Homeownership and Poverty Perception throughout Europe, *Urban Studies*, 46(9), 1787-1805.

Wilcox, J. (2007) Forecasting Components of Consumption with Comments of Consumer Sentiment, *Business Economics*, 42(4), 22-32.

Willis, L. (2008) Against Financial Literacy Education, *Scholarship at Penn Law.*, paper 208.

Windmeijer, F. (2005) A finite sample correction for the variance of linear efficient two-step GMM estimators, *Journal of Econometrics,* 126(1), 25-51.

Woodward, S., Hall, R. (2010) Consumer Confusion in the Mortgage Market: Evidence of Less than a Perfectly Transparent and Competitive Market, *American Economic Review: Papers & Proceedings*, 100, 511-515.

World Retail Banking Report (2009) *online available at* www.capgemini.com.

Yao, R., Zhang, H. (2005) Optimal Consumption and Portfolio Choices with Risky Housing and Borrowing Constraints*, Review of Financial Studies*, 18(1), 197-239.

Biography

Ruben Cox (Maastricht, 16 September 1985) received his HAVO diploma (Science & Technology-track) in 2003 from the Bonnefanten College in Maastricht. He holds a Bachelor in Industrial Engineering (2007, *cum laude*) from Zuyd University of Applied Sciences in Heerlen and a Master in Business Administration, specialization Finance and Investments (2009, *cum laude*) from the Rotterdam School of Management, Erasmus University. During his Masters he worked as a financial analyst at the Rotterdam Port Authority. Starting his PhD in Finance in September 2009 with the Erasmus Research Institute of Management (ERIM), his research position is sponsored by the National Mortgage Guarantee (NHG). During his PhD, Ruben attended academic summer courses at the Barcelona Graduate School of Economics and spent four months at the National University of Singapore as a visiting PhD candidate. His work has been presented at a number of international conferences including the AREUEA annual meetings in Atlanta (2010) and Chicago (2012), AREUEA mid-year meeting in Washington DC (2011), AREUEA international meetings in Rotterdam (2010), Jeju, South-Korea (2011) and Singapore (2012), the ARES annual meetings in Seattle (2011) and St. Petersburg, FL (2012), the ERES annual meetings in Milan (2010) and Edinburgh (2012) as well as smaller scale conferences including the ZEW ReCapNet meetings in Mannheim (2010 and 2011), the CESifo conference on Housing Taxation and Regulation in Munich (2010) the BHPS 'Understanding Society' conference in Colchester (2011) and the European Retail Investment Conference in Stuttgart (2013). The paper of chapter two has been accepted for publication at *Urban Studies* and the paper of chapter five was awarded the *Doctoral Student Best Paper Award* at the ERIC (2013) conference. Ruben has taught classes on both the bachelor (Corporate Finance) and master level (Research Skills and Real Estate Finance and Investments) and supervised Bachelors and Masters theses.

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TO OWN, TO FINANCE, AND TO INSURE RESIDENTIAL REAL ESTATE REVEALED

This dissertation contains four studies that contribute to our understanding of the social and financial consequences of homeownership. The first study examines the effects of homeownership on residential satisfaction and neighborhood safety. I show that neighborhoods with higher homeownership rates are safer and that residents are more satisfied with their neighborhood. In the second study, I provide insight into the decision making process that households undergo when arranging mortgage financing. Specifically, I document that those households who are either less risk averse or more financially literate are more likely to opt for alternative mortgage products such as interest-only mortgages. The third chapter focuses on the mortgage origination process and investigates whether provision-based compensation of financial intermediaries affects underwriting outcomes for households. The results indicate that this, contrary to popular belief, is not the case when mortgage lenders are exposed to default and reputational risks, thereby providing them with an incentive to screen mortgage applications and monitor brokers. The final study investigates the demand for mortgage insurance. Households with recourse mortgage debt face wealth risks in case they are forced to sell their house following an adverse income shock. The findings in this study support the hypothesis that households eligible for insurance who are overconfident are significantly less likely to obtain mortgage insurance.

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