Mortgage Literacy and Mortgage Risks

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Abstract

We study the relationship between mortgage literacy and mortgage risks. We assess how much households know about their mortgages, and the impact of this knowledge on the riskiness of their mortgage. To address these research questions, we introduce the Mortgage Literacy Questionnaire, which evaluates the domain-specific knowledge of households about mortgages. Studies of risk attitudes have shown risk-taking behaviour is domain-specific. This raises the question whether financial literacy is domain-specific as well. The Mortgage Literacy Questionnaire captures the domain-specific knowledge people need to make sound decisions in selecting a mortgage and manage risks associated with their mortgage. This knowledge includes differences between mortgage products, as well as the legal and fiscal implications of different types of mortgages. Using data from a survey among more than 2,000 Dutch households. We find that mortgage literacy is indeed distinct from basic and advanced financial literacy. A significant group of households are financially literate but mortgage illiterate. We demonstrate that mortgage literacy is associated with lower perceived mortgage risk, and with how well households hedge mortgage risk.

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1. Introduction

Buying a flat or house is a common and one of the most consequential financial decisions households face (Campbell and Cocco 2003). In the last decades, innovation and deregulation of mortgage markets have opened up access to mortgages to a bigger share of the population, and increased the complexity of mortgage decisions for households (Gerardi, Rosen, and Willen 2010). Moreover, a number of households make mistakes in selecting a mortgage (Campbell 2006). If households over-borrow, a spell of unemployment or a rise in interest rates can put a severe strain on their budgets. On a systemic level, mortgage debt has played a key role in triggering and amplifying the financial crisis of 2007/8. (International Monetary Fund 2011). Lusardi and Mitchell suggest more research is needed to study the impact of financial literacy on hitherto underexplored economic outcomes (Lusardi and Mitchell 2014).

We answer Lusardi and Mitchell's call by studying the relationship between mortgage literacy and mortgage risks. We assess how much households know about their mortgages, and the impact of this knowledge on the riskiness of their mortgage. To address these research questions, we introduce the Mortgage Literacy Questionnaire, which evaluates the domain-specific knowledge of households about mortgages. Mortgage literacy is an aspect of financial literacy. Traditional measures of financial and debt literacy focus on numeracy skills and the understanding of basic financial concepts (Van Ooijen and Van Rooij 2016; Alessie, Rooij, and Lusardi 2011; Lusardi and Mitchell 2011a; Lusardi and Tufano 2015). But studies of risk attitudes have shown risk-taking behaviour is domain-specific (Dohmen et al. 2011). This raises the question whether financial literacy is domain-specific as well. The Mortgage Literacy Questionnaire captures the domain-specific knowledge people need to make sound decisions in selecting a mortgage and manage risks

associated with their mortgage. This knowledge includes differences between mortgage products, as well as the legal and fiscal implications of different types of mortgages.

We administered the Mortgage Literacy Questionnaire to a representative sample of more than 2,000 Dutch households. We find that mortgage literacy is indeed distinct from basic and advanced financial literacy. A significant group of households are financially literate but mortgage illiterate. We demonstrate that mortgage literacy is associated with lower perceived mortgage risk, and with how well households hedge mortgage risk.

Our results suggest that efforts to promote financial literacy should not be limited to teaching financial numeracy and basic financial concepts. Instead, acquiring detailed knowledge about mortgage products and their legal and fiscal environment matter considerably for financial choices regarding mortgages. These results suggest more emphasis should be placed on these domains of knowledge in financial education.

The paper is structured as follows. Section 2 situates our approach in the literature on financial literacy. This section also gives an overview of the Dutch mortgage market. Section 3 introduces the Mortgage Literacy Questionnaire and gives an overview of what Dutch households know about mortgages. Moreover, this section describes how we measure the dependent variables in our study. Section 4 presents regression results. Section 5 discusses the strengths and limitations of the current investigation, and points to opportunities for further research.

2. Contribution and Related Literature

Research on financial literacy investigates to what extent households have the required knowledge to make good decisions in selecting financial products and managing risks associated with these products (Van Rooij, Lusardi, and Alessie 2011a; Lusardi 2012; Duca and Kumar 2014).

The dominant approach to measuring financial literacy is to ask people a number of questions eliciting their basic numeracy skills as well as their knowledge about finance (Lusardi and Mitchell 2011b). Commonly used questions cover proficiency with respect to interest rates, compounded interest, and the time value of money (Van Rooij, Lusardi, and Alessie 2012). We will refer to these questions as *basic financial literacy questions*. In addition, a further questionnaire covers distinctions between bonds and stocks and the functioning of financial markets (Van Rooij, Lusardi, and Alessie 2012). We will refer to these questions as *advanced financial literacy* questions.

Basic and advanced financial literacy questionnaires have been used in numerous studies (Lusardi and Mitchell 2011b). These studies show robustly that financial literacy is low among households (Lusardi and Mitchell 2014). A study of 1,500 Dutch households is indicative of the broader trend: only 40% of respondents answered all five basic financial literacy questions correctly, and only 5% of respondents answered all 11 advanced financial literacy questions correctly (Van Rooij, Lusardi, and Alessie 2012).

Financial literacy matters because it is strongly associated with financial outcomes. People scoring higher on financial literacy are more likely to build up wealth (Lusardi and Mitchell 2007) manage wealth effectively (Hilgert, Hogarth, and Beverly 2003), invest in the stock market (Van Rooij, Lusardi, and Alessie 2011b), select mutual funds with lower fees (Hastings and Tejeda-Ashton 2008), and plan ahead for retirement (Lusardi and Mitchell 2011a).

We contribute to the financial literacy by answering Mitchell and Lusardi's call to address understudied outcome measures by investigating the relationship between financial literacy and mortgage outcomes. There have been relatively few studies looking at household debt to date. One

study finds that people with low financial literacy are more likely to take out consumer credit and have larger shares of high cost credit such as payday loans (Disney and Gathergood 2013).

Concerning the link between financial literacy and mortgage outcomes, one study finds that households with higher financial literacy are more likely to opt for interest-only mortgages if they also report lower risk aversion (Cox, Brounen, and Neuteboom 2015). Another study shows that financial literacy does not seem to be correlated with financial advice seeking (Kramer 2016).

Alternative measures of financial literacy emphasising saving and borrowing are the questionnaires developed by Van Ooijen and Van Rooij as well as Gathergood and Weber (Gathergood and Weber 2017; Van Ooijen and Van Rooij 2016). Both measures are very similar to basic financial literacy by focussing on basic numeracy and the ability to apply basic financial concepts. In particular, they test familiarity with interest compounding and the time value of money. The difference to basic financial literacy is that these questionnaires are asked in the context of borrowing and saving decisions. These questions have been used with the Dutch DNB Household panel by Van Ooijen et al. (2014). Disney and Gathergood (2013) have administered the questions in panels in the UK the Netherlands. The studies show that people with higher debt literacy tend to avoid high-cost consumer borrowing and banking fees. Van Ooijen et al. study the relationship of debt literacy on mortgage choice explicitly. They find that home owners with higher debt literacy are more likely to take out non-traditional and riskier mortgages. Gathergood and Weber show that higher scores on their measure of mortgage financial literacy are associated with a higher likelihood of choosing an interest-only mortgage (Gathergood and Weber 2017).

What is missing from the existing literature is a measure of mortgage literacy that emphasises the knowledge required to selecting a mortgage and managing risks emerging from mortgages. Our main contribution is to introduce a new measure of mortgage literacy. Mortgage literacy addresses

the gap in the literature by focusing on the knowledge relevant to selecting a mortgage and managing risks emerging from mortgages. In particular, we include questions on legal and fiscal aspects of mortgage borrowing. Including these aspects ties our questionnaire to the Dutch environment, as legal and fiscal implications of different mortgage products differ between jurisdictions. In the following section, we provide some background to the Dutch mortgage market, before describing the results of the mortgage risk questionnaire in detail.

2.1 The Dutch Mortgage Market

In 2015, 56% of Dutch households owned their home (The European Commission 2017, 24f). Middle income households often enter the owner-occupied housing markets at an early age, because the private rental market is small in many areas. This is partly due to a large subsidized social housing sector, which 30% of the Dutch relied on in 2015 (The European Commission 2017), and a generous interest deductibility for mortgages. In the Netherlands, interest payments on mortgages are fully tax deductible for up to 30 years. In effect, many areas in the Netherlands do not offer attractive rental options to middle income households ineligible for social housing. A result of the early entry into the mortgage market are high payment-to-income ratios, because the income of young borrowers tends to be lower than for people more advanced in their careers. 75% of households in our sample have taken out a mortgage at some point in their life.

The sharp fall in house prices in the Netherlands during the financial crisis of 2007/08 of 20% on average had a lasting impact on household finance (Statistics Netherlands (CBS) 2017). In effect of the price drop, in 2015 17.6% of homeowners in the Netherlands had higher mortgages than the current value of their house. Household debt-to-GDP stands at 118%, almost twice as much as the

EU-28 average (The European Commission 2017, 25). As a result, the European Systemic Risk board issued a warning to the Netherlands in 2016.

Against this backdrop, it is all the more important that households take informed decisions on whether to take out a mortgage, and how to hedge risks associated with mortgages. In our analysis, we evaluate to what extent households are in a position to assess and manage mortgage risks, taking the specific legal and fiscal situation of mortgage borrowers in the Netherlands into account.

A couple of features of the Dutch housing market deserve to be mentioned, because they provide the background to the questions in the Mortgage Literacy Questionnaire.

Starting in 2013, the Dutch government has begun putting a number of policies in place to improve the functioning of the owner-occupied housing market. Loan-to-income and loan-to-value ratios have been tightened, requiring house buyers to put up more equity and limiting their mortgage payments to a smaller share of their disposable income (Dutch Authority for the Financial Markets 2017c). In particular, banks are required to limit new mortgages to 104% of the value of the mortgaged property.

Moreover, the government mandated a change in the remuneration regime for mortgage advisors. The most important element of this change is the commission ban (Dutch Authority for the Financial Markets 2017d). Mortgage advisors may no longer accept kickbacks from mortgage providers or charge a mark-up on the interest rate of the mortgage. Instead, customers pay advisors a fee for their service, regardless of whether customers take out a mortgage.

As a result, so-called “execution-only mortgages” have become more widespread (Dutch Authority for the Financial Markets 2017a). Customers save the advice fee, paying instead a much lower

execution fee. However, customers are required to select their mortgage terms and do the required paperwork by themselves, without the help of a financial advisor.

The new regulation exempts interest-only mortgages taken out after January 2013 from tax deduction. Mortgage types that qualify for tax benefits now are annuity mortgages and linear mortgages. Annuity mortgages repay the principal over the course of the mortgage contract, keeping monthly payments consisting of interest and repayment stable. Annuity mortgages are the most common type of new mortgage. Linear mortgages are less commonly chosen. Borrowers who take out a linear mortgage repay a fixed proportion of their remaining loan each month, leading to decreasing payments over time.

Partly due to these regulatory changes, mortgage borrowers in the Netherlands commonly have several types of mortgage on the same property. In our sample, 32% of mortgage borrowers have more than one mortgage on their property.

Fixing mortgage rates is common, with 87% of respondents in our sample having fixed the interest rate of their mortgage. On average, borrowers fix their mortgage rate for 11 years.

A unique feature of the Dutch mortgage market is the National Mortgage Guarantee Scheme, an institution to protect mortgage lenders against losses and protect borrowers from spiralling penalty fees if they cannot meet mortgage payments (National Mortgage Guarantee 2017). While the scheme helps borrowers with mortgage payments in circumstances beyond their control, it does not allow borrowers to keep their house if they consistently cannot meet mortgage payments.

2.2 Mortgage Literacy Questionnaire

The Mortgage Literacy Questionnaire is designed to capture salient differences between different types of mortgages, the understanding of the legal rules and protections pertaining to mortgages,

as well as the fiscal implications of mortgages. Since our respondents are from the Netherlands, we tailored the questionnaire to the Dutch situation. Hence some of the questions would need to be adapted to employ the questionnaire in other countries. But the results of this study have implications that extend far beyond the Netherlands. While the questions we ask are specific to the Netherlands, knowledge about mortgage types, tax deductibility, and legal protection in the case of default matter in most jurisdictions. Table 1 lists the questions and answer options. Correct answers are marked in bold.

We took inspiration from the knowledge quiz developed by the "Dutch Authority for the Financial Markets" for customers as well as from questionnaires that Dutch banks use with customers to help them decide whether they have the knowledge required to opt for a "execution-only" mortgage (Dutch Authority for the Financial Markets 2017b). We discussed the questions with several experts, aiming at covering different common mortgage products in the Netherlands, as well as legal and fiscal issues that can make a major difference to the financial risks created by mortgages.

Participants' answers to the questions elicit whether respondents are aware of the risks associated with different types of mortgage, as well as whether they are aware of the strategies to manage these risks. Question 1 asks respondents about the advantages of fixing mortgage rates. Fixing mortgage rates is a way of managing potential financial vulnerabilities generated by mortgages, i.e. by hedging the risk of a rise in mortgage rates.

Questions 2 and 3 concern the workings of annuity mortgages. Question 2 asks about the evolution of interest payments for an annuity mortgage, and question 3 about the fiscal implications of annuity mortgages.

Question 4 concerns the evolution of outstanding debt for a household with two mortgages, an annuity and an interest-only mortgage. To answer this question correctly, respondents need to combine their knowledge of the workings of annuity and interest-only mortgages.

Question 5 concerns knowledge about the National Mortgage Guarantee Scheme. We test whether borrowers understand the limitations of the help this institution offers in case borrowers are unable to continue to pay their mortgage rates.

Finally, question 6 concerns the difference between taxable income and the amount by which taxes are reduced.

Table 1: Mortgage Literacy Questionnaire

1 What is the advantage of fixing the interest rate of your mortgage for longer? (select all that apply) ***i) You will not run the risk that interest rates go up unexpectedly.*** *ii) A longer fixing period is cheaper over the duration. iii) The interest rate is lower in a long interest period. iv) You repay less each month. v) I don't know.*
2 An annuity mortgage is a mortgage that keeps gross mortgage payments stable over the term of the mortgage. How does the share of interest you pay each month develop over the term of the annuity mortgage? ***i) The share of the interest decreases, and the share of your monthly*** *repayment increases. ii) The share of the interest increases, and the share of your monthly repayment decreases. iii) The share of interest stays stable over the period. v) I don't know.*
3 An annuity mortgage is a mortgage that keeps gross mortgage payments stable over the term of the mortgage. How does the amount that you can deduct from your income tax evolve over the term of the mortgage*?* ***i) You can deduct a higher amount at the beginning of the term.*** *ii) You can deduct a higher amount at the end of the term. iii) The amount you can deduct stays stable during the term. iv) I don't know.*
4 Suppose that you have a mortgage loan that consists of two parts: 1) An annuity mortgage loan part of € 50,000; 2) an interest-only mortgage loan part of € 150,000. You don't make any unscheduled repayments during the term. How big is your outstanding debt at the end of the term of your mortgage? *i) 0 EUR ii) 50.000 EUR iii) 100.000 EUR* ***iv) 150.000 EUR*** *iv) 200.000 EUR v) I don't know.*
5 During the term of the mortgage things can happen that lower your income. Think of disability or unemployment. Does the National Mortgage Guarantee scheme allow you to continue living in your house if you cannot pay the mortgage by yourself? *i) yes* ***ii) no*** *iii) I don't know.*
6 You live in your own house. Last year, you paid EUR 10.000 in interest for your mortgage. Your income tax rate in the relevant bracket is 42%. How much of your mortgage interest payments can you deduct from your taxable income? *i) Less than 4.200 EUR ii) 4.200 EUR* ***iii) 10.000 EUR*** *iv) I don't know.*

How is mortgage literacy conceptually related to financial literacy? Mortgage literate borrowers are financially literate in one specific domain, the domain of mortgages. On the conceptual level, mortgage literacy is therefore an aspect of financial literacy. Since mortgage literacy is an aspect of financial literacy, we expect a positive correlation between our measure of mortgage literacy and existing measures of financial literacy.

However, our measure of mortgage literacy covers financial literacy concerning mortgages in considerably more depth than existing measures of financial literacy. In particular, mortgage literacy emphasises legal and fiscal issues as well as differences between mortgage types not covered by existing general measures of financial literacy. The interest in developing a new measure of mortgage literacy lies precisely in the fact that people who know about the general financial concepts captured by the basic and advanced financial literacy questionnaires may not always know about the specifics relevant in making mortgage decisions, and vice versa. Therefore, we expect that a sizable group of respondents scores high on financial literacy while scoring low on mortgage literacy, and vice versa.

The regression analysis in section 4 focuses on the association between mortgage literacy and perceived mortgage risk, and the management of mortgage risk.

Concerning the relationship between mortgage literacy and perceived mortgage risk, we expect mortgage literate people to be more aware of potential risks associated with their mortgage. We expect that this awareness puts them in a better position to avoid and offset the risks associated with a mortgage. This is in line with the theory by Lusardi and Mitchell, according to which mortgage literacy is a form of human capital (Lusardi and Mitchell 2014). They note that the conventional microeconomic approach to saving and borrowing decisions assumes fully rational and well-informed individuals who are capable of optimizing their spending over their life-cycle, in the light of their preferences, expectations about the evolution of the economic environment, including returns on investment and liquidity constraints. Formulating and executing the required saving and spend-down plans to optimize spending over the life cycle involves complex economic calculations and requires expertise in dealing with financial markets. Mortgage decisions are an important element of a saving plan for many Dutch households. Acquiring the required knowledge

comes at a cost. Individuals who acquire the skills and knowledge to make complex financial decisions, including mortgage decisions, can therefore be seen as having a form of human capital that yields returns in the financial planning process.

Mortgage literacy can thus be seen as a form of human capital whose benefit consists in more appropriate mortgage decisions, including the avoidance of excessive risk. Hence, we expect mortgage literate borrowers to report their mortgages to be less risky. There are three channels that are likely to link mortgage literacy with lower mortgage risk. First, mortgage literate borrowers know more about the risks associated with mortgages (Huston 2010). This stock of knowledge will often be directly helpful in avoiding or managing excessive mortgage risks. Moreover, the knowledge covered by the Mortgage Literacy Questionnaire also puts their bearers in a better position to acquire new knowledge relevant to their mortgage choice. Having a basic understanding of mortgage products makes it easier to compare alternative offers along relevant dimensions.

Second, mortgage literate people are more likely to be aware of their knowledge about mortgages and the limitations of that knowledge. Improved self-awareness allows mortgage literate people to avoid mistakes in mortgage decisions. By contrast, people with low mortgage literacy are vulnerable to the "Dunning–Kruger effect," according to which people of low ability tend to overestimate their ability. This effect can be explained by the inability of people with low ability in some domain, such as mortgage literacy, to realize their lack of ability (Kruger and Dunning 1999).

Third, mortgage literate borrowers are likely able to deal with mortgage advice more productively. First, they are in a better position to judge the quality of the advice. This involves placing trust in advisors intelligently, by screening out bad advice, and acting on the recommendations of trustworthy advisors (Gaudecker 2015).

For these three reasons, we expect that mortgage literate people are better able avoid excessively risky mortgage choices that might put their household finances in jeopardy. In particular, we expect people with higher mortgage literacy to report that servicing their mortgage is less threatened by income and wealth shocks.

We expect that the human capital that mortgage literacy affords will make mortgage literate borrowers also more able to manage the risks originating from their mortgages. Specifically, we investigate whether households fix interest rates. Mortgages with fixed rates are *ex ante* more expensive than mortgages with floating rates, as households need to pay creditors for assuming the risk of rate hikes (Badarinza, Campbell, and Ramadorai 2017). At the same time, however, fixing interest rates is an effective means of managing some of the risks originating from a mortgage by hedging the downside risk of rate increases (Campbell 2006). While the added costs of fixing interest rates are transparent for borrowers regardless of how mortgage literate they are, the benefits are more likely to be apparent to mortgage literate borrowers. We therefore expect that mortgage literate people are more likely to fix their interest rates.

3. The Data

3.1 The DNB Household Survey

We have designed a questionnaire on mortgage literacy, which was fielded in the CentERpanel over two weeks in June 2017. The CentERpanel is an Internet based panel of over 2,000 households administrated by CentERdata at Tilburg University and sponsored by the Dutch Central Bank. The panel is representative of the Dutch population. Questionnaires are administered online. Panel members without internet access receive equipment that enables them to participate through their television. Both the head of the household and any partner aged 20 or above are interviewed. 2,126

people completed the survey (1,746 households). 68% of respondents have a residential mortgage on their property (1,443 respondents).

Our questionnaire is combined with background information from the 2016 Dutch Household Survey (DHS). The DHS is an annual study of Dutch households which collects detailed information on wealth holdings, earnings, socio-demographic information and psychological traits. The DHS consists of six modules. The module on accommodation and mortgages is answered by the household member managing the household finances only. Our final sample consists of the heads of households that could be matched to the accommodation module of the DHS 2016 as well as modules on income and wealth to obtain controls (N=1,174)

Table 2: Sample size

Sample	Size
All individuals who answered our questionnaire	2,126
Individuals from different households who answered our questionnaire	1,746
Heads of households that matched accommodation data from the DHS 2016	1,174

Table 4 contains the summary statistics of the variables we use in the analysis. In the following subsections, we explore the key variables we use in the regression analysis.

Table 3: Summary statistics of variables used in the analysis

Variable	N	Mean	SD	Min	Max
Literacy Scores					
Mortgage Literacy	1174	3.18	1.78	0	6
Basic Financial Literacy	1174	4.19	0.90	1	5
Advanced Financial Literacy	1174	6.57	3.13	0	11
Dependent Variables					
R1: Self-reported general mortgage risk	872	1.76	0.78	0	4
R2: Self-reported income risk dummy	872	1.98	0.40	1	3
R3: Self-reported wealth risk dummy	872	2.01	0.38	1	3
Fixed: Interest rate fixing dummy	562	0.88	0.33	0	1
Duration of fix in years	491	11.72	6.54	1	30
Controls					
Male	1174	0.66	0.47	0	1
Age	1174	58.39	15.47	21	92
Household Net Income	1174	2803	1385	0	12617
Household Wealth	1174	52116	165000	1	2870000
Socio Economic Status	1173	3.62	1.05	1	5
School Degree	1174	0.36	0.48	0	1
Vocational Degree	1174	0.48	0.50	0	1
University Degree	1174	0.16	0.37	0	1
Married	1174	0.60	0.49	0	1
Divorced	1174	0.07	0.25	0	1
Number of Children in Household	1174	0.49	0.92	0	5
Self-employed	1174	0.05	0.22	0	1
Retired	1174	0.36	0.48	0	1
Unemployed	1174	0.07	0.26	0	1
Government employee	1174	0.09	0.29	0	1
Risk proneness	1092	0.00	0.83	-1.22	2.24
OLTV: Original Loan to Value Ratio	487	0.98	0.37	0.13	2
CLTV: Current Loan to Value Ratio	478	0.55	0.35	-0.05	2.61
PTI: Payment to Income Ratio	498	0.19	0.15	0	1.84
Yfix: Year of Mortgage Origination	492	2010.58	4.79	1981	2016

3.2 Mortgage Literacy and Financial Literacy

Table 4 shows the summary statistics for the responses to the Mortgage Literacy Questionnaire. Panel A reports the proportion of correct and incorrect answers for each of the six mortgage literacy questions individually. The share of correct answers ranges between over three quarters for question 1 to below one quarter for question 6. Question 1 on the benefits of fixing interest rates is

answered correctly by 77% of respondents. Questions 2 and 4 on differences between mortgage products receive 60% and 63% correct answers, indicating that just below two thirds of respondents understand these differences. The remaining three questions concern the fiscal and legal aspects of mortgages. Question 3 asks about the fiscal implications of annuity mortgages. 55% of respondents answer this question correctly. Question 5 on the protections the National Guarantee Scheme affords delinquent borrowers receives just over a third correct answers. For the most difficult question 6 on tax benefits of mortgages, only 24% answered the question correctly.

Panel B looks at the proportion of people who achieved a particular score on the entire questionnaire. Only 7% of respondents answered all six mortgage literacy questions correctly. These results indicate that many Dutch households have difficulties answering questions about differences between mortgage products, as well as their legal and fiscal implications. These are precisely the aspects of mortgage decisions not covered in established measures of financial literacy.

Table 4: Summary Statistics Mortgage Literacy

Panel A: Percentage of respondents who answered individual questions correctly / incorrectly / don't know

	Questions					
	1	2	3	4	5	6
Correct	77%	60%	55%	63%	35%	24%
Incorrect	17%	21%	23%	14%	42%	43%
Don't know	6%	19%	22%	23%	23%	33%

Panel B: Percentage of respondents with respective number of correct / don't know answers

	Number of questions						
	none	1	2	3	4	5	6
Correct	11%	12%	14%	14%	22%	21%	7%
Don't Know	5%	3%	2%	1%	0%	0%	0%

We have included the basic and advanced financial literacy questionnaires in our survey to enable comparison with the Mortgage Literacy Questionnaire. Appendix 3 shows the results of the basic

and advanced financial literacy surveys, respectively. Our results are very similar to the results collected by Van Rooij et al. (Van Rooij, Lusardi, and Alessie 2011a) in 2011. The share of correct answers ranges from three quarters to nine out of ten for the basic literacy questions, and just over a quarter to seven out of ten for advanced financial literacy. Question four about the time value of money remains the most difficult basic literacy question (63% correct); the same holds for question 11 about what happens to bond prices if interest rates fall the most difficult advanced literacy question (27% correct). The share of do not know answers is lower for basic literacy questions (3%-8%) than for advanced literacy questions (12%-42%), consistent with the 2011 data. Similar to six years ago, 40% of respondents answer all five basic literacy questions correctly. Just 9% of respondents got all advanced literacy questions right. Financial literacy in the Netherlands has not changed in the seven years since 2010.

Comparing the mortgage literacy scores with the financial literacy scores shows that respondents find mortgage literacy questions more difficult than the basic and advanced literacy questionnaires. While only 7% of respondents answered all six mortgage literacy questions correctly, 40% answered all five basic financial literacy questions correctly. 24% answered the first six advanced literacy questions correctly, more than three times as many as in the case of mortgage literacy. Nonetheless, respondents are more confident about their knowledge about mortgages than about advanced financial literacy. On average, 21% say that they don't know the right answer to the mortgage debt literacy questions, in contrast to 23% for advanced financial literacy. The difference between these means is statistically significant ($p=0.00$).

Mortgage literacy is not just a more difficult version of the financial literacy questionnaires. Rather, mortgage literacy gets at a distinct domain of knowledge, which is only moderately correlated with

financial literacy scores.[1] The correlations between the three measures are all positive, indicating that mortgage literacy is related to financial literacy. The correlation coefficient between basic financial literacy and mortgage literacy is 0.34. Mortgage literacy is more strongly correlated to advanced financial literacy, with a correlation coefficient of 0.63. It is not surprising that advanced financial literacy is more strongly correlated with mortgage literacy than basic financial literacy, because the former tests knowledge about specific financial products such as stocks and bonds, whereas the latter focuses on numeracy. The Mortgage Literacy Questionnaire emphasises knowledge about specific financial products as well, albeit with a focus on mortgages, rather than investment products.

Nonetheless, the correlation between mortgage literacy and advanced financial literacy implies that advanced financial literacy captures just 40% of the variance in mortgage literacy. Hence 60% of variance in mortgage literacy is unaccounted for by advanced financial literacy. 35% of respondents (N=407) are in matching quintiles for advanced literacy and mortgage literacy. This leaves almost two thirds of respondents who score in a higher or lower quintile for mortgage literacy than for advanced financial literacy. 11% of respondents (N=126) score in the lowest two quintiles for financial literacy and the highest two quintiles for mortgage literacy or vice versa. These results support the assumption that mortgage literacy measures a distinct construct from financial literacy.

3.3 Mortgage Risks

We included three questions to measure whether respondents perceive their mortgage as being risky. The first question asks about whether respondents perceive having a mortgage as a financial

[1] Correlations between the literacy scores are reported in Appendix 2.

risk for them in general. The second question asks whether becoming unemployed would put servicing the mortgage in jeopardy. The third question asks whether a drop in housing prices would put pressure on the financial planning of the household. These questions follow a similar structure to the questions van Ooijen et al. use to measure perceived mortgage risk (Van Ooijen and Van Rooij 2016).[2]

The results show that 14% of respondents think that taking out a mortgage is a very high or a high-risk decision (R1). By contrast, more than a third consider taking out a mortgage to be no risk at all.

Almost one in ten respondents believe that six months of unemployment would cause difficulties with servicing their mortgage (8% don't know) (R2).

Almost 7% believe that a 20% price drop in the value of their house would cause them financial distress (8% don't know) (R3). Our results seem to be lower than the results reported by Van Ooijen et al. with respect to related questions administered to the same panel (2016, 11). Their study found that almost two thirds of respondents expect to run into problems with repaying their mortgage in case of an adverse income shock. They find that a quarter of respondents are convinced that a drop in housing prices would lead to serious financial problems. However, we cannot directly compare results because the authors do not report the exact wording of the questions they posed in the study.

3.4 Loan-to-value and Payment-to-income ratios

[2] Appendix 4 reports the wording of the questions and gives an overview of the results. Note that we gathered only 872 responses to these questions because we only asked respondents who have a mortgage.

To put perceived mortgage risks into perspective, we include objective measures of mortgage riskiness as controls. We measure objective mortgage riskiness by computing the original loan to value ratio and the payment to income ratio from the household statistics.

Including these objective measures as controls is important because we expect mortgage literacy to have two effects on the perceived riskiness of mortgages running contrary to one another. On the one hand, we expect mortgage literate borrowers to anticipate and manage mortgage risks better. We call this the *cautionary effect* of mortgage literacy. On the other hand, mortgage literate borrowers are more sensitive to the risks associated with their mortgages than less literate borrowers. We call this the *sensitivity effect* of mortgage literacy.

Taking into account loan-to-value and payment-to-income ratios allows us to study the impact of mortgage literacy on perceived mortgage riskiness while controlling for the volume of a mortgage relative to income and equity of the borrower. To the extent that the cautionary effect determines perceived mortgage risks, mortgage literate respondents should tend to report their mortgages to be less risky, because they will have taken steps to manage income and wealth risk, such as fixing interest rates. In contrast, to the extent that the sensitivity effect determines perceived mortgage risks, mortgage literate borrowers should report their mortgages to be riskier, because they would be more keenly aware of risks.

Following the methodology developed by Van Ooijen et al., and in line with the literature on mortgage defaults, we characterize the riskiness of mortgages in terms of the relationship between the mortgage value and the value of the house (loan-to-value ratio), as well as between monthly mortgage payments and monthly household income (payment-to-income ratio) (Van Ooijen and Van Rooij 2016, 8). High loan-to-value and payment-to-income ratios were a major cause of personal bankruptcy during the financial crisis. In the case of loan-to-value ratios, the reason is that

if borrowers have little equity in their house, the amount of their mortgage debt quickly exceeds the value of the house once house prices start to drop (Admati and Hellwig 2013). In the case of payment-to-income ratios, the reason is that unemployment spreads in times of crisis. If payment-to-income ratios are high, even short spells of unemployment or a moderate income drop can force households to sell off their house. Fire-sales concentrated in one region lead to a drop in housing prices, exacerbating existing problems with high loan-to-value ratios.

We calculate the original loan-to-value ratio (OLTV) by dividing the original loan amount by the purchase price of the house. We also calculate the current loan-to-value ratio (CLTV), by dividing the outstanding amount of debt by the current perceived house value. We take into account any savings to pay off the mortgage at the end of the term, for instance in the case of investment mortgages or life insurance mortgages. We calculate the payment-to-income ratio (PTI) by dividing monthly gross mortgage payments by monthly net household income.

As reported in Table 4, the mean original loan-to-value ratio is 0.97, suggesting that the average borrower makes a down-payment on their mortgage of just 3%. This implies that if house-prices drop by more than 3% at the beginning of the repayment period, the volume of the mortgage exceeds the value of the house. 45% of borrowers took out a mortgage exceeding the value of their house. Note that in the Dutch context, paying off the mortgage may still generate a positive return on investment for borrowers, as mortgage payments are subsidized by the government through the tax deductibility of interest paid on mortgages. However, it would be more advantageous for borrowers with negative equity to walk away from their mortgage and buy a house at reduced housing prices with a new mortgage. Unlike in the US, walking away from your mortgage is however not permitted in the Netherlands.

Our findings are consistent with the findings in Van Ooijen et al. In their study, the authors point out a rising trend in OLTV ratios in the period between 2007 and 2010, the last year for which data was available. This period is of course exceptional due to the financial crisis of 2008/9. As illustrated by Figure 1 in Appendix 4, we see that the presumed trend did not last, as OLTV ratios diminished after 2011. This development is consistent with tightening regulation in the mortgage market in the aftermath of the financial crisis. According to our calculations, 60% of loans in the period from 2007-2010 had an OLTV ratio exceeding 1 (67% according to Van Ooijen et al.'s computations; the difference is probably due to different strategies in cleaning the data). In the period between 2010 and 2016, the share of new mortgages with OLTV ratios above 1 has diminished to 47%.

We find that current Loan-to-Value ratios are 0.56 on average. Van Ooijen et. al find a very similar ratio of 0.55 on average. CLTV ratios about half of OLTV ratios reflect the fact that many households have paid off parts of their mortgage debt. It is the CLTV ratio that determines at what point a drop in housing values leads to the mortgage exceeding the value of the house. Hence the CLTV ratio is crucial from a financial stability perspective.

Our final measure is the payment-to-income ratio. The PTI ratio is a measure of the payment burden of a mortgage. It expresses what share of their income households spend on housing. While LTV ratios are high by international comparison, PTI ratios are comparatively low at just below 20%. Note that our calculation does not take the full tax deductibility of mortgage interest payments in the Netherlands into account. Taking the deduction into account would further decrease PTI ratios.

With these measures of the objective riskiness of mortgages in place, we are now in a position to investigate the relationship between perceived mortgage riskiness and objective measures of risk. Table 5 shows the perceived mortgage risks relative to the original and current LTV ratios, as well

as the current PTI ratios. Answers to R1, the question about general mortgage risks, range from 1 (no risk at all) to 4 (very high risk). The columns for R2 on income risk and R3 on wealth risk report the proportion of respondents in each category who answer the income risk and wealth risk question in the affirmative, respectively. For the current LTV and PTI ratios, the differences between the low, medium, and high quantiles are significant at a 1% level according to Pearson's Chi^2 test. In the case of the original LTV ratio, differences are significant at the 1% level for R2 and R3, but not for R1. For current LTV and PTI, perceived riskiness goes up for respondents with objectively riskier mortgages. This result suggests that respondents with objectively riskier mortgage terms tend to be aware of the increased risks they run. Our findings are consistent with van Ooijen et. al, who also find that borrowers with objectively riskier mortgages tend to report higher perceived mortgage risks (Van Ooijen and Van Rooij 2016). It appears that borrowers are in general well attuned to the mortgage risks they face.

Table 5: Perceived mortgage risks relative to LTV and PTI ratios

Original LTV	Mean	R1: Overall Risk	R2: Income Risk	R3: Wealth Risk
Low	0.57	1.66	6.43%	3.51%
Medium	0.99	1.94	12.43%	7.10%
High	1.35	1.86	10.00%	7.65%
Average	0.97	1.82	9.61%	6.08%
Pearson's Chi^2 test		p-value = 0.00	p-value = 0.22	p-value = 0.16

Current LTV	Mean	R1: Overall Risk	R2: Income Risk	R3: Wealth Risk
Low	0.18	1.57	4.73%	0.59%
Medium	0.53	1.70	3.01%	2.41%
High	0.96	2.06	16.56%	12.27%
Average	0.56	1.77	8.03%	5.02%
Pearson's Chi^2 test		p-value = 0.00	p-value = 0.00	p-value = 0.00

Current PTI	Mean	R1: Overall Risk	R2: Income Risk	R3: Wealth Risk
Low	0.06	1.55	2.82%	2.26%
Medium	0.17	1.82	5.71%	5.71%
High	0.35	2.02	19.19%	11.05%
Average	0.19	1.79	9.16%	6.30%
Pearson's Chi^2 test		p-value = 0.00	p-value = 0.00	p-value = 0.00

Note: Mean reports the average LTV/PTI value within the respective category. R1 is reported as a mean on a scale from 0 (no risk) to 4 (high risk). R2 and R3 are dummy variables. The percentages indicate the proportion of respondents who reported that they were concerned about income and wealth risk, respectively.

4. Results

In this section, we investigate the relationship between mortgage literacy and perceived mortgage risk as well as the management of mortgage risks. We use the following demographic variables as controls: the net household income, household wealth, education, gender, age, family circumstances, professional status, and risk proneness. These standard controls are included in all regressions.

4.1 Mortgage Literacy and Perceived Mortgage Risk

Let us first consider how mortgage literacy relates to perceived mortgage risks. In section **Error! Reference source not found.**, we distinguished two effects mortgage literacy might have on perceived mortgage risks which run contrary to each other: the cautionary effect and the sensitivity

effect. The cautionary effect consists in the mortgage literate to be better able to manage the risks from their mortgages. They should therefore be less vulnerable to income and wealth shocks. In contrast, to the extent that mortgage literate people are more sensitive to mortgage risks without taking action to address these risks, they should perceive their mortgage to be riskier. The empirical question is whether the sensitivity effect or cautionary effect dominates.

By introducing objective measures of mortgage riskiness, we have prepared the ground to test which of these two effects is more pronounced. By controlling for LTV and PTI ratios, we estimate the effect of mortgage literacy on perceived mortgage riskiness abstracting from differences in the size of the mortgage relative to household income or wealth. Given that households have decided they want a mortgage of a certain size relative to their economic potential, we measure to what extent they manage (perceived) mortgage risks.

Table 6 reports the results of an OLS regression with the z-score of perceived general mortgage riskiness introduced in section 3.3 as outcome variable (R1). We first show the results for mortgage literacy in addition to standard controls (Column 1), add the objective risk measures (Column 2), replace mortgage literacy with basic and advanced financial literacy (Column 3), and finally include mortgage literacy as well as financial literacy scores (Column 4).

Column 1 shows no significant association between mortgage literacy and perceived mortgage risks. Mortgage literacy turns significant at a 10% level with a negative sign once objective risk measures are included. In light of our distinction between sensitivity and caution we can interpret these results as follows: Since the regression in Column 1 does not control for the objective riskiness of mortgages, the sensitivity effect and the cautionary effect may cancel each other out. By contrast, once we control for objective risk measures, the cautionary effect becomes salient. The payment-to-income ratio is significant at a 1% level. The positive coefficient of the PTI

indicates that respondents who spend a greater proportion of their income on their mortgage perceive their mortgage to be riskier. The mortgage literacy coefficient expresses the contribution mortgage literacy makes when objective risk measures are controlled for. An increase in mortgage literacy by one standard deviation is associated with a 11% of a standard deviation decrease in perceived overall mortgage risk. This can be explained by the cautionary effect of mortgage literacy that is now salient: given mortgages with identical LTV and PTI ratios, mortgage literate borrowers will do more to manage the risks of their mortgages, such as fixing interest rates.

The negative coefficient of mortgage literacy stays significant, now at a 5% level, and becomes slightly larger once we additionally include basic and advanced financial literacy scores (Column 4). Neither basic nor advanced financial literacy are significantly related to overall mortgage riskiness in this model (Column 3). This result indicates that mortgage literacy is significantly associated with perceived financial riskiness over and above basic and advanced financial literacy. By contrast, neither basic nor advanced financial literacy are significantly related to differences in perceived mortgage riskiness.

Table 6: Regression results: Mortgage literacy and perceived general mortgage risks (R1)

Variables	(1)	(2)	(3)	(4)
Mortgage Literacy	-0.0016	-0.1086*		-0.1228**
	(0.0405)	(0.0571)		(0.0616)
Basic Financial Literacy			-0.0038	0.0050
			(0.0521)	(0.0521)
Advanced Financial Literacy			-0.0055	0.0386
			(0.0607)	(0.0644)
Male	0.0320	0.0030	-0.0015	-0.0133
	(0.0788)	(0.1063)	(0.1100)	(0.1097)
Age (18-34 omitted)				
35-44 years	-0.0636	-0.3113	-0.2907	-0.3153
	(0.1525)	(0.2141)	(0.2159)	(0.2153)
45-54 years	-0.3258**	-0.6200***	-0.6016***	-0.6230***
	(0.1496)	(0.2157)	(0.2176)	(0.2170)
55-64 years	-0.4424***	-0.4758**	-0.4648**	-0.4809**
	(0.1499)	(0.2233)	(0.2257)	(0.2249)
65 years and older	-0.4505**	-0.5663**	-0.5393**	-0.5734**
	(0.1816)	(0.2705)	(0.2730)	(0.2724)
Education (School degree omitted)				
Vocational Education	0.0387	0.1146	0.1466	0.1162
	(0.0843)	(0.1139)	(0.1138)	(0.1143)
University Education	0.1575	0.2430	0.2686	0.2407
	(0.1333)	(0.1650)	(0.1656)	(0.1655)
Log Household Income	-0.0435	0.1842	0.1824	0.1744
	(0.0918)	(0.1448)	(0.1466)	(0.1460)
Log Household Wealth	-0.0278**	-0.0347*	-0.0424**	-0.0361*
	(0.0137)	(0.0206)	(0.0206)	(0.0208)
Socio Economic Status	0.0348	0.0150	-0.0007	0.0110
	(0.0465)	(0.0611)	(0.0615)	(0.0616)
Married	-0.0478	0.0696	0.0636	0.0717
	(0.0849)	(0.1111)	(0.1118)	(0.1114)
Divorced	0.0548	-0.0954	-0.1089	-0.0952
	(0.1530)	(0.1993)	(0.2005)	(0.1998)
Number of Children in Household	0.0750*	0.0903*	0.0939*	0.0925*
	(0.0426)	(0.0527)	(0.0532)	(0.0530)
Self-employed	0.0593	0.1660	0.1615	0.1776
	(0.1544)	(0.2064)	(0.2085)	(0.2078)
Retired	-0.2099	-0.0931	-0.0877	-0.0894
	(0.1333)	(0.1860)	(0.1874)	(0.1866)
Unemployed	0.1984	0.0758	0.1121	0.0684
	(0.1736)	(0.2286)	(0.2294)	(0.2295)
Government worker	-0.0958	0.0864	0.0971	0.0865
	(0.1145)	(0.1372)	(0.1387)	(0.1382)
Risk proneness	0.1339***	0.1275**	0.1172**	0.1188**
	(0.0421)	(0.0543)	(0.0563)	(0.0561)
Mortgage Characteristics				
OLTV		-0.1107	-0.1163	-0.1112
		(0.1144)	(0.1151)	(0.1147)
CLTV		0.0022	0.0009	0.0066
		(0.1934)	(0.1949)	(0.1941)
PTI		1.5778***	1.5425***	1.5588***
		(0.4662)	(0.4702)	(0.4683)
Constant	0.8254	-1.0414	-0.9684	-0.9274
	(0.7078)	(1.1038)	(1.1259)	(1.1215)
Observations	814	383	383	383
R-squared	0.1226	0.2428	0.2352	0.2436
Adjusted R-squared	0.102	0.196	0.186	0.193

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

In Appendix 5, we run a robustness check with perceived income risk (R2) and wealth risk (R3) as dependent variables. The results support the present analysis: increased mortgage literacy is associated with lower perceived mortgage risk.

4.2 Addressing Endogeneity

Based on the results from the OLS regressions reported so far, we cannot yet give a causal interpretation of the relationship between mortgage literacy and perceived mortgage risks. Mortgage literacy might be endogenous due to reverse causality, if by managing mortgage risks better one becomes more mortgage literate. Omitted variables are another potential source for endogeneity. We have included a wide range of controls to mitigate omitted variable bias. Nonetheless, we cannot control for the general ability to deal with fiscal and legal issues and to navigate intransparent product markets. As a result, the estimated mortgage literacy coefficient may be biased upwards. By contrast, it is likely that mortgage literacy is measured with substantial error with the short instrument we developed, which may lead to a downward bias in the estimated mortgage literacy coefficient.

To address these concerns about potential upward or downward biases in the mortgage literacy coefficient, we perform an instrumental variable estimation, instrumenting mortgage literacy with financial literacy scores ten years ago. Having general knowledge about personal finance puts people in a better position to acquire more specialized knowledge about finance. Mortgage literacy is a specialized aspect of financial literacy. It is therefore plausible that being financially literate ten years ago is causally linked to being more mortgage literate today. Hence financial literacy in 2006 is a good candidate to meet the *first stage requirement* on a good instrument.

The regression results reported above suggest that not even present basic and advanced financial literacy scores are significantly associated with perceived mortgage risks. It is therefore hard to see how financial literacy ten years ago should be influenced by perceived mortgage risks today. Financial literacy scores in 2006 therefore seem to meet the *exclusion requirement* on good instruments, making it a promising instrument to rule out reverse causality.

Finally, good instruments are required to be *unrelated to the assumed omitted variables* we want to control for. Financial literacy is likely to be unrelated to the omitted variables we are most concerned about, including the ability to deal with tax and legal issues and the ability to navigate intransparent product markets. The reason is that financial literacy abstracts from the details of concrete financial products, as well as the legal and tax implications of financial decisions.

Appendix 7 reports the results of a GMM regression using basic and advanced literacy scores in 2006 as instruments for mortgage literacy. The second-stage regression supports our previous analysis. Mortgage literacy is negatively related to perceived mortgage risks, significant at a 1% level. The coefficient is almost ten times as large as in the OLS regression, suggesting that the OLS estimate may be biased downwards. The results of the Wu-Hausman test for endogeneity suggest that mortgage literacy is indeed endogenous ($p = 0.0008$). Hansen's over-identification test suggests that there is indeed no significant correlation between our instrument and the error term ($p = 0.83$).

However, financial literacy in 2006 is far from a perfect instrument for mortgage literacy. After merging with the data from the 2006 survey, our sample shrinks to 131 observations. The F-statistic is well below the recommended cut-off point of 10 to avoid the weak-instrument problem ($F = 2.48$) (Staiger and Stock 1997). For weak instruments, the coefficients in GMM estimations may be biased in the same direction as the OLS estimate. However, repeating the regression with the LIML instead of the GMM estimator leads to qualitatively the same results (mortgage literacy has a coefficient of -1.25, again significant at the 1% level). LIML estimators tend to be less biased for weak instruments than GMM estimates. Moreover, we conducted the conditional likelihood ratio test (CLR), which is robust to weak instruments (Moreira 2003). Based on the CLR, we construct a confidence set for the mortgage literacy coefficient based on a 95% confidence level that is robust

to the weak instrument problem (-2.31, -0.64), supporting the results of the previous analysis. Overall, the instrumental variable approach supports the conclusion that mortgage literacy leads to lower perceived mortgage risks.

It is worth mentioning an alternative explanation for why mortgage literate borrowers report lower perceived mortgage risks. Increased mortgage literacy may somehow be associated with a lower sensitivity for risks associated with a mortgage. This explanation is strongly counter-intuitive, as the Mortgage Literacy Questionnaire tests for knowledge that should improve the awareness of borrowers of mortgage risks. Because of the implausibility of the alternative explanation, we conclude that increased mortgage literacy is associated with lower perceived mortgage risk because mortgage risks for this group are indeed smaller.

We suspect that mortgage risks are smaller for mortgage literate borrowers because they manage risks originating from their mortgage more cautiously. For instance, fixing the interest rate of a mortgage for longer hedges the risk of surging mortgage payments due to interest rate increases. This explanation supports our expectation that increased mortgage literacy is associated with lower mortgage risks. In the next section, we provide further support by showing that mortgage literate borrowers do indeed take additional steps to hedge risks from their mortgages.

4.3 Mortgage Literacy and Mortgage Terms

In this section, we test our expectation that increased mortgage literacy is associated with borrowers hedging risks originating from their mortgage. Fixing mortgage interest rates is a way of managing the risk of interest rate hikes. For this reason, we expect that more mortgage literate respondents are more likely to fix their interest rates.

We run a probit analysis with the dummy variable whether people fixed their interest rates as dependent variable. We first show results for mortgage literacy as independent variable, in addition to standard controls (Column 1). Second, we replace mortgage literacy by basic and advanced financial literacy (Column 2). Finally, we combine all three literacy measures into one regression (Column 3).

The coefficient of mortgage literacy is positive and significant at the 1% level. This result suggests that more mortgage literate people are more likely to fix their rates, with an increase in mortgage literacy of one standard deviation associated with an increase of 28% of the likelihood of fixing your rate. In contrast, financial literacy is not associated with a significant increase of rate-fixing. If financial and mortgage literacy scores are combined, mortgage literacy stays significant, and financial literacy remains insignificant. Therefore, the significant association of mortgage literacy with rate fixing exists even if we control for financial literacy.

Table 7: Regression results: Mortgage Literacy and rate-fixing

Variables	(1)	(2)	(3)
Mortgage Literacy	0.2383***		0.2065**
	(0.0920)		(0.1009)
Basic Financial Literacy		0.0592	0.0302
		(0.0900)	(0.0920)
Advanced Financial Literacy		0.1467	0.0688
		(0.1011)	(0.1093)
Male	-0.0128	-0.0380	-0.0481
	(0.1844)	(0.1879)	(0.1904)
Age (18-34 omitted)			
35-44 years	-0.1038	-0.0706	-0.0922
	(0.4142)	(0.4040)	(0.4129)
45-54 years	-0.1553	-0.1260	-0.1398
	(0.4045)	(0.3972)	(0.4048)
55-64 years	-0.6373	-0.5659	-0.6280
	(0.3939)	(0.3840)	(0.3946)
65 years and older	-0.8363*	-0.7907*	-0.8262*
	(0.4630)	(0.4567)	(0.4645)
Education (School degree omitted)			
Vocational Education	-0.3473*	-0.3915*	-0.3466*
	(0.2054)	(0.2040)	(0.2057)
University Education	-0.5521*	-0.5981**	-0.5521*
	(0.3035)	(0.3007)	(0.3036)
Log Household Income	0.3594*	0.3294	0.3417
	(0.2117)	(0.2125)	(0.2137)
Log Household Wealth	0.0248	0.0260	0.0216
	(0.0300)	(0.0302)	(0.0304)
Socio Economic Status	0.0767	0.0962	0.0684
	(0.1073)	(0.1070)	(0.1081)
Married	-0.2919	-0.2673	-0.2893
	(0.1942)	(0.1934)	(0.1947)
Divorced	0.0995	0.1502	0.1014
	(0.3887)	(0.3795)	(0.3882)
Number of Children in Household	-0.0426	-0.0475	-0.0429
	(0.1012)	(0.1009)	(0.1013)
Self-employed	-1.0001***	-0.9510***	-0.9849***
	(0.2964)	(0.2978)	(0.2979)
Retired	-0.0609	-0.0756	-0.0592
	(0.3150)	(0.3157)	(0.3164)
Unemployed	-0.6570*	-0.7204**	-0.6787*
	(0.3597)	(0.3570)	(0.3613)
Government worker	-0.2126	-0.2138	-0.2186
	(0.2483)	(0.2487)	(0.2496)
Risk proneness	-0.2701***	-0.2847***	-0.2902***
	(0.0972)	(0.1001)	(0.1010)
Constant	-1.0550	-0.8896	-0.8521
	(1.6217)	(1.6425)	(1.6541)
Observations	533	533	533
Pseudo R-squared	0.113	0.105	0.115

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

The first question in the Mortgage Literacy Questionnaire concerns the advantages of fixing mortgage rates. The expected answer is that fixing the interest rate hedges the downside risk of interest rate hikes. Is the regression result driven just by the answer to the first question, or does the Mortgage Literacy Questionnaire as a whole elicit a tendency to manage mortgage risks better? In Appendix 6, we report the results of a robustness analysis to address this issue. We run the above

regression with a modified mortgage literacy score, which is only based on answers to questions two to six in the questionnaire, excluding question 1. The results are qualitatively the same as in the above regression, with the exception that the significance level of mortgage literacy in column 1 decreases to 5%.

For robustness, we run an additional OLS regression with the duration of the interest rate fix as dependent variable. On average, the 42% of respondents who fixed their interest rates (N=491) fixed rates for 12 years, from a minimum of one year (N=10) to a maximum of 30 years (N=26). Popular choices are five years (N=62), ten years (N=226), and 20 years (N=54). We include as an additional control the year in which the mortgage was fixed, to pick up on trends in inflation expectations and varying practice over time. Column 1 reports results for mortgage literacy, column 2 for financial literacy, and column 3 for both mortgage and financial literacy.

The coefficient of mortgage literacy is positive and significant at a 5% level, suggesting that an increase in mortgage literacy of one standard deviation is associated with an increase in the duration of the interest rate fix of almost three quarters of a year. There is no significant association between financial literacy and the duration of the interest fix. If both mortgage and financial literacy are included, mortgage literacy stays significant, at the 10% level, while financial literacy remains insignificant.

This result supports the finding from the previous analysis: mortgage literacy is associated with an increase not only of whether people fix their mortgage rates, but also with for how long. Financial literacy, however, does not appear to be associated with the duration of the interest rate fix.

Table 8: Regression results: Mortgage literacy and duration of interest rate fix

Variables	(1)	(2)	(3)
Mortgage Literacy without Q1	0.6801**		0.6702*
	(0.3350)		(0.3619)
Basic Financial Literacy		0.2856	0.2222
		(0.3396)	(0.3404)
Advanced Financial Literacy		0.1755	-0.0799
		(0.3789)	(0.4023)
Male	-0.7963	-0.7950	-0.8067
	(0.6398)	(0.6613)	(0.6595)
Age (18-34 omitted)			
35-44 years	1.7629	1.8182	1.8113
	(1.1476)	(1.1554)	(1.1522)
45-54 years	0.0763	0.0515	0.1254
	(1.1625)	(1.1708)	(1.1683)
55-64 years	-1.2236	-1.1493	-1.1284
	(1.1807)	(1.1964)	(1.1932)
65 years and older	-1.8086	-1.7729	-1.7321
	(1.5163)	(1.5297)	(1.5257)
Education (School degree omitted)			
Vocational Education	-0.1196	-0.2325	-0.1174
	(0.7221)	(0.7228)	(0.7235)
University Education	0.3816	0.2475	0.3798
	(1.0868)	(1.0894)	(1.0888)
Log Household Income	1.3279	1.3319	1.3090
	(0.9032)	(0.9127)	(0.9102)
Log Household Wealth	-0.0456	-0.0180	-0.0461
	(0.1265)	(0.1272)	(0.1277)
Socio Economic Status	-0.4979	-0.3856	-0.4943
	(0.4073)	(0.4065)	(0.4096)
Married	0.1206	0.1815	0.1301
	(0.6998)	(0.7025)	(0.7012)
Divorced	0.4600	0.7181	0.4416
	(1.3138)	(1.3116)	(1.3165)
Number of Children in Household	-0.5018	-0.5315	-0.5040
	(0.3316)	(0.3330)	(0.3325)
Self-employed	-3.0205**	-3.1168**	-2.9952**
	(1.2966)	(1.3014)	(1.2995)
Retired	-0.6086	-0.6969	-0.6318
	(1.2051)	(1.2106)	(1.2078)
Unemployed	-0.3832	-0.5186	-0.4550
	(1.6774)	(1.6930)	(1.6888)
Government worker	0.1147	0.0177	0.0795
	(0.8683)	(0.8735)	(0.8717)
Risk proneness	-0.2484	-0.2657	-0.2559
	(0.3501)	(0.3648)	(0.3638)
Year of Mortgage Contract	-0.6332***	-0.6279***	-0.6293***
	(0.0559)	(0.0565)	(0.0564)
Constant	1,277.8977***	1,266.8896***	1,270.2631***
	(112.4391)	(113.7170)	(113.4204)
Observations	464	464	464
R-squared	0.2717	0.2668	0.2724
Adjusted R-squared	0.239	0.232	0.236

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

The results from this section lend additional support to the hypothesis that increased mortgage literacy has a cautionary effect on borrowers. This is consistent with the explanation that since mortgage literate borrowers know more about risks that originate from mortgages, they take active steps to hedge these risks, such as fixing their mortgage for longer. The reason that more mortgage

literate borrowers perceive their mortgage to be less risky may thus indeed be that their mortgage risks are in fact lower due to better management of mortgage risks on the part of borrowers.

5. Discussion and Conclusion

We introduced the Mortgage Literacy Questionnaire, a new measure of the domain-specific knowledge relevant to mortgage decisions, to study mortgage risks and risk management strategies. We showed that mortgage literacy captures a specific domain of knowledge that is not covered by basic and advanced financial literacy. We have investigated two main questions: First, how much do mortgage borrowers know about different mortgage products, as well as the legal and fiscal implications of their mortgage? Second, is increased mortgage literacy associated with differences in how mortgage risks are perceived and whether they are hedged?

We find that there are considerable shortcomings in the knowledge of Dutch households concerning mortgages. Less than 7% of respondents answered all six questions of the Mortgage Literacy Questionnaire correctly. Only a minority understand the National Mortgage Guarantee scheme or the fiscal implications of taking out a mortgage. The three questions concerning legal and fiscal matters were answered correctly by between a quarter and just over half of participants.

We find evidence that mortgage literacy is associated with lower perceived mortgage risk. We considered two reasons for this result: either increased mortgage literacy makes borrowers less sensitive to mortgage risks, or increased mortgage literacy leads to more cautionary management of mortgage risks. The former explanation is highly counterintuitive. We have found additional support for the latter explanation by investigating whether mortgage literacy is associated with a particular strategy to hedge mortgage risks, namely to fix interest rates. We find that mortgage literate borrowers are more likely to fix their mortgage rates, and that they fix their rates for longer.

These results suggest that mortgage literacy has a cautionary effect, leading to better management of mortgage risks and thus to less vulnerability to income and wealth shocks.

It is noteworthy that basic and advanced financial literacy are not significantly associated with either mortgage risks or the management of mortgage risks. This result suggests that mortgage literacy has predictive power concerning mortgage decisions over and above financial literacy.

Our OLS regressions do not exclude the possibility that mortgage literacy arises endogenously with financial choices. If mortgage literacy is correlated with unobserved variables, this could lead to falsely attributing the effects of these unobserved variables to mortgage literacy. We addressed this problem partly by including a large range of controls that could influence the outcome variables and may be correlated with mortgage literacy, including variables capturing household wealth and income as well as socio-economic status, gender, age, employment, risk proneness, loan-to-value and payment-to-income ratios, and education.

Another potential source of endogeneity is reverse causality. Mortgage literacy might arise from financial behaviour or outcomes, rather than vice versa. For instance, in making particular mortgage decisions, people may gain mortgage literacy (Allgood and Walstad 2016).

Evidence on endogeneity bias in studies examining financial literacy is mixed. Lusardi and Mitchell find that IV approaches tend to show larger effect sizes than OLS regressions, suggesting that OLS regressions tend to underestimate the importance of financial literacy for financial outcomes (Lusardi and Mitchell 2014). By contrast, Fernandes et al. find smaller effects for IV designs than OLS designs (Fernandes, Lynch, and Netemeyer 2014).

Insofar as reverse causality influences our estimates, it likely leads to an underestimation of the effect size of mortgage literacy on our outcome variables. Concerning our first regression, people

who perceive their mortgages to be riskier may feel motivated to learn more about mortgages, thereby improving their mortgage literacy. Our OLS regression would tend to underestimate the negative association of mortgage literacy on perceived mortgage risks. The negative association we find between mortgage literacy and perceived mortgage risks would thus in reality be even larger.

Concerning the second regression, it is difficult to see how rate fixing would lead to improved mortgage literacy. By contrast, borrowers who opt for adjustable-rate mortgages may increase their mortgage literacy as they work through the reasons for changing mortgage payments over the duration of the loan. We find that mortgage literacy increases the likelihood of rate-fixing. Therefore, insofar as reverse causality affects the results, it likely decreases the effect size of mortgage literacy on rate-fixing behaviour.

To further address the endogeneity problem, we take an instrumental variable approach to address reverse causality and remaining omitted variable bias (section 4.2) with respect to the regression with perceived mortgage risk as dependent variable (Gathergood and Weber 2017). We find that financial literacy ten years ago meets the criteria of a good instrument. The GMM estimation supports the results from the OLS regression. However, financial literacy ten years ago is only a weak instrument. Based on a conditional likelihood ratio test, we can be confident that there is a negative causal relation between mortgage literacy and perceived mortgage risks.

The main policy implication of this study is that mortgage literacy matters. Mortgage literacy is distinct from financial literacy. Training numeracy and educating people about general financial concepts such as interest rates and the time value of money is insufficient to put them in a good place for selecting a mortgage. Rather, an expanded notion of mortgage literacy, including

information about different mortgage products, as well as legal and fiscal aspects of mortgages is needed to equip households to make prudent mortgage choices.

Appendix 1 Questions

Table 7: Basic Financial Literacy Questions

#	Question	Answer
B1	Numeracy: Suppose you had €100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow?	**(i) More than €102**; (ii) Exactly €102; (iii) Less than €102; (iv) Do not know.
B2	Interest compounding: Suppose you had €100 in a savings account and the interest rate is 20% per year and you never withdraw money or interest payments. After 5 years, how much would you have on this account in total?	**(i) More than €200**; (ii) Exactly €200; (iii) Less than €200; (iv) Do not know.
B3	Inflation: Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, how much would you be able to buy with the money in this account?	(i) More than today; (ii) Exactly the same; **(iii) Less than today**; (iv) Do not know.
B4	Time value of money: Assume a friend inherits €10,000 today and his sibling inherits €10,000 3 years from now. Who is richer because of the inheritance?	**(i) My friend**; (ii) His sibling; (iii) They are equally rich; (iv) Do not know.
B5	Money illusion: Suppose that in the year 2010, your income has doubled and prices of all goods have doubled too. In 2010, how much will you be able to buy with your income?	(i) More than today; **(ii) The same**; (iii) Less than today; (iv) Do not know.

Table 8: Advanced Financial Literacy Questions

#	Question	Answer
A1	Which of the following statements describes the main function of the stock market?	(i) The stock market helps to predict stock earnings; (ii) The stock market results in an increase in the price of stocks; **(iii) The stock market brings people who want to buy stocks together with those who want to sell stocks;** (iv) None of the above; (v) Do not know.
A2	Which of the following statements is correct? If somebody buys the stock of firm B in the stock market:	**(i) He owns a part of firm B**; (ii) He has lent money to firm B; (iii) He is liable for firm B's debts; (iv) None of the above; (v) Do not know.
A3	Which of the following statements is correct?	(i) Once one invests in a mutual fund, one cannot withdraw the money in the first year; **(ii) Mutual funds can invest in several assets, for example invest in both stocks and bonds**; (iii) Mutual funds pay a guaranteed rate of return which depends on their past performance; (iv) None of the above; (v) Do not know.

A4	Which of the following statements is correct? If somebody buys a bond of firm B	(i) He owns a part of firm B; **(ii) He has lent money to firm B;** (iii) He is liable for firm B's debts; (iv) None of the above; (v) Do not know.
A5	Considering a long time period (for example 10 or 20 years), which asset normally gives the highest return?	(i) Savings accounts; (ii) Bonds; **(iii) Stocks**; (iv) Do not know.
A6	Normally, which asset displays the highest fluctuations over time?	(i) Savings accounts; (ii) Bonds; **(iii) Stocks**; (iv) Do not know.
A7	When an investor spreads his money among different assets, does the risk of losing money	(i) Increase; **(ii) Decrease**; (iii) Stay the same; (iv) Do not know.
A8	If you buy a 10-year bond, it means you cannot sell it after 5 years without incurring a major penalty. True or false?	(i) True; **(ii) False**; (iii) Do not know.
A9	Stocks are normally riskier than bonds. True or false?	**(i) True**; (ii) False; (iii) Do not know.
A10	Buying a company stock usually provides a safer return than a stock mutual fund. True or false?	(i) True; **(ii) False**; (iii) Do not know.
A11	If the interest rate falls, what should happen to bond prices?	**(i) Rise**; (ii) Fall; (iii) Stay the same; (iv) None of the above; (v) Do not know; (vi) Refusal.

Appendix 2 Correlation Matrix

Table 9: Correlation matrix of variables used in the analysis

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
1 Mortgage Literacy	1.00																											
2 Basic Financial Literacy	0.34	1.00																										
3 Advanced Financial Literacy	0.63	0.36	1.00																									
4 R1: Self-reported general mortgage risk	0.08	0.07	0.11	1.00																								
5 R2: Self-reported income risk dummy	-0.07	-0.02	-0.08	-0.26	1.00																							
6 R3: Self-reported wealth risk dummy	-0.13	-0.09	-0.14	-0.22	0.29	1.00																						
7 Fixed: Interest rate fixing dummy	0.09	0.03	0.02	0.00	-0.04	-0.05	1.00																					
8 Duration of fix in years	0.06	0.08	-0.01	0.06	-0.04	-0.06	-	1.00																				
9 Male	0.19	0.16	0.30	-0.01	0.03	0.00	-0.04	-0.05	1.00																			
10 Age	-0.05	-0.02	0.03	-0.27	0.19	0.06	-0.14	-0.15	0.18	1.00																		
11 Household Net Income	0.29	0.14	0.28	0.11	-0.02	-0.10	0.04	0.02	0.14	-0.16	1.00																	
12 Household Wealth	0.11	0.10	0.17	-0.04	0.03	-0.02	-0.10	-0.01	0.06	0.08	0.08	1.00																
13 Socio Economic Status	0.31	0.20	0.31	0.11	-0.09	-0.13	0.01	-0.01	0.05	-0.13	0.33	0.12	1.00															
14 School Degree	-0.16	-0.15	-0.16	-0.14	0.09	0.06	0.03	-0.05	-0.01	0.29	-0.25	-0.07	-0.51	1.00														
15 Vocational Degree	0.01	0.02	-0.01	0.04	-0.04	0.03	-0.02	0.01	0.01	-0.17	0.05	-0.01	0.11	-0.71	1.00													
16 University Degree	0.19	0.17	0.22	0.11	-0.06	-0.11	0.00	0.04	-0.01	-0.14	0.25	0.10	0.55	-0.32	-0.42	1.00												
17 Married	0.15	0.07	0.12	-0.07	0.04	0.03	-0.05	-0.02	0.34	0.18	0.27	0.04	-0.01	0.01	0.04	-0.06	1.00											
18 Divorced	-0.02	-0.03	-0.05	0.02	-0.07	0.02	0.02	0.00	-0.18	0.05	-0.17	-0.03	-0.02	0.06	-0.06	-0.01	-0.33	1.00										
19 Number of Children in Household	0.07	0.05	0.00	0.20	-0.12	-0.04	0.05	0.04	0.01	-0.42	0.25	-0.07	0.08	-0.16	0.14	0.02	0.21	-0.02	1.00									
20 Self-employed	0.06	-0.02	0.03	0.04	-0.06	-0.01	-0.13	-0.08	-0.04	-0.09	0.11	-0.03	0.17	-0.04	0.01	0.04	-0.03	0.00	0.02	1.00								
21 Retired	0.03	0.01	0.06	-0.24	0.17	0.06	-0.08	-0.12	0.19	0.70	-0.08	0.09	-0.04	0.17	-0.10	-0.09	0.14	0.01	-0.36	-0.18	1.00							
22 Unemployed	-0.13	-0.05	-0.10	0.06	0.01	-0.05	-0.07	-0.04	-0.08	-0.07	-0.22	-0.04	-0.05	0.02	0.00	-0.02	-0.13	0.08	-0.05	-0.07	-0.21	1.00						
23 Government employee	0.07	0.09	0.07	0.05	-0.09	-0.05	0.02	0.05	-0.04	-0.20	0.14	0.00	0.07	-0.10	0.01	0.12	0.00	-0.01	0.11	-0.07	-0.19	-0.04	1.00					
24 Risk proneness	0.21	0.19	0.33	0.14	-0.01	-0.01	-0.07	0.01	0.19	-0.13	0.15	0.12	0.21	-0.15	0.01	0.19	-0.04	-0.04	0.07	0.02	-0.09	-0.03	0.04	1.00				
25 OLTV: Original Loan to Value Ratio	0.01	-0.04	0.00	0.06	-0.04	0.00	-0.01	0.03	-0.03	-0.18	0.16	-0.07	0.04	-0.10	0.07	0.01	0.01	-0.02	0.12	0.05	-0.21	-0.04	0.10	0.01	1.00			
26 CLTV: Current Loan to Value Ratio	0.04	0.05	0.07	0.29	-0.11	-0.13	0.07	0.14	-0.11	-0.58	0.32	-0.10	0.23	-0.27	0.06	0.22	-0.03	-0.07	0.30	0.01	-0.38	-0.01	0.16	0.09	0.26	1.00		
27 PTI: Payment to Income Ratio	-0.01	-0.04	-0.03	0.30	-0.23	-0.04	0.04	0.22	-0.03	-0.41	-0.07	-0.12	0.09	-0.13	0.06	0.07	-0.08	0.05	0.21	0.15	-0.31	0.06	0.11	-0.04	0.17	0.48	1.00	
28 Yfix: Year of Mortgage Origination	0.04	-0.05	0.04	0.04	0.00	-0.01	-	-0.45	-0.01	-0.08	0.05	-0.04	0.05	0.00	-0.03	0.03	0.06	-0.03	0.04	0.00	-0.03	0.05	-0.01	-0.05	-0.11	0.07	-0.07	1.00

Appendix 3 Financial Literacy

Table 12: Summary Statistics Basic Financial Literacy

Panel A: Percentage of respondents who answered individual questions correctly / incorrectly / do not know

	Question				
	1	2	3	4	5
Correct	90%	81%	88%	63%	73%
Incorrect	6%	16%	6%	29%	22%
Don't know	4%	3%	6%	8%	5%

Panel B: Percentage of respondents with respective number of correct / do not know answers

	Number of questions					
	None	1	2	3	4	5
Correct	2%	2%	6%	15%	33%	40%
Do not know	85%	9%	1%	0%	0%	1%

Table 10: Summary Statistics Advanced Financial Literacy

Panel A: Percentage of respondents who answered individual questions correctly / incorrectly / do not know

	Question										
	1	2	3	4	5	6	7	8	9	10	11
Correct	69%	69%	64%	63%	50%	79%	77%	30%	69%	54%	27%
Incorrect	10%	19%	13%	14%	29%	9%	13%	28%	9%	12%	38%

Panel B: Percentage of respondents with respective number of correct / do not know answers

	Number of questions											
	—	1	2	3	4	5	6	7	8	9	10	11
Correct	7%	3%	3%	6%	6%	9%	10%	13%	13%	12%	9%	9%
Do not know	11%	9%	6%	5%	4%	3%	2%	2%	1%	0%	0%	0%

Appendix 4 Mortgage Risks

Table 11: Summary statistics Perceived financial mortgage risk questions

R1: General Riskiness: Does having a mortgage pose a risk to your overall financial situation?		
	Frequency	Percent
Very high risk	18	2.98
High risk	103	11.81
Low Risk	427	48.97
No risk	298	34.17
I don't know	26	2.98
Total	872	100
R2: Income Risk: If you became unemployed for half a year, would that cause problems with servicing your mortgage?		

	Frequency	Percent
Yes	80	9.17
No	729	83.60
I don't know	63	7.22
Total	872	100

R3: Wealth Risk: If the market price of your house dropped 20%, would that cause you financial distress?

	Frequency	Percent
Yes	59	6.77
No	745	85.44
I don’t know	68	7.80
Total	872	100

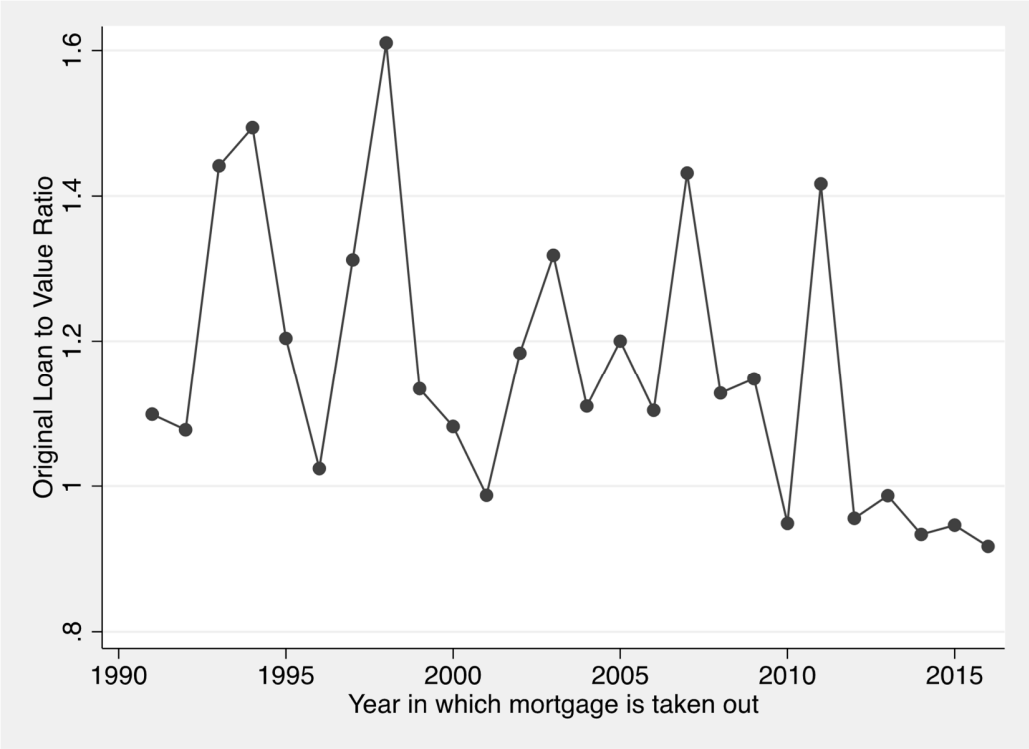

Figure 1: Plot of mean OLTV ratios in the Netherlands by year, 1990-2016

Appendix 5 Robustness Check Perceived Mortgage Risks

In the main text, we only analysed R1, the first question pertaining to general mortgage risk. Here we show that using R2 and R3 as dependent variables further supports the analysis in the main text. We use a probit analysis with the dummy reflecting whether respondents believe that they run into

financial difficulties if they become unemployed (R2) as dependent variable in columns 1-3. In columns 4-6, the dependent variable is a dummy reflecting whether respondents believe that they will run into financial difficulties if the value of their house drops (R3). Column 1 and 4 shows results for mortgage literacy. Columns 2 and 5 show results for financial literacy. Columns 3 and 6 show results for mortgage and financial literacy together. All models include standard demographic controls as well as the objective risk measures OLTV, CLTV and PTI.

Mortgage literacy has the expected negative sign throughout, and is significant in column 3, at the 5% level. Basic financial literacy is significant only in column 2, at the 10% level. Advanced financial literacy is significant at 5% and 1% level respectively for income risk (Columns 2 and 3). However, the positive sign of the coefficient indicates that respondents who score higher in advanced financial literacy are more likely to report income vulnerabilities due to their mortgage. There are two possible and complimentary explanations for this result. First, advanced financial literacy may increase the sensitivity of borrowers to income risks associated with their mortgages. Second, respondents who score high in advanced financial literacy but low in mortgage literacy may assume that they understand mortgages better than they do. As a result, they may end up with riskier mortgages and do less to manage the income risks associated with their mortgages.

The robustness analysis supports the results from the regression in the main text. Mortgage literacy is negatively associated with perceived income and wealth vulnerability concerning mortgages even when financial literacy scores are included as dependent variables. Hence mortgage literacy explains variation in income and wealth vulnerability due to mortgage risk over and above measured financial literacy.

Table 12: Regression results: Literacy scores and perceived income and wealth risks (R2 and R3)

Variables	(1) R2: Income Risk	(2) R2: Income Risk	(3) R2: Income Risk	(4) R3: Wealth Risk	(5) R3: Wealth Risk	(6) R3: Wealth Risk
Mortgage Literacy	-0.2422		-0.4478**	-0.2798		-0.3695
	(0.1575)		(0.1858)	(0.2057)		(0.2298)
Basic Financial Literacy		-0.2393*	-0.2247		0.0609	0.1148
		(0.1363)	(0.1374)		(0.1987)	(0.2045)
Advanced Financial Literacy		0.4695**	0.6649***		0.0238	0.1460
		(0.2023)	(0.2264)		(0.2020)	(0.2192)
Male	0.0363	-0.1750	-0.2359	0.2485	0.1920	0.1685
	(0.2741)	(0.2865)	(0.2974)	(0.3498)	(0.3606)	(0.3698)
Age (18-34 omitted)						
35-44 years	0.8603	0.7397	0.7185	0.8459	0.8658	0.9040
	(0.5999)	(0.5796)	(0.6291)	(0.5758)	(0.5737)	(0.5951)
45-54 years	0.7428	0.6201	0.6525	0.6580	0.6906	0.7079
	(0.6303)	(0.6071)	(0.6588)	(0.6242)	(0.6219)	(0.6435)
55-64 years	0.6094	0.4432	0.4543	-0.3416	-0.2792	-0.3034
	(0.6686)	(0.6567)	(0.7032)	(0.8204)	(0.8032)	(0.8318)
65 years and older	0.6308	0.5297	0.4499	-1.0485	-0.7298	-0.9374
	(0.8088)	(0.8052)	(0.8464)	(1.6568)	(1.7739)	(1.6450)
Education (School degree omitted)						
Vocational Education	0.2130	0.4028	0.1971	-0.2065	-0.0973	-0.2587
	(0.3657)	(0.3741)	(0.3850)	(0.5033)	(0.4918)	(0.5129)
University Education	0.5984	0.7307	0.5492	0.6334	0.6665	0.5678
	(0.4956)	(0.5090)	(0.5102)	(0.7110)	(0.7036)	(0.7169)
Log Household Income	-0.3769	-0.5376	-0.5264	0.0962	-0.0084	0.0483
	(0.3952)	(0.4205)	(0.4272)	(0.5562)	(0.5638)	(0.5710)
Log Household Wealth	-0.1291**	-0.1765***	-0.1508***	-0.1136*	-0.1306**	-0.1100*
	(0.0508)	(0.0508)	(0.0528)	(0.0581)	(0.0569)	(0.0591)
Socio Economic Status	0.0123	-0.0638	-0.0254	-0.2192	-0.2318	-0.1974
	(0.1925)	(0.1978)	(0.1962)	(0.2591)	(0.2566)	(0.2608)
Married	-0.3239	-0.4116	-0.3491	-0.2839	-0.3009	-0.2118
	(0.3049)	(0.3247)	(0.3320)	(0.3821)	(0.3873)	(0.3889)
Divorced	0.1785	0.1515	0.2527	0.4675	0.4386	0.4796
	(0.5374)	(0.5247)	(0.5391)	(0.5881)	(0.5666)	(0.5967)
Number of Children in Household	0.1339	0.2024	0.1834	-0.1706	-0.1330	-0.1883
	(0.1314)	(0.1375)	(0.1399)	(0.1557)	(0.1506)	(0.1584)
Self-employed	0.1035	0.1952	0.2122	-0.2356	-0.2520	-0.1949
	(0.4941)	(0.5121)	(0.5277)	(0.6711)	(0.6744)	(0.6691)
Retired	-0.4914	-0.4389	-0.4635	0.7010	0.5217	0.6455
	(0.5917)	(0.6093)	(0.6207)	(1.5917)	(1.7143)	(1.5743)
Government worker	0.4084	0.6439*	0.5946*	-0.2910	-0.2400	-0.3460
	(0.3297)	(0.3384)	(0.3414)	(0.4332)	(0.4331)	(0.4481)
Risk proneness	0.0270	-0.0764	-0.0735	-0.1658	-0.2004	-0.2062
	(0.1565)	(0.1639)	(0.1686)	(0.1958)	(0.1971)	(0.2025)
Mortgage Characteristics						
OLTV	-1.1317**	-1.0562**	-1.0509**	-0.5632	-0.5627	-0.6105
	(0.4506)	(0.4555)	(0.4627)	(0.6557)	(0.6514)	(0.6827)
CLTV	0.6093	0.5697	0.6170	1.5817**	1.6280**	1.6829**
	(0.5631)	(0.5790)	(0.5888)	(0.6921)	(0.6927)	(0.7098)
PTI	1.3811	1.1259	1.2079	1.6282	1.0623	1.4815
	(1.2047)	(1.2255)	(1.2045)	(1.4252)	(1.3938)	(1.4579)
Unemployed	*omitted*	*omitted*	*omitted*	0.7103	0.7966	0.6714
				(0.6235)	(0.6071)	(0.6290)
Constant	2.4013	4.2513	4.0136	-1.6858	-0.7762	-1.4355
	(3.0036)	(3.2139)	(3.2637)	(4.2493)	(4.3128)	(4.3725)
Observations	368	368	368	383	383	383
Pseudo R-squared	0.270	0.296	0.325	0.364	0.353	0.370

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Appendix 6 Robustness Check Mortgage Risk Management

The regression below repeats the regression in section 4.2 with a revised mortgage literacy measure excluding question 1 on the advantages of rate fixing from the calculation of the score.

Table 13: Regression results: Literacy scores and interest-rate fixing, with revised mortgage literacy score

Variables	(1)	(2)	(3)
Mortgage Literacy without Q1	0.2207**		0.1893**
	(0.0883)		(0.0950)
Basic Financial Literacy		0.0592	0.0394
		(0.0900)	(0.0915)
Advanced Financial Literacy		0.1467	0.0767
		(0.1011)	(0.1083)
Male	-0.0019	-0.0380	-0.0449
	(0.1840)	(0.1879)	(0.1904)
Age (18-34 omitted)			
35-44 years	-0.1066	-0.0706	-0.0915
	(0.4147)	(0.4040)	(0.4131)
45-54 years	-0.1616	-0.1260	-0.1410
	(0.4050)	(0.3972)	(0.4051)
55-64 years	-0.6416	-0.5659	-0.6291
	(0.3946)	(0.3840)	(0.3949)
65 years and older	-0.8373*	-0.7907*	-0.8242*
	(0.4632)	(0.4567)	(0.4646)
Education (School degree omitted)			
Vocational Education	-0.3495*	-0.3915*	-0.3471*
	(0.2053)	(0.2040)	(0.2057)
University Education	-0.5422*	-0.5981**	-0.5430*
	(0.3035)	(0.3007)	(0.3037)
Log Household Income	0.3571*	0.3294	0.3376
	(0.2115)	(0.2125)	(0.2134)
Log Household Wealth	0.0252	0.0260	0.0214
	(0.0300)	(0.0302)	(0.0304)
Socio Economic Status	0.0733	0.0962	0.0637
	(0.1076)	(0.1070)	(0.1084)
Married	-0.2919	-0.2673	-0.2898
	(0.1941)	(0.1934)	(0.1946)
Divorced	0.0931	0.1502	0.0957
	(0.3877)	(0.3795)	(0.3875)
Number of Children in Household	-0.0435	-0.0475	-0.0436
	(0.1010)	(0.1009)	(0.1012)
Self-employed	-0.9937***	-0.9510***	-0.9770***
	(0.2960)	(0.2978)	(0.2975)
Retired	-0.0608	-0.0756	-0.0589
	(0.3146)	(0.3157)	(0.3163)
Unemployed	-0.6653*	-0.7204**	-0.6897*
	(0.3594)	(0.3570)	(0.3611)
Government worker	-0.2034	-0.2138	-0.2132
	(0.2483)	(0.2487)	(0.2497)
Risk proneness	-0.2612***	-0.2847***	-0.2860***
	(0.0967)	(0.1001)	(0.1009)
Constant	-1.0270	-0.8896	-0.8006
	(1.6213)	(1.6425)	(1.6534)
Observations	533	533	533
Pseudo R-squared	0.112	0.105	0.114

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Appendix 7 Instrumental Variable Approach

Table 0.14: Second stage regression with perceived mortgage risk (R1) as dependent variable

Variables	(1)
Mortgage Literacy	-1.2511***
	(0.3582)
Male	-0.0721
	(0.2373)
Age (18-44 omitted)	
45-54 years	0.1059
	(0.3558)
55-64 years	0.2646
	(0.3990)
65 years and older	-0.1144
	(0.4532)
Education (School degree omitted)	
Vocational Education	-0.5733**
	(0.2542)
University Education	-0.5245
	(0.3613)
Log Household Income	0.4770
	(0.3366)
Log Household Wealth	0.0183
	(0.0660)
Socio Economic Status	0.1293
	(0.1396)
Married	0.0034
	(0.2544)
Divorced	-0.1405
	(0.3381)
Number of Children in Household	0.0391
	(0.1180)
Self-employed	0.0302
	(0.2868)
Retired	-0.3043
	(0.3229)
Unemployed	-0.7373
	(0.6786)
Government worker	-0.3392
	(0.2678)
Risk proneness	0.2323*
	(0.1295)
Mortgage Characteristics	
OLTV	-0.3210
	(0.2547)
CLTV	-0.4300
	(0.4693)
PTI	3.7644***
	(1.3491)
Constant	-3.5181
	(2.4873)
Observations	131
F (22,108) first stage	2.48
p-value endogeneity test	0.0008
p-value Hansen OIR test	0.8347

p-value CLR	0.0003

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 0.15: First stage regression

VARIABLES	(1)
Male	0.0443
	(0.1854)
Age (18-44 omitted)	
45-54 years	0.1699
	(0.2622)
55-64 years	0.2484
	(0.2947)
65 years and older	-0.0092
	(0.3369)
Education (School degree omitted)	
Vocational Education	-0.3179**
	(0.1595)
University Education	-0.3459
	(0.2189)
Log Household Income	-0.0384
	(0.2407)
Log Household Wealth	-0.0061
	(0.0462)
Socio Economic Status	0.0348
	(0.0891)
Married	-0.0753
	(0.1514)
Divorced	0.0766
	(0.2415)
Number of Children in Household	-0.0168
	(0.0779)
Self-employed	0.1396
	(0.1869)
Retired	-0.0554
	(0.1738)
Unemployed	-0.5161
	(0.4172)
Government worker	-0.0071
	(0.2095)
Risk proneness	0.0372
	(0.0829)
Mortgage Characteristics	
OLTV	-0.0042
	(0.1695)
CLTV	-0.2093
	(0.3613)
PTI	1.1647
	(0.8844)
Basic Financial Literacy 2006	-0.7103
	(1.4613)
Advanced financial literacy 2006	0.5303***
	(0.1473)

Constant	0.7247
	(1.7041)
Observations	131
F(22, 108)	2.48
R-squared	0.2578

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1