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Does present bias matter in mortgage choices across Dutch households?

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Abstract

This paper evaluates present bias in the mortgage market in the Netherlands over the time period 2008 - 2020. Data is obtained from the DNB Household Survey which is administrated by Centerdata (Tilburg University). Present bias is defined as over consuming in the present due to lack of self-control. In contrast to impatient consumers who consume more in the present deliberately, present biased consumers do not plan this. With the specific data and methodology used, this paper is unable to find statistical evidence for an association between present bias and an increased chance of Dutch households choosing for an Alternative Mortgage Product (AMP). AMPs are mortgages that leave (part of the) principle repayment until maturity. Additionally, this paper evaluates whether present bias may be associated with a decreased chance in insuring the mortgage. There is also no statistical evidence within this methodology and data found to associate present bias with mortgage insurance.

Contents

1. Introduction

Choosing a mortgage is one of the biggest choices households face as a home is their most valuable asset (Cox et al., 2015; Kullmann & Siegel, 2003; Campbell, 2006). A typical household needs to finance their house with a mortgage. Due to financial innovation there are different types of mortgages available rather than just the 'Standard Repayment Mortgage' (SRMs) and therefore, households face the complex choice of mortgage type. An increasing number of Dutch households are choosing Alternative Mortgage Products (AMPs) (Hypotheken Data Netwerk, 2021). AMPs are mortgages that leave (part of the) principle repayment until maturity. Because (part of) the principle repayment is deferred, monthly payments consist (mostly) of interest. Approximately half of the monthly cost is associated with amortization in the case of standard mortgage products. Interest rates these days are low however, monthly amortization can become a large expense as rising house prices may lead households to finance more with debt. In April 2021, 33.6% of Dutch mortgages have at least partly deferred amortization, comparing to 30.4% in 2019 (Hypotheken Data Netwerk, 2021). Within these numbers are also an increasing amount of first-time home buyers that choose AMPs (13.7% compared to 10.4% in 2019). Since the 2007 – 2008 financial crisis, policy makers have attempted to make SRMs more attractive, due to the risks associated with AMPs. In the Netherlands, households are able to deduct mortgage interest from their taxes. Since 2013 however, this is only possible for SRMs. At that time the 10-year interest rate was about 4% which made the policy an effective incentive to choose an SRM, however, at the moment this interest is only 1.5%, reducing incentive.

More households choosing AMPs may not be a concern, provided these choices are made deliberately and not based on the lower monthly payment (Authority Financial Markets, 2021). However, many households lack the sophistication to make suitable decisions regarding retail financial products, like mortgages (Van Rooij et al., 2011). Previous research done in the Netherlands, shows households with higher financial literacy and lower risk aversion are more likely to choose an AMP (Cox et al., 2015). However, due to the greater complexity and low sophistication of certain households, some consumers of AMPs may not realize that lower payments lead to larger future outstanding debt. Additionally, AMPs might be most attractive to myopic borrowers (Cocco, 2013). Another concern is that households choose AMPs due to present bias (Gathergood & Weber, 2017). Present bias is defined as consumption tilted toward the present, due to lack of self-control (Laibson, 1997). Present biased consumers are more likely to default (Geradi et al., 2013) and financial biases are

often made by a less educated and poorer minority (Campbell, 2006). The financial crisis in 2007 – 2008 has shown mortgage choices have a large impact on the wealth and wellbeing of households. Mortgage mistakes can lead to stressful financial situations that may lead to depression and health problems making it a relevant topic for research (Currie & Tekin, 2015).

In an effort to mitigate these risks associated with mortgages, households can purchase insurance. Insurance is an important choice households need to make as mortgage debt is a liability on household's balance sheets and can be a substantial risk to household wealth. Declining house prices can lead to negative equity when the property value falls below the outstanding mortgage balance. In the Netherlands insurance is possible and voluntary. Prior research has found risk exposure, type of mortgage lender, and the involvement of financial advisors to be relevant for the demand of mortgage insurance across Dutch homeowners (Cox & Zwinkels, 2016). Additionally, wealthier and younger households are more likely to insure. Before 2010 precautionary behaviour, perceived control over financial situations, risk aversion and house price expectations were found irrelevant in explaining insurance choices. However, since the mortgage market failure during the 2007-2008 financial crisis, households are more careful and the event plays an important role in decisions in the U.S. mortgage market (Mayer et al., 2009; Bernanke, 2010; Einav et al., 2012; Gerardi et al., 2013; Ghent, 2015).

Therefore and due to the changing mortgage market, this paper largely replicates Cox et al., (2015) and Cox & Zwinkels, (2016) in a newer time frame. The data set consist of mortgages originating between 2008 – 2020. An advantage of this time frame is that it includes possible influences of the 2007 - 2008 crisis and it covers the new tax regulation in 2013. Besides the time frame, a key difference is this paper's main objective is to evaluate whether present bias matters in the choice of mortgage, whereas Cox et al., (2015) main variables of interest are financial literacy and risk aversion. The more recent time frame is relevant to research as impact from the crisis can have made households more aware of the risks. Additionally, since 2013 there has been a change in requirements for mortgage insurance in the Netherlands, namely only SRMs that are completely amortized over a period of maximum 30 years can be insured. Lastly, interest is no longer deductible for AMPs. This paper contributes by focussing on a time period starting from 2008. Another contribution this paper will make is the evaluation of how present bias influences mortgage choices in the Netherlands. The key research objective of this paper is:

How does present-bias influence Dutch household's choice for an Alternative Mortgage Product (AMP) that (partly) defers amortization and the choice to insure this mortgage?

Additionally, for Dutch households that choose Standard Repayment mortgages (SRMs) this paper will replicate Cox & Zwinkels, (2016) in a newer time frame to re-evaluate what characteristics influence the chance of these households insuring their mortgage. It is in favour of their (financial) wellbeing that households make deliberate mortgage choices and it is, therefore, important to investigate these characteristics and behavioural traits that might increase the chances of choosing AMPs. Financial advisors need to be aware of behavioural traits that can lead to poor mortgage choices and their influence in this. This paper finds statistically inconclusive evidence for influence of present bias in mortgage market decisions across Dutch households. No statistical evidence is found for an association between present bias and an increased chance of Dutch households choosing for an AMP. Additionally, there is no statistical evidence to associate present bias with mortgage insurance.

This paper is organized as follows: After the introduction there is an overview of previous research covering mortgage types, behavioural traits and mortgage insurance. Next is a description of the data and the methodology, followed by the results. The final section discusses the limitations of this paper and concludes.

2. Literature review

2.1 Alternative mortgage products

Three broad categories of mortgages can be distinguished in the Netherlands (Cox et al., 2015). The first is a classic mortgage that amortizes the total amount each month commonly referred to as a 'Standard Repayment Mortgage' (SRM). The second is a mortgage that partly defers amortization. Finally, interest only mortgages used to be available. In the rest of this paper mortgage types will be categorized as either SRM or AMP, with AMPs covering both mortgages that partly defer amortization as those that completely defer amortization.

Households that are more risk averse prefer fixed rate mortgages. They also might avoid AMPs because of uncertainty surrounding the principle repayment. Alternatively, if they are worried about future income and concerned with high payments in the present, risk averse households may prefer AMPs (Campbell & Cocco, 2003). Households that are less risk averse are more likely to choose AMPs (Lachour-Little & Yang, 2010; Cox et al., 2015). In the Netherlands, wealthier, risk tolerant and financially literate households tend to choose for AMPs (Cox et al., 2015 and Van Ooijen & van Rooij, 2016). Whereas in the U.K. financial literate households more often hold SRMs and poor financial literacy correlates with AMPs (Gathergood & Weber, 2017). Differences in these studies may be due to differences in the mortgage markets between the U.K. and the Netherlands. Dutch households that choose AMPs often have an investment account linked to their mortgage and until 2013 AMPs involved tax benefits in the Netherlands. In the Netherlands prior to 2013 interest paid on all types of mortgages was deductible at the marginal income tax rate, which changes over time but is typically between 37% and 52%. When amortization payments are made, the principle outstanding decreases, which in turn decreases the interest rate. Therefore, deferring amortization enabled household to exploit the tax benefit as much as possible.

The differences between the research of Gathergood & Weber, (2017) and Cox et al., (2015) could also be due to differences in the way financial sophistication is measured. Gathergood & Weber, (2017) use questions that test the understanding of concepts like simple interest, compounding, accrual interest over time and deferred principle payments. They find that more than two thirds of U.K. households can make a simple interest calculation and understand that longer mortgage durations imply higher accrued interest. Only half of these households understand compound interest and even less can distinguish an AMP from an SRM. Cox et al., (2015) measure financial literacy in two ways. First a self-reported measure

is used by asking survey respondents how knowledgeable they find themselves with respect to financial matters on a scale from not knowledgeable to very knowledgeable. The second measure relies on the holdings of 7 different asset classes. A scale is constructed from 0 (no holdings) to 7 (holdings in each asset class).

2.2 Behavioural characteristic

A common reason for using AMPs is to smooth consumption over time (Cocco, 2013) which makes sense if income is expected to rise. Households with lower financial literacy may be drawn towards higher initial consumption and may choose the product by mistake. Additional factors that have shown to impact the choice between AMPs and SRMs are present bias and impatience. Both of these behavioural traits increase the chance of a household to choose an AMP in the U.K (Gathergood & Weber, 2017). Present bias is a term that originates from self-control theory in behavioural finance (Thaler & Shefrin, 1981). It is associated with borrowing, instant gratification and undesirable spending. Present biased consumers spend more in the present and save less for the future (Xiao & Porto, 2019). Prior research finds these consumers spend more (Nguyen, 2016) and save less than other consumers (Brown & Previtero, 2014). It is important to distinguish between consumers with high discount rates (impatience) and consumers that are present biased. A household with a high discount rate cares less about the future and tends to be impatient, whereas present-biased households have self-control issues that leads to them overweighting present consumption (Laibson, 1997 and Gathergood & Weber, 2017). Substantiated by the research above the first hypothesis is stated as:

There is a positive association between a respondent being present biased and the chance of them choosing for an AMP.

Gathegood & Weber measure present bias by asking respondents the amount to which they agree to the statement: "I am impulsive and tend to buy things even when I can't really afford them." If households respond with agree or strongly agree, they are labelled as present biased. Their proxy for patience is similar to that of Dohmen et al., (2010) and is constructed with the question: "How do you see yourself: are you generally an impatient person, or someone who always shows great patience? The answers then range from 0 (very impatient) to 10 (very patient). Across cognitive ability, both risk aversion and impatience vary. Higher cognitive ability is associated with an increased bearing for risk as well as more patience (Dohmen, et al., 2010).

Additionally, research finds that low financial literacy may be a barrier for young households to purchase a home as they lack experience. Younger homeowners with lower financial literacy generally have larger mortgage debts and have an increased chance of using alternative mortgage products (Gathergood & Weber, 2017).

2.3 National mortgage guarantee

Research in the insurance field shows individuals under insure low probability, high consequence risks (LPHC) (Eisner & Strotz 1961; Slovic et al. 1977; Kunreuther 1978, Ganderton et al. 2000; Sydnor 2010). Prior to 2010 only 30% of eligible households chose to insure (Cox & Zwinkels, 2016), which considering the low initial costs, tax benefit and discount on the mortgage rate (30 to 60 basis points), is surprising. In the case of default, mortgagors are liable for their deficiency. When households do not hold insurance, this means lenders have a claim on other assets. Costs are not likely to be a reason for households not to insure. The low insurance rate might have been driven by the favourable housing market circumstances between 1995 and 2008, many households may have underestimated the chance of needing insurance or became reluctant. As of 2010 there is a sharp increase in insured mortgages, from just under 30% in 2009 to over 60% in 2010 (Cox & Zwinkels, 2016). It therefore makes it interesting to access a new sample on mortgages, as the financial crisis and new policies may alter results. Dutch household's insurance choices are affected by involvement of financial advisors, type of mortgage lender and risk exposure. In addition, likelihood of insurance is higher in younger and wealthier households. Overconfidence is also evaluated, and it seems this has negative impact on the likelihood of insuring. Precautionary behaviour, perceived control over financial situations, risk aversion and house price expectations seem to be irrelevant in explaining insurance choices before 2010 (Cox & Zwinkels, 2016). Furthermore, present bias also plays a role in an insurance context, as individuals tend to have self-control problems when they need to take on precautionary activities Ai et al., (2016). It is therefore relevant to evaluate this in a mortgage insurance market as well.

Substantiated by prior research covered above the second hypothesis is:

There is a negative association between respondents being present biased and the likelihood of them obtaining an insurance for their mortgage.

Mortgage insurance, the National Mortgage Guarantee (NMG), is supplied by a single provider in the Netherlands, the Homeowner Guarantee Fund Foundation (HGFF). In the case of default due to involuntary unemployment, death or divorce the NMG compensates the lender for the shortage of outstanding balance. The Dutch government supports the HGFF in case reserves are insufficient. In 2021 the maximum mortgage that can be insured by NMG is 325 000 euros. This amount can be increased to 344 500 euros if the excess amount is used for increasing the energy efficiency of the home. Furthermore, the costs are a single payment of 0,7% of the mortgage. Insurance adoption is often rewarded by lower mortgage interests.

3. Data

3.1 Description of data

This paper uses data from the DNB Household Survey which is administrated by Centerdata (Tilburg University). The survey contains economic and psychological components of financial behaviour by the approximately 2000 households that participate. Households are requested to join over the phone and are randomly selected, making the panel data set representative for Dutch households. Centerdata has collected this survey data since 1993. This paper uses data between 2008 and 2020. Participants fill out six questionnaires: General Information on the household, household & work, accommodation & mortgages, health & income, assets & liabilities and economic & psychological concepts. This paper makes use of each of the questionnaires. The survey is filled out by participants at home behind their computers and they do not receive any financial compensation. Filling out the survey at home, reduces reporting errors as any financial information needed will be easily accessible. In an effort to minimize response errors further, continuous variables are winsorized at 5%. To obtain unique personal indexes of household members the household index is multiplied by 100 and thereafter the member number is added. Data from the questionnaires is merged each year by the personal index and then the year 2008 is appended with the years 2009 through 2020 to create the panel data set. The key objective of this paper is to evaluate how present bias matters in the choice of mortgage type. To reduce the impacts of learning effects over time, observations are only included if the mortgage is obtained in the same year as the survey is filled out. To only include these observations mentioned above, the data is restricted to the respondents that have taken out a mortgage that year. This gives a total of 189 mortgages taken out over the years 2008-2020. Of these mortgages 100 are SRMs and 89 are AMPs.

3.2 Description of variables

Table 1 gives an overview of control variables that will be used and summarizes the definitions. Net income of respondents is the total net income obtained from the aggregated data on income. Three income classes are then defined with the first being below median income. The next class is income between median income and double median income and the final class contains respondents whose income is above double median income. The measure of wealth is measured in quartile dummies and is defined as (Morin & Suarez, 1983):

Checking and saving 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. The data is based on the year that households have obtained a mortgage, and therefore their wealth is also based on that year. Financially active is measured with the assets and liabilities survey similar to Cox et al., (2015). There are however, slight differences in the survey compared to earlier years. As of 2019 the asset class, crypto coin is included and call-options, put-option, falcons, warrants and sprinters are asked in the same survey question. Therefore, to keep the variable consistent over time the following five assets classes are used:

1. Mutual funds
2. Bonds
3. Stocks
4. Put-options, call-options, falcons, warrants, and/or sprinters.
5. Written put-options, call-options, falcons, warrants and/or sprinters

A dummy is created for each asset class to determine if a respondent is active in that class. The dummy takes on the value 1 if the respondent owns the financial product. Then dummy values are added to create a measure of financial activeness ranging from 0 to 5.

This paper uses a similar question to Gathergood & Weber, (2017) to access present bias across Dutch households: "Do you find it easy or difficult to control your expenditures?" Respondents rate this question from 1 (very easy) to 7 (very difficult). This creates a categorical variable representing present bias ranging from 1 to 7. To evaluate patience the survey question "Some people spend all the money that they receive. Other people want to have some reserves. Can you indicate what you do with your money after you paid for food, rent and first necessities of life?" is used. Answers are on a scale from 1 ("I want to spend all my money immediately") to 7 ("I want to save as much as possible"). This question reveals a respondent's preference for spending now or in the future and the variable created ranges from 1 to 7. It is important to note the difference between preference for spending more now (impatience) as opposed to being unable to control expenditures which causes unwanted spending in the present (present bias).

Table 1 Definition of control variables

Variable name	Definition
House value	Latest known WOZ value of the house bought (Valuation of Immovable Property Act)
Log house value	The natural log of the house value
Mortgage debt	The loan at the time the mortgage is taken out
Log mortgage debt	The natural log of the mortgage debt
LTV ratio	Ratio of the mortgage debt to the house value
Insurance	Dummy equal to 1 if the mortgage has National Mortgage Guarantee (NMG)
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
Loan-to-income ratio	Ratio between the mortgage debt and annual net income
Debt-service ratio	Ratio between annual mortgage payments and annual net income
Financially active	Amount of asset classes (see Appendix)
Age(years)	Respondents age in years
Female	Dummy equal to 1 if respondent is female
Household size	Number of members in household
Number of children	Number of children in the household
Partner	Dummy equal to 1 if the respondent has a partner or is married
Higher Vocational	Dummy equal to 1 if the respondent has completed higher vocational education
University	Dummy equal to 1 id the respondent has completed university education
Retired	Dummy equal to 1 if the respondent is retired
Self-employed	Dummy equal to 1 if the respondent is self-employed
Median income	Dummy equal to 1 if the respondent's income is between median household income and double median household income
Double median income	Dummy equal to 1 if the respondent's income is more than double the median income
Wealth Quartile 1	Dummy equal to 1 if the respondent's wealth is in the first quartile of the distribution
Wealth Quartile 2	Dummy equal to 1 if the respondent's wealth is in the second quartile of the distribution
Wealth Quartile 3	Dummy equal to 1 if the respondent's wealth is in the third quartile of the distribution
Wealth Quartile 4	Dummy equal to 1 if the respondent's wealth is in the fourth quartile of the distribution

Table 2 Definitions of behavioural characteristics

Behavioural trait	Definition
Present bias	A categorical variable of a self-reported measure of ability to control expenditures; 1(easy) to 7(difficult)
Patience	A measure of how much money is saved after necessities have been paid for; 1(spend soon) to 7(save as much as possible)
Financial literacy	A self-reported measure on how financially literate the respondent is; 1 to 4(very knowledgeable)
Risk averse	A measure of how risk averse the respondent is; 3 to 21
Risk seeking	A measure of how risk seeking the respondent is: 3 to 21

Risk preference will be defined with two alternative measures as well, one measuring how risk averse a respondent is and the other measuring how risk seeking the respondent is. The first uses the following three statements: "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", "I want to be certain my investments are safe" and "I would never consider investments in shares because I find this too risky". Respondents indicate to what extent they agree with these statements scaling from 1 (totally disagree) through 7 (totally agree). The variable, risk averse, ranges from 3 (not at all risk averse) to 21 (very risk averse). To access to what extent respondents are risk seeking the following 3 questions are used: "If I think an investment will be profitable, I am prepared to borrow money to make this investment", "I get more and more convinced that I should take greater financial risks to improve my financial position" and "I am prepared to take the risk to lose money, when there is also a chance to gain money". Respondents indicate to what extent they agree with these statements scaling from 1 (totally disagree) through 7 (totally agree). The variable risk seeking then created ranges from 3 (not at all risk seeking) to 21 (very risk seeking). Finally, to measure the financial literacy the statement "How knowledgeable do you consider yourself with respect to financial matters?" is used. Answers range from 1 (not knowledgeable) to 4 (very knowledgeable). Table 2 summarizes the definitions of the behavioural characteristics.

3.3 Summary statistics by mortgage type

This section first discusses summary statistics for control variables and behavioural characteristics by mortgage. These statistics are reported in three separate ways; for the years 2008 – 2012, 2013 – 2020 and the full sample. The advantage of this is that the periods before and after 2013 can be distinguished, as from 2013 onwards interest is no longer tax deductible for AMPs. The differences between means per variable in SRM and AMP are tested with t-tests to evaluate the significance. After this summary, statistics are shown for the respondents that are eligible for insurance, by whether or not they are insured.

The summary statistics in table 3 show that for the period 2008 – 2012 there were relatively more women that choose for an AMP. Within respondents that obtained AMPs there is a larger amount in the least wealthy category than for SRMs. The rest of the control variables do not statistically differ between mortgage types in this sample.

Table 3 Summary statistics for control variable by mortgage type; 2008 – 2012

	SRM			AMP			SRM-AMP	Total		
	Mean	SD	N	Mean	SD	N		Mean	SD	N
House value (WOZ)	241.0	66.9	7	247.1	78.16	37	-6.05	246.09	75.79	44
Log house value	5.46	0.25	7	5.47	0.30	37	-0.01	5.46	0.29	44
Mortgage debt	164.0	75.1	9	181.0	115.5	45	-17.01	178.18	109.4	54
Log mortgage debt	4.99	0.52	9	4.94	0.84	45	0.05	4.94	0.79	54
LTV ratio	0.62	0.27	6	0.64	0.41	36	-0.02	0.64	0.39	42
Originator: bank	0.45	0.52	11	0.46	0.50	46	0.00	0.46	0.50	57
Originator: Insurer	0.18	0.40	11	0.28	0.46	46	-0.10	0.26	0.44	57
Loan-to-income ratio	5.10	5.26	3	9.01	15.51	27	-3.91	8.62	14.79	30
Debt-service ratio	0.03	0.02	2	0.04	0.08	24	-0.01	0.04	0.08	26
Financially active	0.44	0.53	9	0.30	0.61	40	0.14	0.33	0.59	49
Age(years)	54.36	13.8	11	59.33	14.43	46	-4.96	58.37	14.32	57
Female	0.09	0.30	11	0.33	0.47	46	-0.24*	0.28	0.45	57
Household size	3.00	1.26	11	2.61	1.22	46	0.39	2.68	1.23	57
Number of children	1.00	1.26	11	0.78	1.09	46	0.22	0.82	1.12	57
Partner	1.00	0.00	11	0.83	0.38	46	0.17*	0.86	0.35	57
Higher Vocational	0.27	0.47	11	0.37	0.49	46	-0.10	0.35	0.48	57
University	0.18	0.40	11	0.13	0.34	46	0.05	0.14	0.35	57
Retired	0.09	0.30	11	0.20	0.40	46	-0.10	0.18	0.38	57
Self-employed	0.09	0.30	11	0.04	0.21	46	0.05	0.05	0.23	57
Median income	0.18	0.40	11	0.26	0.44	46	-0.08	0.25	0.43	57
Double median income	0.64	0.50	11	0.43	0.50	46	0.20	0.47	0.50	57
Wealth Quartile 1	0.09	0.30	11	0.28	0.46	46	-0.19*	0.25	0.43	57
Wealth Quartile 2	0.18	0.40	11	0.15	0.36	46	0.03	0.16	0.37	57
Wealth Quartile 3	0.36	0.50	11	0.30	0.47	46	0.06	0.32	0.47	57
Wealth Quartile 4	0.36	0.50	11	0.26	0.44	46	0.10	0.28	0.45	57

This table shows the mean values and standard deviations for control variables reported by mortgage types. Mortgage types are the Standard Repayment Mortgage (SRM) or the Alternative Mortgage Product (AMP). The definition for these mortgage categories can be found in the introduction or appendix in more detail. Differences between the means of the variables in SRM and AMP are tested for statistical significance with a t-test. The subscripts *, ** and ** indicate the difference is statistically significant at respectively; 10%, 5% and 1%. The variable house value and mortgage debt are shown in thousands of euros. Data is obtained from the DNB Household Survey and this table contains mortgages originated within the period 2008 - 2012.

Table 4 Summary statistics for behavioural characteristics by mortgage type; 2008 – 2012

	SRM			AMP			SRM - AMP	Total		
	Mean	SD	N	Mean	SD	N		Mean	SD	N
Present bias	3.11	1.54	9	3.03	1.50	39	0.086	3.04	1.49	48
Patience	5.00	1.32	9	4.89	1.29	39	0.10	4.92	1.29	48
Financial literacy	1.89	0.60	9	2.26	0.64	38	-0.37*	2.19	0.65	47
Risk averse	14.63	5.32	8	14.84	4.42	37	-0.21	14.8	4.53	45
Risk seeking	6.88	3.76	8	7.30	3.29	37	-0.42	7.22	3.34	45

This table shows the mean values and standard deviations for behavioural traits reported by mortgage types. Mortgage types are the Standard Repayment Mortgage (SRM) or the Alternative Mortgage Product (AMP), the definition for these can be found in the Appendix. Differences between the means of the variables in SRM and AMP are tested for statistical significance with a t-test. The subscripts *, ** and ** indicate the difference is statistically significant at respectively; 10%, 5% and 1%. A more detailed description of survey questions asked to determine behavioural characteristics can be found in the Appendix. Data is obtained from the DNB Household Survey and this table contains mortgages originated within the period 2008 - 2012.

The summary statistics in table 5 show that for the years 2013 – 2020, AMPs are generally chosen by older and wealthier households. Additionally, among respondents choosing for AMPs there is a larger percentage retired and a smaller percentage self-employed. Respondents choosing for AMPs are however, less educated on average than those opting for an SRM. On average the house value is higher for AMPs, however the mortgage debt is generally lower. Another difference is that people choosing AMPs are also somewhat more financially active. Table 6 reveals that present, patience and financial literacy do not differ between mortgages types in the time frame 2013 – 2020. In general, Dutch households have a preference for saving money. Additionally, Dutch households are on average more risk averse than they are risk seeking and this does not differ over mortgage types.

The most striking difference between the years 2008 – 2012 and the years 2013 – 2020 is the relative number of AMPs chosen. Before altered tax regulations in 2013, there are a lot more respondents that have an AMP. Before 2013, approximately 81 % (46/57) of respondents purchased an AMP. Whereas as of 2013, this percentage decreases to 67% (89/132). Additionally, before 2013 the respondents choosing an AMP consider themselves as more financially literate than respondents that choose for an SRM. After 2013, there is no statistical difference in the how respondents in each group perceive their financial literacy.

Table 5 Summary statistics for control variables by mortgage type; 2013 - 2020

	SRM			AMP			SRM - AMP	Total		
	Mean	SD	N	Mean	SD	N		Mean	SD	N
House value (WOZ)	228.58	102.88	57	247.31	96.51	35	-18.74	235.71	100.38	92
Log house value	5.35	0.41	57	5.45	0.35	35	-0.10	5.38	0.39	92
Mortgage debt	196.56	92.58	81	148.71	84.84	34	47.85***	182.41	92.63	115
Log mortgage debt	5.16	0.54	81	4.86	0.52	34	0.29***	5.01	0.54	115
LTV ratio	0.83	0.34	55	0.66	0.41	32	0.17**	0.77	0.37	87
Originator: bank	0.24	0.43	89	0.35	0.48	43	0.11*	0.27	0.45	132
Originator: Insurer	0.35	0.48	89	0.23	0.43	43	0.12*	0.31	0.46	132
Loan-to-income ratio	8.70	9.43	64	5.33	4.23	26	3.37*	7.72	8.39	90
Debt-service ratio	0.03	0.03	56	0.01	0.01	26	0.02***	0.03	0.03	82
Financially active	0.08	0.35	78	0.21	0.47	39	0.13*	0.12	0.40	117
Age(years)	46.81	10.94	43	61.26	13.13	89	-14.45***	51.52	13.58	132
Female	0.40	0.49	43	0.40	0.49	89	0.01	0.40	0.49	132
Household size	2.54	1.33	43	2.53	1.24	89	0.00	2.54	1.30	132
Number of children	0.82	1.15	43	0.72	1.01	89	0.10	0.79	1.11	132
Partner	0.69	0.47	43	0.79	0.41	89	-0.11	0.72	0.45	132
Higher Vocational	0.44	0.50	43	0.21	0.41	89	0.23***	0.36	0.48	132
University	0.19	0.40	43	0.12	0.32	89	0.07	0.17	0.37	132
Retired	0.04	0.21	43	0.44	0.50	89	0.40***	0.17	0.38	132
Self-employed	0.09	0.29	43	0.05	0.21	89	0.04	0.08	0.27	132
Median income	0.36	0.48	43	0.28	0.45	89	0.08	0.33	0.47	132
Double median income	0.26	0.44	43	0.35	0.48	89	-0.09	0.29	0.45	132
Wealth Quartile 1	0.31	0.47	43	0.12	0.45	89	0.20**	0.25	0.43	132
Wealth Quartile 2	0.24	0.43	43	0.28	0.45	89	-0.04	0.25	0.43	132
Wealth Quartile 3	0.27	0.45	43	0.21	0.41	89	0.06	0.25	0.43	132
Wealth Quartile 4	0.18	0.39	43	0.40	0.49	89	-0.22**	0.25	0.43	132

This table shows the mean values and standard deviations for control variables reported by mortgage types. Mortgage types are the Standard Repayment Mortgage (SRM) or the Alternative Mortgage Product (AMP). The definition for these mortgage categories can be found in the introduction or appendix in more detail. Differences between the means of the variables in SRM and AMP are tested for statistical significance with a t-test. The subscripts *, ** and ** indicate the difference is statistically significant at respectively; 10%, 5% and 1%. The variable house value and mortgage debt are shown in thousands of euros. Data is obtained from the DNB Household Survey and this table contains mortgages originated within the period 2013 - 2020.

Table 6 Summary statistics for behavioural characteristics by mortgage type; 2013 - 2020

	SRM			AMP			SRM-AMP	Total		
	Mean	SD	N	Mean	SD	N		Mean	SD	N
Present bias	2.91	1.38	82	2.70	1.38	41	0.22	2.85	1.38	123
Patience	5.29	1.07	82	5.01	1.09	41	0.28	5.23	1.08	123
Financial literacy	2.33	0.80	82	2.22	0.76	41	0.11	2.29	0.78	123
Risk averse	16.22	3.47	77	15.69	4.00	39	0.53	16.04	3.65	116
Risk seeking	8.01	3.46	77	7.38	3.53	39	0.71	7.85	3.94	116

This table shows the mean values and standard deviations for behavioural traits reported by mortgage types. Mortgage types are the Standard Repayment Mortgage (SRM) or the Alternative Mortgage Product (AMP), the definition for these can be found in the Appendix. Differences between the means of the variables in SRM and AMP are tested for statistical significance with a t-test. The subscripts *, ** and ** indicate the difference is statistically significant at respectively; 10%, 5% and 1%. A more detailed description of survey questions asked to determine behavioural characteristics can be found in the Appendix. Data is obtained from the DNB Household Survey and this table contains mortgages originated within the period 2013 - 2020.

Moving on to the full sample, covering the years 2008 – 2020, table 7 shows that houses financed with an AMP are generally more expensive, although the debt taken out is lower. Therefore, the LTV-ratio for AMPs is also significantly lower. Furthermore, AMPs are more often issued by banks than SRMs and respondents with AMPs are more financially active on average. Holders of AMPs are also older, more often have a partner and are more often retired. Additionally, respondents that have obtained an AMP in the years 2008 – 2020 generally have completed a higher degree of education. Finally, among those that have an AMP, a larger proportion is wealthier and has an income that is at least twice the median.

When observing behavioural traits for the full sample in table 8 it can be seen participants that have obtained an SRM over the last 12 years are generally more patient. This means they have a preference for saving more money. Additionally, these participants are also more risk averse on average.

Table 7 Summary statistics for control variables by mortgage type; full sample 2008 – 2020

	SRM			AMP			SRM-AMP	Total		
	Mean	SD	N	Mean	SD	N		Mean	SD	N
House value (WOZ)	229.94	99.25	64	247.18	86.94	72	-17.24	239.07	92.985	136
Log house value	5.36	0.40	64	5.46	0.32	72	-0.10**	5.410	0.362	136
Mortgage debt	193.30	91.14	90	167.11	104.07	79	26.19**	181.06	97.985	169
Log mortgage debt	5.14	0.53	90	4.91	0.72	79	0.23***	5.03	0.634	169
LTV ratio	0.81	0.34	61	0.65	0.41	68	0.16***	0.72	0.385	129
Originator: bank	0.26	0.44	100	0.40	0.49	89	-0.14**	0.33	0.471	189
Originator: Insurer	0.33	0.47	100	0.26	0.44	89	0.07	0.30	0.458	189
Loan-to-income ratio	8.54	9.29	67	7.20	11.50	53	1.34	7.95	10.301	120
Debt-service ratio	0.03	0.03	58	0.03	0.06	50	0.01	0.03	0.044	108
Financially active	0.11	0.39	87	0.25	0.54	79	-0.14**	0.18	0.471	166
Age(years)	47.64	11.45	100	60.26	13.77	89	-12.62***	53.58	14.063	189
Female	0.37	0.49	100	0.36	0.48	89	0.01	0.37	0.483	189
Household size	2.59	1.33	100	2.57	1.22	89	0.02	2.58	1.276	189
Number of children	0.84	1.16	100	0.75	1.05	89	0.09	0.80	1.107	189
Partner	0.72	0.45	100	0.81	0.40	89	-0.09*	0.76	0.427	189
Higher Vocational	0.42	0.50	100	0.29	0.46	89	0.13**	0.36	0.481	189
University	0.19	0.39	100	0.12	0.33	89	0.07*	0.16	0.366	189
Retired	0.05	0.22	100	0.31	0.47	89	-0.26***	0.17	0.381	189
Self-employed	0.09	0.29	100	0.31	0.21	89	-0.22	0.069	0.254	189
Median income	0.34	0.48	100	0.27	0.45	89	0.07	0.31	0.462	189
Double median income	0.30	0.46	100	0.39	0.49	89	-0.09*	0.34	0.476	189
Wealth Quartile 1	0.29	0.46	100	0.20	0.40	89	0.09*	0.25	0.433	189
Wealth Quartile 2	0.23	0.42	100	0.21	0.41	89	0.02	0.22	0.417	189
Wealth Quartile 3	0.28	0.45	100	0.26	0.44	89	0.02	0.27	0.445	189
Wealth Quartile 4	0.20	0.40	100	0.33	0.47	89	-0.13**	0.26	0.439	189

This table shows the mean values and standard deviations for control variables reported by mortgage types. Mortgage types are the Standard Repayment Mortgage (SRM) or the Alternative Mortgage Product (AMP). The definition for these mortgage categories can be found in the introduction or appendix in more detail. Differences between the means of the variables in SRM and AMP are tested for statistical significance with a t-test. The subscripts *, ** and ** indicate the difference is statistically significant at respectively; 10%, 5% and 1%. The variable house value and mortgage debt are shown in thousands of euros. Data is obtained from the DNB Household Survey and this table contains mortgages originated within the period 2008 - 2020.

Table 8 Summary statistics for behavioural characteristics by mortgage type; full sample

	SRM			AMP			SRM-AMP	Total		
	Mean	SD	N	Mean	SD	N		Mean	SD	N
Present bias	2.93	1.39	91	2.86	1.44	80	0.072	2.90	1.41	171
Patience	5.26	1.09	91	5.00	1.19	80	0.26*	5.14	1.14	171
Financial literacy	2.29	0.79	91	2.24	0.70	79	0.045	2.26	0.75	170
Risk averse	16.07	3.67	85	15.28	4.21	76	0.79*	15.70	3.94	161
Risk seeking	7.98	3.49	85	7.34	3.40	76	0.63	7.68	3.45	161

This table shows the mean values and standard deviations for behavioural traits reported by mortgage types. Mortgage types are the Standard Repayment Mortgage (SRM) or the Alternative Mortgage Product (AMP), the definition for these can be found in the Appendix. Differences between the means of the variables in SRM and AMP are tested for statistical significance with a t-test. The subscripts *, ** and ** indicate the difference is statistically significant at respectively; 10%, 5% and 1%. A more detailed description of survey questions asked to determine behavioural characteristics can be found in the Appendix. Data is obtained from the DNB Household Survey and this table contains mortgages originated within the period 2008 - 2020.

3.4 Summary statistics national mortgage guarantee

Table 9 Summary statistics for control variables by NHG; 2008 - 2020

	Uninsured			Insured			Difference Uninsured – insured	Total		
	Mean	SD	N	Mean	SD	N		Mean	SD	N
House value (WOZ)	270.52	96.83	50	201.13	69.23	61	69.39***	232.39	89.41	111
Log house value	5.54	0.35	50	5.26	0.31	61	0.28***	5.38	0.36	111
Mortgage debt	205.35	112.36	72	169.85	84.72	76	35.50**	187.12	100.38	148
Log mortgage debt	5.14	0.67	72	4.98	0.61	76	0.16**	5.06	0.64	148
LTV ratio	0.69	0.37	50	0.80	0.37	58	-0.11**	0.75	0.37	108
Originator: bank	0.40	0.49	72	0.18	0.39	87	0.22**	0.28	0.45	159
Originator: Insurer	0.26	0.44	72	0.38	0.49	87	-0.12*	0.33	0.47	159
Loan-to-income ratio	9.67	13.78	46	7.58	8.10	57	2.09	8.51	10.99	103
Debt-service ratio	0.04	0.06	42	0.03	0.02	49	0.01*	0.03	0.05	91
Financially active	0.20	0.48	60	0.17	0.47	77	0.03	0.18	0.47	137
Age(years)	53.58	13.98	72	49.86	12.60	87	3.72**	51.55	13.33	159
Female	0.36	0.48	72	0.37	0.49	87	-0.01	0.36	0.48	159
Household size	2.47	1.23	72	2.76	1.32	87	-0.29*	2.63	1.29	159
Number of children	0.76	1.11	72	0.92	1.15	87	-0.16*	0.85	1.13	159
Partner	0.71	0.46	72	0.82	0.39	87	-0.11	0.77	0.42	159
Higher Vocational	0.40	0.49	72	0.39	0.49	87	0.01	0.40	0.49	159
University	0.26	0.44	72	0.07	0.25	87	0.19***	0.16	0.37	159
Retired	0.11	0.32	72	0.05	0.21	87	0.07	0.08	0.26	159
Self-employed	0.11	0.32	72	0.13	0.33	87	-0.02*	0.12	0.33	159
Median income	0.28	0.45	72	0.36	0.48	87	-0.08	0.32	0.47	159
Double median income	0.42	0.50	72	0.28	0.45	87	0.14**	0.34	0.48	159
Wealth Quartile 2	0.18	0.39	72	0.24	0.43	87	-0.06	0.21	0.41	159
Wealth Quartile 3	0.26	0.44	72	0.31	0.47	87	-0.05	0.29	0.45	159
Wealth Quartile 4	0.32	0.47	72	0.14	0.35	87	0.18***	0.22	0.42	159

This table shows the mean values and standard deviations for control variables reported by whether or not respondents hold an insurance (NHG) for their mortgage. Differences between the means of the variables in NHG or no NHG are tested for statistical significance with a t-test. The subscripts *, ** and ** indicate the difference is statistically significant at respectively; 10%, 5% and 1%. The variable house value and mortgage debt are shown in thousands of euros. Data is obtained from the DNB Household Survey and this table contains mortgages originated within the period 2008 - 2020.

Table 10 Summary statistics for behavioural characteristics by NHG; 2008 - 2020

	Uninsured			Insured			Difference	Total		
	Mean	SD	N	Mean	SD	N	Uninsured - Insured	Mean	SD	N
Present bias	2.810	1.469	63	2.949	1.278	78	-0.139	2.887	1.363	141
Patience	5.095	1.187	63	5.141	1.113	78	-0.046	5.121	1.143	141
Financial literacy	2.317	0.692	63	2.260	0.785	77	0.058	2.286	0.742	140
Risk averse	15.852	4.070	61	15.671	3.898	73	0.181	15.754	3.963	134
Risk seeking	7.607	3.446	61	7.795	3.346	73	-0.188	7.709	3.380	134

This table shows the mean values and standard deviations for behavioural traits reported by whether respondents are insured for their mortgage or not. Differences between the means of the variables in uninsured and insured respondents are tested for statistical significance with a t-test. The subscripts *, ** and ** indicate the difference is statistically significant at respectively; 10%, 5% and 1%. A more detailed description of survey questions asked to determine behavioural characteristics can be found in the Appendix. Data is obtained from the DNB Household Survey and this table contains mortgages originated within the period 2008 - 2020.

When looking at the differences between uninsured and insured respondents in table 9, it can be seen more expensive houses and houses with more debt are less likely to have a mortgage insurance. Furthermore, Insured houses have a higher LTV-ratio, which makes economic sense as a higher LTV-ratio is more risky. Among mortgages that are originated by an insurer there are more insured mortgages. Whereas among mortgages originated by banks, less are insured. Insured respondents are on average younger and have bigger families. Within uninsured respondents a higher amount has completed university education than within insured respondents. Self-employed households insure more often. Finally, wealthier respondents and those with higher incomes are less often insured. In table 10, it can be seen there are no statistically significant differences in behavioural characteristics between insured and uninsured households.

4. Methodology

In this section the methodologies used to answer the hypotheses are discussed. Additionally, the methodology of robustness checks are described including; firthlogit regressions, alternation between risk preference variables and evaluation of an alternative time period. First in section 4.1 methodologies used to answer the first hypothesis regarding alternative mortgage products are discussed. After this in section 4.2, methodologies used to answer the second hypothesis regarding mortgage insurance are discussed.

4. 1 Alternative mortgage products

To be able to evaluate the first hypothesis;

There is a positive association between a respondent being present biased and the chance of them choosing for an AMP.

First a logit estimate is made for the multivariate analysis to model the chance of a respondent choosing an Alternative Mortgage Product (AMP). The dependent variable is the AMP dummy, which takes on a 1 if a respondent has taken out an AMP. The vector *X* contains behavioural traits described in table 2 and controls described in table 1 (Cox et al, 2015).

$$Alternative\ Mortgage\ Product(1 = yes)_{it} = \alpha_{it} + \beta_{it}\boldsymbol{X}_{it} + \varepsilon_{ij} \tag{1}$$

A logistic and a probit model are evaluated with the behavioural explanatory variables; present bias, patience, financial literacy, risk aversion and risk seeking. Risk seeking and risk aversion are not significantly correlated (-0.272) and are thus both included. The correlation between patience and present bias are tested to check whether the different components of time preference are measured. Gathergood & Weber, (2017) find a correlation coefficient of -0.06 between their variables for present bias and patience which shows these factors should be considered separately. This paper finds a correlation of -0.174. Although this is a slightly higher correlation than found in the paper of Gathergood & Weber (2017), it is reasonable to add them as separate constructs. With the economic reasoning being that present bias is defined as consuming more than planned in the present due to lack of self-control, whereas impatience is a preference for consuming more now than in the future. In both cases consumption is tilted toward the present. However, with a key difference being, that present-bias consumers do not plan this, whereas impatient consumers make the choice deliberately. Further explanatory variables added are; house value, log debt, LTV ratio, originated by

bank, originated by insurer, Loan-to-income-ratio, financially active, age, gender, education level, median income, double median income and the wealth quartiles. Not a lot of respondents are retired or self-employed and therefore; wealth, income and age are used as proxies. The correlation between the loan to income and debt to service ratio is high (0.926) and therefore, debt to service is left out of the regression. The same is true for the correlation between household size and the number of children in a household (0.9346). Household size is used in the regression and the number of children is left out.

As a robustness check firthlogit regressions are included in the analysis. Firthlogit is used to counter issues with standard maximum likelihood estimation that arise with small datasets. Small datasets are less likely to reflect the population's true distribution and maximum likelihood estimation techniques used in logistic regressions are only unbiased when used for big datasets. Therefore, the quality of the model's predictions with a small amount of observations drop. A problem that often occurs with small sample sizes it that predictions are overly confident, and coefficients are overestimated. Firth logit penalizes the maximum likelihood, producing more conservative predictions and smaller coefficients (Firth, 1993).

Analysis of the first set of regressions shows when the log likelihood is penalized with firth, the overall model becomes insignificant. Therefore, additional logistic and probit models with less variables are added to mitigate over specification. Variables that kept are; Present bias, patience, financial literacy, risk seeking or risk averse, log debt, financially active, age, gender, household size, higher education, higher income and higher wealth. One table is be made with risk seeking as the variable describing risk preference and a separate table with regressions will be made with risk averse instead. The purpose of this is to evaluate robustness across both measures of risk preference. Adjustments are made to reduce the number of variables whilst keeping their power as much as possible. Instead of quartiles for wealth, wealth is divided into higher and lower wealth. Higher wealth contains respondents that are wealthier than the average respondent and lower wealth contains respondents that are less wealthy than average. Likewise, income is divided into lower and higher income. Finally, higher vocational and university education are combined into one variable that indicates whether a respondent has finished either of the two. To access robustness overtime, logistic, probit and firth logit regressions are evaluated over the time period 2013 – 2020.

4.2 National mortgage guarantee

To be able to answer the second hypothesis:

There is a negative association between respondents being present biased and the likelihood of them obtaining an insurance for their mortgage.

For eligible respondents a logit and a probit estimates are made to model the chance that a household insures the mortgage (Cox & Zwinkels, 2016). Here the dependent variable is the mortgage insurance dummy that takes on a 1 if the mortgage is insured. The vector *X* contains the behavioural traits described in table 2 and the controls described in table 1 with a dummy for insurance instead of for AMP.

$$Mortgage\ insurance\ (1 = yes)_{it} = \alpha_{it} + \beta_{it}X_{it} + \varepsilon_{ij} \tag{2}$$

In line with section 4.1, to mitigate over specification the following variables are kept; present bias, patience, financial literacy, risk seeking or risk averse, log debt, financially active, age, gender, household size, higher education, higher income and higher wealth. Additionally, and in line with section 4.1, firth logit regressions are included for robustness. Finally, to further assess robustness overtime, logistic, probit and firth logit regressions are evaluated over the period 2013 – 2020.

5. Results

The following section contains the results for the logistic, firthlogit and probit regressions. First in section 5.1 the results of logistic, firthlogit and probit regressions with AMP as dependent variable will be reported and discussed. Thereafter, the results for the logistic, firthlogit and probit regressions will be reported with the NHG (Insurance) as dependent variable. The reason the number of observations in the regression analysis is lower than in the summary statistics, is because respondents do not always complete the survey. Furthermore, missing variables are not consistent between respondents, e.g. some respondents may not have filled out their mortgage debt, whereas others may have left out answers in behavioural sections. In the analysis, list wise deletion is used. This means that if there is a missing value in the logistic regression for any variable, the entire respondent is excluded. In both cases firthlogit regressions are included as robustness check because of the sparsity of certain observations. Additionally, as robustness checks, regressions with a different time frame and alternative measures of risk preference are included.

5.1 Alternative mortgage products

Table 11 below, reports the results of logistic, firthlogit and probit regressions respectively with AMP as dependent variable. AMP takes on the value 1 if a respondent has an AMP. The first column shows the explanatory variables used. The second and third column show the logistic odds ratios and corresponding p-values, respectively. The fourth and fifth column show the firthlogit coefficients and corresponding p-values, respectively. Finally, in the sixth and seventh column probit coefficients and their p-values are represented. For both the logistic and probit regression the probability $> chi^2$ is 0.001. This means the probability of obtaining a chi-square statistic of 47.88 for the logistic, respectively 48.58 for the probit regression if the null (there is no effect of independent variables jointly on the dependent variable) is true, is low. Therefore, the overall logistic and probit models are statistically significant (at 1%). However, when evaluating the firthlogit regression, the probability $> chi2$ is 0.683. This could indicate that the number of observations is too low and logistic and probit results may not be reliable. Therefore, overall, the results in table 11 are inconclusive.

Table 11 AMP regressions extensive variables

Dependent variable: AMP (1 = yes)	Logistic		Firthlogit		Probit	
	Odds ratio	p-value	Coefficient	p-value	Coefficient	p-value
Present bias	0.602	0.133	-0.318	0.240	-0.300	0.131
Patience	0.450	0.053	-0.509	0.117	-0.476	0.050
Financial literacy	1.475	0.479	0.255	0.550	0.216	0.503
Risk averse	0.965	0.763	-0.025	0.792	-0.018	0.792
Risk seeking	0.736	0.030	-0.195	0.074	-0.181	0.026
House value	0.999	0.840	-0.001	0.868	-0.001	0.894
Log debt	4.564	0.390	0.925	0.493	0.838	0.407
LTV ratio	0.004	0.092	-3.648	0.152	-3.203	0.093
Originator: bank	0.143	0.047	-1.254	0.109	-1.206	0.036
Originator: Insurer	0.155	0.057	-1.194	0.120	-1.106	0.051
Loan-to-income ratio	0.915	0.278	-0.043	0.319	-0.054	0.248
Financially active	1.958	0.458	0.438	0.550	0.429	0.409
Age(years)	1.103	0.016	0.063	0.044	0.059	0.012
Female	1.649	0.559	0.363	0.590	0.321	0.515
Household size	1.529	0.249	0.279	0.335	0.257	0.235
Higher Vocational	0.273	0.114	-0.819	0.206	-0.784	0.098
University	0.194	0.204	-1.132	0.279	-1.001	0.188
Median income	0.261	0.144	-0.812	0.252	-0.773	0.143
Double median income	0.441	0.648	-0.462	0.746	-0.506	0.627
Wealth quartile 1	4.547	0.355	0.870	0.506	0.912	0.342
Wealth quartile 2	4.255	0.230	0.909	0.350	0.897	0.211
Wealth quartile 3	0.233	0.154	-1.058	0.192	-0.826	0.159
Constant	1.062	0.993	0.268	0.960	0.135	0.973
Number of observations	83		83		83	
Wald/LR chi2(23)	47.88		18.38		48.580	
Prob > chi2	0.001		0.683		0.001	
Pseudo R2	0.416				0.4222	
(Penalized) Log likelihood	-33.587		-8.527		-33.237	

This table contains coefficients and p-values of logistic (column 2 & 3), firthlogit (column 4 & 5) and probit (column 6 & 7) regressions. The dependent variable is AMP. AMP is a dummy variable that takes on the value one if the respondent has an AMP. Data is obtained from the DNB Household Survey and this table contains mortgages originated within the period 2008 - 2020.

Table 12a AMP regressions limited variables with risk seeking

Dependent variable: AMP (1 = yes)	Logistic		Firthlogit		Probit	
	Odds ratio	p-value	Coefficient	p-value	Coefficient	p-value
Present bias	1.130	0.469	0.107	0.498	0.065	0.511
Patience	0.794	0.199	-0.208	0.217	-0.138	0.195
Financial literacy	1.314	0.382	0.245	0.402	0.179	0.340
Risk seeking	0.971	0.686	-0.025	0.714	-0.015	0.720
Log debt	0.790	0.538	-0.209	0.563	-0.143	0.517
Financially active	2.457	0.061	0.754	0.087	0.539	0.051
Age(years)	1.083	0.000	0.071	0.000	0.048	0.000
Female	1.572	0.359	0.398	0.390	0.269	0.357
Household size	1.123	0.497	0.103	0.520	0.065	0.517
Higher education	0.563	0.189	-0.508	0.218	-0.333	0.196
Higher income	1.124	0.800	0.101	0.817	0.067	0.806
Higher wealth	0.944	0.910	-0.032	0.947	-0.025	0.933
Constant	0.035	0.259	-2.970	0.285	-2.017	0.242
Number of observations	135		135		135	
Wald/LR chi2(12)	43.8		27.44		44.03	
Prob > chi2	0		0.0067		0	
Pseudo R2	0.235				0.236	
(Penalized) Log likelihood	-71.374		-51.263		-71.260	

This table contains coefficients and p-values of logistic (column 2 & 3), firthlogit (column 4 & 5) and probit (column 6 & 7) regressions. The dependent variable is AMP. AMP is a dummy variable that takes on the value one if the respondent has an AMP. As a measure for risk preference, risk seeking is used. Data is obtained from the DNB Household Survey and this table contains mortgages originated within the period 2008 - 2020.

Table 12a that shows the results of a logistic, firthlogit and probit regression respectively with AMP as dependent variable with less explanatory variables than in table 11. AMP takes on the value 1 if a respondent has an AMP. The first column shows the explanatory variables used. The second and third column show the logistic odds ratios and corresponding p-values, respectively. The fourth and fifth column show the firthlogit coefficients and corresponding p-values, respectively. Finally, in the sixth and seventh column probit coefficients and their p-values are represented. Table 12a has risk seeking as a variable to describe the risk preference of respondents. For all three regressions the probability > chi2 is small enough to make each model jointly significant. The two variables that remain statistically significant across all three models in the table are financially active and age. According to this table respondents that are older are associated with being slightly more likely to have an AMP. Additionally, more financially active respondents more often have an AMP.

Table 12b AMP regressions limited variables with risk averse

Dependent variable: AMP (1 = yes)	Logistic		Firthlogit		Probit	
	Odds ratio	p-value	Coefficient	p-value	Coefficient	p-value
Present bias	1.109	0.533	0.093	0.551	0.057	0.559
Patience	0.810	0.257	-0.189	0.277	-0.127	0.251
Financial literacy	1.270	0.444	0.216	0.460	0.157	0.406
Risk averse	0.974	0.659	-0.023	0.679	-0.015	0.656
Log debt	0.811	0.582	-0.187	0.600	-0.131	0.553
Financially active	2.246	0.103	0.674	0.138	0.489	0.089
Age(years)	1.085	0.000	0.073	0.000	0.049	0.000
Female	1.718	0.256	0.481	0.282	0.320	0.253
Household size	1.128	0.478	0.108	0.497	0.070	0.480
Higher education	0.582	0.217	-0.483	0.242	-0.317	0.219
Higher income	1.094	0.846	0.079	0.857	0.055	0.842
Higher wealth	0.933	0.890	-0.038	0.936	-0.029	0.923
Constant	0.033	0.236	-3.050	0.261	-2.035	0.228
Number of observations	135		135		135	
Wald/LR chi2(12)	43.83		27.66		44.1	
Prob > chi2	0		0.0062		0	
Pseudo R2	0.235				0.236	
(Penalized) Log likelihood	-71.358		-51.045		-71.225	

This table contains coefficients and p-values of logistic (column 2 & 3), firthlogit (column 4 & 5) and probit (column 6 & 7) regressions. The dependent variable is AMP. AMP is a dummy variable that takes on the value one if the respondent has an AMP. As a measure for risk preference, risk averse is used. Data is obtained from the DNB Household Survey and this table contains mortgages originated within the period 2008 - 2020.

The difference between table 12a and table 12b is that table 12b has risk averse as a variable to describe the risk preference of respondents. Similar to table 12a, for all three regressions the probability > chi2 is small enough to make each model jointly significant. However, in this table only age remains significant throughout all three regressions. According to this table respondents that are older are associated with being slightly more likely to have an AMP.

Table 13a AMP regressions limited variables with risk seeking 2013 - 2020

Dependent variable: AMP (1 = yes)	Logistic		Firthlogit		Probit	
	Odds ratio	p-value	Coefficient	p-value	Coefficient	p-value
Present bias	0.914	0.717	-0.071	0.752	-0.058	0.690
Patience	0.820	0.431	-0.165	0.466	-0.118	0.431
Financial literacy	0.978	0.959	-0.014	0.970	-0.028	0.912
Risk seeking	0.917	0.381	-0.068	0.452	-0.052	0.368
Log debt	0.765	0.634	-0.235	0.643	-0.202	0.509
Financially active	6.661	0.027	1.529	0.041	1.149	0.024
Age(years)	1.101	0.003	0.078	0.006	0.056	0.002
Female	2.256	0.271	0.646	0.333	0.477	0.267
Household size	1.546	0.087	0.356	0.118	0.261	0.080
Higher education	0.278	0.046	-1.035	0.070	-0.721	0.048
Higher income	2.402	0.203	0.682	0.270	0.546	0.175
Higher wealth	1.403	0.598	0.307	0.596	0.227	0.534
Constant	0.012	0.313	-3.536	0.371	-2.340	0.343
Number of observations	96		96		96	
Wald/LR chi2(12)	38.26		18.94		38.71	
Prob > chi2	0.0001		0.0899		0.0001	
Pseudo R2	0.317				0.321	
(Penalized) Log likelihood	-41.258		-25.278		-41.032	

This table contains coefficients and p-values of logistic (column 2 & 3), firthlogit (column 4 & 5) and probit (column 6 & 7) regressions. The dependent variable is AMP. AMP is a dummy variable that takes on the value one if the respondent has an AMP. As a measure for risk preference, risk seeking is used. Data is obtained from the DNB Household Survey and this table contains mortgages originated within the period 2013 - 2020.

In table 13a above and 13b below the results of a logistic, firthlogit and probit regression respectively with AMP as dependent variable can be seen. AMP takes on the value 1 if a respondent has an AMP. The first column shows the explanatory variables used. The second and third column show the logistic odds ratios and corresponding p-values, respectively. The fourth and fifth column show the firthlogit coefficients and corresponding p-values, respectively. Finally, in the sixth and seventh column probit coefficients and their p-values are represented. The difference between tables 13a and 13b and those above, are the timeframe. To evaluate robustness overtime regressions are added for the time period 2013 – 2020. Table 13a has risk seeking as risk preference variable and table 13b has risk averse instead. Starting with 13a for all three regressions the probability > chi2 is small enough to make each model jointly significant. In this timeframe and with risk seeking as risk preference variable age, financially active and higher education remain significant throughout all three regressions. According to this table respondents that are older are associated with being slightly more likely to have an AMP as are respondent that are more financially active.

Respondents that have finished either higher vocation or university education are less likely to have an AMP over the time period 2013 – 2020. Moving on to 13a for all three regressions the probability > chi2 is small enough to make each model jointly significant. In line with 13b, in this timeframe and with risk averse as risk preference variable age, financially active and higher education remain significant throughout all three regressions. Therefore, according to both 13a and 13b respondents that are older are associated with being slightly more likely to have an AMP as are respondent that are more financially active. Respondents that have finished either higher vocation or university education are less likely to have an AMP over the time period 2013 – 2020.

Table 13b AMP regressions limited variables with risk averse 2013 - 2020

Dependent variable: AMP (1 = yes)	Logistic		Firthlogit		Probit	
	Odds ratio	p-value	Coefficient	p-value	Coefficient	p-value
Present bias	0.890	0.633	-0.091	0.680	-0.069	0.632
Patience	0.801	0.373	-0.184	0.409	-0.134	0.370
Financial literacy	0.968	0.939	-0.022	0.954	-0.026	0.917
Risk averse	1.040	0.662	0.029	0.716	0.023	0.658
Log debt	0.805	0.697	-0.192	0.703	-0.192	0.536
Financially active	6.776	0.037	1.534	0.056	1.147	0.032
Age(years)	1.109	0.001	0.084	0.003	0.060	0.001
Female	2.633	0.179	0.775	0.231	0.572	0.169
Household size	1.596	0.072	0.378	0.103	0.276	0.068
Higher education	0.318	0.061	-0.944	0.085	-0.641	0.068
Higher income	2.311	0.222	0.650	0.293	0.527	0.191
Higher wealth	1.281	0.691	0.236	0.676	0.170	0.635
Constant	0.002	0.151	-5.015	0.205	-3.368	0.167
Number of observations	96		96		96	
Wald/LR chi2(12)	37.68		18.65		38.09	
Prob > chi2	0.0002		0.0973		0.0001	
Pseudo R2	0.312				0.315	
(Penalized) Log likelihood	-41.549		-25.377		-41.343	

This table contains coefficients and p-values of logistic (column 2 & 3), firthlogit (column 4 & 5) and probit (column 6 & 7) regressions. The dependent variable is AMP. AMP is a dummy variable that takes on the value one if the respondent has an AMP. As a measure for risk preference, risk averse is used. Data is obtained from the DNB Household Survey and this table contains mortgages originated within the period 2013 - 2020.

5.2 National mortgage guarantee

Table 14 that shows the results of a logistic, firthlogit and probit regression respectively with NHG as dependent variable. NHG takes on the value 1 if a respondent has an insurance for his or her mortgage. The first column shows the explanatory variables used. The second and third column show the logistic odds ratios and corresponding p-values, respectively. The fourth and fifth column show the firthlogit coefficients and corresponding p-values, respectively. Finally, in the sixth and seventh column probit coefficients and their p-values are represented. When evaluating table 15, which shows the same regressions over the time period of 2013 – 2020 once again joint significance does not remain when firthlogit regressions are performed. Variables that remain significant over all three models in table 14 are higher education and higher wealth. Respondents with a higher education and higher wealth are less likely to insure. However, as the firthlogit regression is jointly insignificant, the models remain statistically inconclusive.

Table 14 NHG regressions

Dependent variable: NHG (1 = yes)	Logistic		Firthlogit		Probit	
	Odds ratio	p-value	Coefficient	p-value	Coefficient	p-value
Present bias	0.911	0.578	-0.079	0.614	-0.057	0.573
Patience	1.414	0.077	0.300	0.098	0.207	0.072
Financial literacy	1.012	0.970	0.011	0.969	0.009	0.961
Risk averse	0.995	0.936	-0.006	0.918	-0.004	0.910
Log debt	0.610	0.197	-0.441	0.218	-0.263	0.239
Financially active	1.286	0.617	0.186	0.685	0.163	0.594
Age(years)	0.975	0.190	-0.023	0.208	-0.015	0.189
Female	1.513	0.381	0.360	0.415	0.217	0.443
Household size	1.333	0.090	0.252	0.111	0.166	0.102
Higher education	0.272	0.006	-1.143	0.010	-0.778	0.006
Higher income	0.974	0.955	-0.008	0.985	-0.057	0.841
Higher wealth	0.387	0.071	-0.828	0.091	-0.557	0.075
Constant	16.454	0.321	2.556	0.332	1.580	0.346
Number of observations	115		115		115	
Wald/LR chi2(12)	22.73		15.83		22.42	
Prob > chi2	0.0301		0.1991		0.0331	
Pseudo R2	0.143				0.141	
(Penalized) Log likelihood	-67.992		-47.862		-68.151	

This table contains coefficients and p-values of logistic (column 2 & 3), firthlogit (column 4 & 5) and probit (column 6 & 7) regressions. The dependent variable is NHG. NHG is a dummy variable that takes on the value one if the respondent has a mortgage insurance. As a measure for risk preference, risk averse is used. Data is obtained from the DNB Household Survey and this table contains mortgages originated within the period 2008 - 2020.

Table 15 NHG regressions 2013-2020

Dependent variable: NHG (1 = yes)	Logistic		Firth logit		Probit	
	Odds ratio	p-value	Coefficient	p-value	Coefficient	p-value
Present bias	1.127	0.621	0.098	0.646	0.075	0.598
Patience	1.543	0.106	0.345	0.143	0.260	0.103
Financial literacy	0.834	0.690	-0.143	0.726	-0.114	0.669
Risk averse	0.910	0.353	-0.076	0.407	-0.057	0.338
Log debt	0.904	0.880	-0.093	0.876	0.028	0.940
Financially active	0.437	0.411	-0.589	0.479	-0.492	0.408
Age(years)	1.000	1.000	-0.001	0.954	-0.001	0.927
Female	1.380	0.621	0.237	0.683	0.110	0.770
Household size	1.139	0.557	0.104	0.597	0.066	0.613
Higher education	0.137	0.009	-1.570	0.017	-1.173	0.008
Higher income	0.409	0.198	-0.702	0.252	-0.605	0.143
Higher wealth	0.264	0.044	-1.064	0.069	-0.769	0.045
Constant	12.828	0.525	2.153	0.547	1.221	0.598
Number of observations	75		75		75	
Wald/LR chi2(12)	22.12		12.74		21.92	
Prob > chi2	0.0362		0.3882		0.0385	
Pseudo R2	0.223				0.221	
(Penalized) Log likelihood	-38.491		-23.082		-38.594	

This table contains coefficients and p-values of logistic (column 2 & 3), firthlogit (column 4 & 5) and probit (column 6 & 7) regressions. The dependent variable is NHG. NHG is a dummy variable that takes on the value one if the respondent has a mortgage insurance. As a measure for risk preference, risk averse is used. Data is obtained from the DNB Household Survey and this table contains mortgages originated within the period 2013 - 2020.

5.3 Additional robustness; variable regularization

To further evaluate robustness of results lasso logit is performed for both AMP and NHG. For an additional robustness check, lasso logit is performed as a form of variable regularization. This a method that selects and fits independent variables for a model to prevent over specification. In other words, selecting the variables that are relevant in predicting the outcome within the specific dataset (Tibshirani, 1996). In the case of AMP as dependent variable, lasso logit finds variables that are suited for predicting the chance of a respondent choosing for an AMP.

Lasso results in table 16 show that patience, financially active, age and higher education are relevant in describing whether a respondent has an AMP. Financially active and age being relevant is in line with results reported earlier. Higher education is in line with results for the time period 2013 – 2020. These results are in line with an absence of statistical evidence within this dataset for a correlation between present bias and the chance of respondents holding an AMP.

Table 16 Lasso logit with AMP as independent variable

Selected variable	Logistic lasso	Post logit
Patience	-0.065	-0.236
Financially active	0.471	0.855
Age (years)	0.056	0.074
Higher education	-0.277	-0.551
Constant	-2.864	-2.919

This table reports lasso logit results with AMP as independent variable.
Data is obtained from the DNB Household Survey and this table
contains mortgages originated within the period 2008 - 2020.

For the lasso with national mortgage guarantee as dependent variable we see in table 17 that only higher education seems to be relevant in predicting insurance within this dataset. This is in line with the absence of evidence for an association between present bias and insurance.

Table 17 Lasso logit with NHG as independent variable

Selected variable	Logistic Lasso	Post logit
Higher education	-0.242	-1.010
Constant	0.290	0.722

This table reports lasso logit results with NHG as independent variable.
Data is obtained from the DNB Household Survey and this table
contains mortgages originated within the period 2008 - 2020.

6. Conclusion

In this paper logistic, firthlogit and probit regressions are performed to evaluate the influence of present bias in mortgage markets in the Netherlands. Additionally, variable regularization is adapted to further evaluate robustness. Data is used from 2008 – 2020 and obtained from the DNB household survey. The first hypothesis;

There is a positive association between a respondent being present biased and the chance of them choosing for an AMP.

With the methodologies and data used in this paper there is no statistical evidence found to be able to reject the null hypothesis of there being no association between being present biased and the chance of a respondent choosing for an AMP.

The second hypothesis;

There is a negative association between respondents being present biased and the likelihood of them obtaining an insurance for their mortgage.

There is no statistical evidence to reject the null hypothesis of no association between present bias and mortgage insurance within this research method with the data used in this paper.

When revisiting the key research objective therefore;

How does present-bias influence Dutch household's choosing for an Alternative Mortgage Product (AMP) that (partly) defers amortization and their choice whether to insure this mortgage?

No statistical evidence can be found based on the methodology and data used in this paper to make a conclusion about any association between present bias and choice in mortgage type and insurance.

7. Discussion

7.1 Limitations

Due to the restriction that a mortgage must originate from the year the survey is filled out, the number of observations is low. Over the years 2008 – 2020 in the used sample, 189 mortgages have been taken out. This number of observations drops further in the analysis due to errors and respondents not properly or completely filling out the survey. Peng et al., (2002) recommend at least approximately 50-100 observations, with additional required observations depending on the number of parameters when using logistic regressions. The logistic regressions with AMP as dependent variable have 135 observations and those with NHG as dependent variable have 115. Issues with small datasets are that they are a lot less likely to reflect the population's true distribution and maximum likelihood estimation techniques used in logistic regressions are only unbiased when for big datasets. Therefore, the quality of the model's predictions with a small amount of observations drop. Furthermore, due to the low number of observations it is not feasible to include year fixed effects as some year dummies only contain a few observations. This is because in some years only a couple of respondents took out a mortgage. However, excluding year fixed effects in such a dynamic type of market, significantly reduces the robustness of results. The descriptive statistics show in 2008 – 2012 there are relatively more AMPs than SRMs, whereas in 2013 – 2020 this is the reversed. This indicates the importance of including year fixed effects. Additionally, results for the full sample with AMP as independent variable do slightly differ from those within the time period 2013 – 2020 where higher education is also correlated with a smaller chance in having an AMP.

Besides the restricted amount of observations, there are some survey biases. First of all, non-response bias: The respondents that fill out certain questions may differ from the respondents that do not fill out the same question. Another bias that may be present and is inherent to survey data, is response bias. Respondents may not truthfully answer questions for multiple reasons. Further, acquiescence bias occurs because of people's tendency to agree with and be positive about the question (Hurd, 1999). For example, applying acquiescence bias to the question asked to obtain the present bias variable; 'Do you find it difficult or easy to control your expenditures?' respondents could be more biased towards answering very easy as opposed to very difficult. Another bias that may tilt answers to the question above towards

very easy, is the social desirability bias. In any survey format respondents are more likely to answer in a way they believe will be approved of. Social desirability bias increases with personal and sensitive topics (Dodou, & de Winter, 2014). It can be argued that the behavioural and financial questions of the survey used in this paper could be viewed as personal and/or sensitive. Also note that habituation bias can be present. When different questions are worded in similar ways, respondents will answer these similarly. This is a biological response to save energy when answering the survey questions (Vaney et al., 2008).

It is important to note that although an extensive amount of control is implemented in the analysis, results may not be interpreted as causal. It is possible there are non-included factors influencing the choice between an AMP and SRM, which also correlate with variables of interest. The same goes for the choice whether or not to insure a mortgage. This survey data and the corresponding results are derived from Dutch households and the time period 2008 – 2020. Tax regulations, options and rules surrounding mortgages are different in each country and change over time. Thus, generalizing results from this paper to other countries and in different time frames is not possible. Adding to this, conditions, prices and risks impacting mortgage and real estate markets are dynamic and interrelated with many economic and psychological factors. Additionally, self-assessments of behavioural responses may reflect other psychological factors. Even for Dutch households it is therefore not possible to make any recommendations based on this paper.

Comparing this paper to prior research, Cox & Zwinkels, (2016) find that overall, less eligible households choose to insure their mortgage. In their paper, using data prior to 2010, only 30% of eligible households are insured. This paper finds that 55% of households have an insurance for their mortgage. Additionally, Cox & Zwinkels, (2016) find that younger and wealthier households are more likely to insure. Cox et al., (2015) find that households that are more financially literate have an increased chance of having an AMP. This paper also finds one of Cox et al., (2015) measures of financial literacy, namely financially active to be correlated with an increased chance of having an AMP. Cox et al., (2015) also find less risk averse respondents more often have an AMP, which this paper finds no evidence for. Both this paper and Cox et al., (2015) find that age is positively associated with the chance of purchasing an AMP.

In this sample there seems to be no evidence for a problem with control issues and households choosing for AMPs. However, a larger sample is needed to make more accurate conclusions. In the descriptive statistics it can be seen between 2008 – 2012 there are relatively more AMPs than SRMs, whereas in 2013 – 2020 this is reversed. As of 2013, interest is no longer tax deductible for AMPs. The tax advantage for SRM varies with the interest rate, therefore further research could evaluate the association between interest rate overtime and the choice between AMPs and SRMs. Additionally, before 2013 with a higher tax advantage for AMPs, it could be the more financially literate and educated households would choose an AMP (Cox et al, 2015). Whereas, after 2013 it this choice may be driven by other factors which remain an open question. In this sample within the time period 2013 – 2020 higher education is correlated with a smaller chance in having an AMP.

Further research could also focus on a broader point of household finance that considers the total household portfolio in combination with behavioural features. It also remains a question as to how different behavioural characteristics lead to certain choices surrounding household finance and whether these lead to financial struggles. If so, markets where households need to make important and impactful decisions like mortgage, pension and insurance markets may benefit from government intervention and/or altered default options.

8. Appendix

Present bias

Question: Do you find it easy or difficult to control your expenditures?

Answer scale:

1   2   3   4   5   6   7

Answer scale ranging from "Very easy (1)" to "Very difficult" (7).

Patience

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

Answer scale ranging from "I want to save as much as possible (7)" to "I want to spend all my money immediately" (1).

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

Answer scale rages from totally disagree (1) to totally agree (7). Answers to 1 and 4 are recorded creating a variable that ranges from very risk tolerant (2) to very risk averse (14).

Self-reported financial literacy

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

9. References

Ai, J., Zhao, L., & Zhu, W. (2016). Contracting With Present-Biased Consumers in Insurance Markets. *The Geneva Risk and Insurance Review,* 41: 107 – 148.

AFM Autoriteit financiële markten.

Badarinza, C., Campbell, J., & Ramadorai, T. (2016). What Calls to ARMs? International Evidence on Interest Rates and the Choice of Adjustable-Rate Mortgages. *Management Science*, (forthcoming).

Bernanke, B. (2010). Monetary policy and the housing bubble: Speech at the Annual Meeting of the American Economic Association. *Speech from Board of Governors of the Federal Reserve System*, 499.

Brown, J. R., & Previtero, A. (2014). Procrastination, present-biased preferences, and financial behaviours. *Landscape Research Japan Online*, 65, 543–546.

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

Campbell, J. (2006). Household Finance. *Journal of Finance* 61: 1553–1604.

Clarke, D. (2011). A Theory of Rational Demand for Index Insurance, *Department of Economics Discussion Paper* Series 572. University of Oxford.

Cocco, J.F. (2013). Evidence on the benefits of alternative mortgage products. *Journal of Finance*, 68(4), 1663–1690.

Cole, S., X. Gine, J. Tobacman, R. Townsend, P. Topalova & J. Vickery. (2013). ´Barriers to Household Risk Management: Evidence from India. *American Economic Journal: Applied Economics* 5: 104–135.

Cox, R., Brounen, D., & Neuteboom, P. (2015). Financial Literacy, Risk Aversion and Choice of Mortgage Type by Households. *The Journal of Real Estate Finance and Economics*, 50(1), 74–112.

Cox, R., & Zwinkels, R. (2016). Mortgage Insurance Adoption in the Netherlands. *Real Estate Economics.* 47(4): 977-1012.

Currie, J., & Tekin, E., (2015). "Is There a Link between Foreclosure and Health?" *American Economic Journal: Economic Policy*, 7 (1): 63-94.

Dohmen, T., Falk, A., Huffman, D., & Sunde, U. (2010). Are risk aversion and impatience related to cognitive ability? *The American Economic Review.* 100(3): 1238-1260.

Dodou, D., & de Winter, J. C. F. (2014). Social desirability is the same in offline, online and paper surveys: A meta-analysis. *Computers in Human Behaviour, 36: 487–495.*

Einav, L., Jenkins, M., & Levin, J. (2012). Contract Pricing in Consumer Credit Markets. *Econometrica*, 80(4), 1387–1432.

Feng, X., Lu, B., Song, X., & Ma, S. (2019). Financial literacy and household finances: A Bayesian two-part latent variable modelling approach. *Journal of empirical finance.* 51: 119-137.

Firth, D. (1993). Bias Reduction of Maximum Likelihood Estimates. *Biometrika*, 80(1): 27-38.

Gathergood, J. (2012). Self-control, financial literacy and consumer over indebtedness. *Journal Economic Psychology*, 33(3), 590–602.

Gathergood, J., & Weber, J. (2017). Financial literacy, present bias and alternative mortgage products. *Journal of Banking and Finance.* 78: 58-83.

Gathergood, J., & Weber, J. (2017). Financial literacy: A barrier to home ownership for the young? *Journal of Urban Economics.* 99: 62-72.

Gerardi, K., Goette, L., & Meier, S. (2013). Numerical ability predicts mortgage default. *Proceedings of the National Academy of Sciences of the United States of America*, 110(28), 11267–71.

Ghent, A. (2015). Home Ownership, Household Leverage and Hyperbolic Discounting. *Real Estate Economics*, 43(3), 750–781.

Guiso, L., Pozzi, A., Tsoy, A., Gambacorta, L., & Mistrulli, P. E. (2021). The cost of steering in financial markets: Evidence from the mortgage market. *Journal of Financial Economics*. (202105).

Hypotheken datanetwerk.

Hurd, M. (1999). Anchoring and Acquiescence Bias in Measuring Assets in Household Surveys. *Journal of Risk and Uncertainty,* 19(1-3): 111-136.

Labison, D., (1997). Golden eggs and hyperbolic discounting. *Quantitative journal of economics.* 112(2): 443 – 478.

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

National Mortgage Guarantee. 2013. Voorlopige NHG–jaarcijfers 2012 [provisional NHG–year figures 2012], online available from www.nhg.nl [in Dutch] (accessed on 20 February 2015).

Nguyen, Q. (2016). Linking loss aversion and present bias with overspending behaviour of tourists: Insights from a lab-in-the-field experiment. *Tourism Management*, 54(36), 152–159.

Nelleke Trappenburg, Financieel dag blad, 16 april 2021.

Peng, C.J., Lee, k. & Ingersoll, M. (2002). An Introduction to Logistic Regression Analysis and Reporting, *The Journal of Educational Research*, 96(1): 3-14.

Thaler, R. H., & Shefrin, H. M. (1981). An economic theory of self-control. *Journal of Political Economy*, 89(2), 392–406.

Thaler, R. H., & Sunstein, C. R. (2009). Nudge: Improving decisions about health, wealth, and happiness. New York, NY: Penguin.

Tibshirani, R. J. 1996. Regression shrinkage and selection via the lasso. Journal of the Royal Statistical Society 58: 267–288.

van Ooijen, R. & van Rooij, M.C.J. (2016). Mortgage risks, debt literacy and financial advice. *Journal of Banking & Finance*, 72(449), 201–217.

van Rooij, M., Lusardi, A., & Alessie, R.J.M. (2011a). Financial literacy and retirement planning in the Netherlands. *Journal of Economic Psychology*, 32(4), 593–608.

van Rooij, M., Lusardi, A., & Alessie, R.J.M. (2011b). Financial literacy and stock market participation. *Journal of Financial Economics*, 101(2), 449–472.

Vaney, N., Dixit, A., Gosh. T., & Gupta. R. (2008). Habituation of event related potentials: a tool for assessment of cognition in headache patients. *University College of Medical Sciences.*

Xiao, J. J., & Porto, N. (2019). Present bias and financial behaviour. *Financial Planning Review.* 2:2