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Mortgage Blind Spot: Rent as the Reference Point for Mortgage Monthly Payments^{*}

Nelson Camanho, Daniel Fernandes and Dan Ariely[‡]

Abstract: This paper explores how the decision to purchase a house is influenced by rental benchmarks. In particular, do prospective house buyers compare the monthly rental payment and the monthly mortgage installment? First, we find that homebuyers covered in the Panel of Study of Income Dynamics (PSID) are likely to pay for mortgage about the same per month as their rental payment just before the home purchase. We then test this pattern in seven experiments and find discontinuities consistent with reference-dependent utility functions representing the preference to buy a house as a function of the monthly mortgage. The likelihood of buying a house is more strongly reduced when the mortgage monthly installment becomes slightly higher than the offered monthly rental payment for the same house. Our results are consistent with the monthly rent acting as a reference point for the monthly mortgage and are not fully explained by budget constraints. While more present-biased individuals use more the rent as reference point for the mortgage, financial literacy and numeracy do not influence this pattern.

Keywords: mortgages, household decisions, experiment, behavioral economics.

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Introduction

Buying a house is perhaps the most important financial decision that households face. For most American homeowners, real estate is the most valuable asset in their balance sheet. Many factors influence the housing decision, making it a complex and difficult task to many potential homebuyers. In addition, there are limited opportunities to learn from taking a mortgage. As a result, consumers are often uncertain about their housing decisions. When people are uncertain about a choice, they draw upon cues to help them arrive at a decision (Slovic 1995; Payne et al. 1999). These cues are sometimes difficult to justify normatively. Previous research has shown that indeed housing decisions might be based in market inefficiencies (Brunnermeier and Julliard 2008; Case and Shiller 1988; Genesove and Mayer 2001; Simonsohn and Loewenstein 2006).

We propose and test a heuristic, that we call *the mortgage blind spot*, potentially used by households when deciding to buy a house, in which potential homebuyers use the monthly rental payment as a reference point for the monthly installment of a mortgage when deciding to buy a house. Homebuyers are more likely to enter mortgage contracts if the monthly rental payment they used to pay is slightly lower than the monthly mortgage installment. They use the rental payment as a reference point to the mortgage even though the monthly rental payment and the monthly mortgage installment are not directly comparable.

We use a large panel data and experiments to test and confirm our hypothesis that the monthly rental payment acts as a reference point for the monthly mortgage installment. First, we examine the Panel Study of Income Dynamics (PSID) and find that the most likely outcome for the first monthly installment of the mortgage is the last rental monthly payment before the house is purchased. We then conduct seven experiments that provide causal evidence of reference dependence in housing purchase. Our results are consistent with homebuyers' preferences associated to two types of reference dependence, either a discontinuity on the utility function at: (i) its level (i.e., a stronger willingness to buy a house

when the monthly mortgage is slightly lower than their last monthly rent), or at (ii) its first derivative (i.e., a stronger sensitivity to monthly mortgage increase when the monthly mortgage is higher than the rent).

Paying a similar amount for mortgage as one pays for rent is a budgeting heuristic that allows home buyers to keep their expenses on track. However, by following the mortgage blind spot effect, some investors might be unaware they are entering into contracts that are expensive. For example, suppose an individual pays \$2,000 each month for rent and is willing to buy a house worth \$300,000. If this person thinks it is a good deal to buy a mortgage in which the monthly installment is similar to the monthly rent, this person may be as likely to enter into a 4.7% fixed rate 40-year mortgage leading to monthly payments of \$2,000 as to enter into a 3.2% fixed rate 30-year mortgage leading to monthly payments of also \$2,000. A down payment can also drive down the monthly installments of like-for-like mortgages. In the example above, consumers may also be as likely to enter into a 4.7% fixed rate 30-year mortgage that requires \$40,000 of down payment, leading to monthly payments of \$2,000 as well. The direct comparison of rent and mortgage installment may drive homebuyers to enter into expensive mortgages with high interest rates. If homebuyers think they are making a good deal to pay for mortgage the same as their previous rent, they may leave money on the table by paying a larger down payment or entering into a longer mortgage contract, instead of negotiating a lower interest rate, in order to pay for mortgage around the same they pay for rent.

In our experiments, we examine the choices to buy a house. We vary one of the following four variables: the mortgage maturity, the mortgage interest rate, the down payment, the monthly rental payment, or the price of the house. Our main finding is a discontinuity effect in the likelihood to buy a house when the monthly mortgage becomes higher than the rent. This discontinuity is manifested in all our eight studies. Our results highlight the reference-dependence preferences of homebuyers: they show a kink for mortgage values slightly higher than rental values, consistent with potential homebuyers more likely to switch from buying to renting if the monthly mortgage installment is slightly higher than the monthly rental payment. This result persists even after we control for budget constraints. Our overall set of results cannot simply be explained by a downward sloping demand curve. We also find that individual

differences in financial literacy cannot explain the mortgage blind spot and that financial education can only partially reduce the mortgage blind spot effect.

The mortgage blind spot is a cognitive bias that causes potential home buyers to deviate from economically rational choices. Those who incur it might enter into bad mortgage contracts. By narrowly focusing on the comparison between the monthly rental payment and the monthly mortgage installment, homebuyers downplay important terms of a mortgage contract such as the interest rate, the down payment, and the maturity. They take out mortgage contracts in part because the monthly mortgage installment is about the same as the monthly rental payment. The rational benchmark for a mortgage choice for a given set of individual preferences involves the minimization of the present value of the outstanding mortgage loan to repay, which is increasing with the mortgage interest rate agreed with the mortgage lender. Homebuyers may deviate from the optimal choice by considering mostly the difference between the monthly instalment of the mortgage and the rental payment. However, the monthly installment of the mortgage is not only driven by the interest rate, but also by the down payment and the maturity of the mortgage contract. The excessive focus on the monthly rent vs mortgage comparison may drive homebuyers to enter into mortgage contracts that are long enough or that require a large down payment for the monthly rent to be about the same as the monthly mortgage despite a higher interest rate.

In the next section, we review the relevant literature and derive the central mortgage blind spot prediction that individuals use the monthly rental payment as a reference point when deciding to buy or rent a house. Next, we examine the Panel Study of Income Dynamics (PSID) to compare the monthly amounts home buyers pay for mortgage and for rent just before buying. We then present the findings of experimental studies that establish the mortgage blind spot and the rental reference-dependence, test the underlying process, rule out alternative explanations, and examine its generalizability across a range of situations, contract terms, and choice formats. We conclude by suggesting managerially relevant and implementable corrective techniques.

Literature Review

Narrow framing and loss aversion are important features of how people evaluate financial prospects (Kahneman and Tversky 1979). According to prospect theory, decisions depend on a comparison of potential outcomes with a reference point, which is constructed narrowly. People do not like to obtain outcomes below a reference point about twice as much as they like to obtain outcomes above the reference point by the same absolute amount (Kahneman and Tversky 1979). Reference points can be based on past outcomes or some aspiration level. For instance, people betting on horse races make bigger bets at the end of the day to recover losses incurred earlier in the day (McGlothlin 1956). Investors prefer to sell winners rather than losers (the disposition effect; Barberis and Xiong 2009). Cab drivers are highly motivated to achieve a targeted daily income and end up going home too early in a particularly profitable day (Camerer, Babcock, Loewenstein, and Thaler 1997). Consumers pay more attention to proportional and not absolute discount (Thaler 1985).

These biases arise because of cognitive limitations. Even though people know that gains and losses in total wealth are more relevant, they focus too much on gains and losses in one part of their wealth simply because information about those gains and losses is more readily available (Rabin and Thaler 2001). Kahneman and Frederick (2002) propose that people engage in attribute substitution, when individuals struggle to find an answer to a decision problem and substitute the solution to a related simple problem. People find adequate, though often imperfect, answers to difficult questions if they are highly accessible.

This is evidenced in anchoring, i.e., the fact that people's estimates can be affected by a highly accessible number. For instance, when uncertain about the price of a product, people anchor to a certain reference number and adjust very little from that initial number. The adjustment is often insufficient because people stop when they are no longer certain that they should adjust further. The adjustment is a deliberate attempt to find reasons to distance from the anchor (Simmons, LeBoeuf, and Nelson 2010).

Migrants arriving from more expensive cities end up renting pricier apartments even though the prices in the previous city are not relevant anymore (Simonsohn and Loewenstein 2006).

Because of how narrowly people evaluate choices, we expect that consumers will anchor on their previous monthly rent for the monthly installment of a mortgage when deciding to buy a house. Therefore, potential home buyers will prefer to pay per month for a mortgage about the same as what they pay per month for rent. Consumers might focus on the monthly expenses of renting vs. buying – the mortgage blind spot effect – and fail to consider that these expenses are part of a longer stream of payments. Rather than employing a discounted cash flow analysis, home buyers might be resorting to the simpler mortgage blind spot heuristic when deciding to buy a house. This may cause home buyers to overlook important features of mortgages such as the interest rate.

Our paper contributes to the literature on mortgage choice. Amromin et al (2018) show that in 2005, 30% of all U.S. mortgage originations were complex mortgages, featuring interest-only and negative-amortization mechanisms. Complex mortgage borrowers were more likely to become delinquent and, surprisingly, were used mostly by high income households. Gurun, Matvos and Seru (2016) provide evidence on the persuasion view of how lenders advertise mortgages. In it, subprime lenders deceptively advertise more initial rates while omitting reset rates, in particular for less sophisticated borrowers. Keys, Pope and Pope (2016) show that 20% of unconstrained households leave money on the table by not refinancing their mortgages when interest rates decline. In a related work, Johnson, Meier and Toubia (2019) explore the Home Affordable Refinance Program and show that 51% of borrowers did not take advantage of mortgage refinancing opportunities that would otherwise have saved them money. They run a survey and associate, among other factors, the incentive to not refinance to the suspicion of the motives of financial institutions to offer refinancing. Bailey, Davila, Kuchler and Stroebel (2019) show that pessimistic homebuyers who think house prices are going to fall pay smaller down payments despite larger interest rates as if their mortgage is not their own money. Research is needed to improve mortgage decisions of homebuyers. Our paper suggests that they deviate from rational expectations because of anchoring on the rent amount.

In the next section, we develop a rational benchmark for how households should decide about whether to take a mortgage. We also derive our predictions about how households actually decide about whether to take a mortgage.

Rational Benchmark

In order to examine the financial attractiveness of a mortgage one has to consider all the variables that determine the net present value of the outstanding loan of the contract: the interest rate, the term and the down payment, all of which have a direct effect on the monthly payment, rendering it less salient the direct comparison of the mortgage with the rental payment. A discounted cash flow analysis of the renting and buying alternatives would therefore elicit the best financial housing decision.

Consider a house selling with the following mortgage conditions: down payment, length term, and interest rate. When combined, these conditions are associated to a monthly mortgage installment. Now, suppose the same house is renting for a monthly rental payment. In order to compare the rent with the mortgage, one may consider the rent as being analogous to an interest-only mortgage with zero down payment.

Put it differently, the typical mortgage contract (with principal and interest repayment) is nothing more than a bank loan that allows homebuyers to pay for the house seller. This loan has two components: (i) principal and (ii) interest. For a fixed rate mortgage, the monthly installment is determined by the down payment, the interest rate and the length of the mortgage contract. By the same token, many fixed rate mortgages with the same monthly payment have different outstanding loan present values. Therefore, it is not possible to directly compare the monthly rent to the monthly mortgage installment. However, one may consider the interest-only mortgages with zero down payment as a rational benchmark. If the rent is higher than the equivalent interest-only mortgage payment, one should buy the house. If the rent is lower than the interest-only mortgage payment, one should rent it instead. We formalize below this rationale

with a standard user cost model widely used in the literature (Hendershott and Slemrod, 1983; Poterba, 1984; Glaeser et al., 2013).

Consider R as the annual rental payment and P as the house price. In equilibrium, the utility of renting should be equal to the utility of owning a house, taking into account all preferences and decisions taken when deciding whether to buy or rent a house, such as tax deductions, discount rate, probability of moving, property taxes, maintenance and insurance and all variables related to the pricing of rent and mortgage, such as the down payment, the mortgage rate and the growth rate of both rent and house prices. This boils down to the following equilibrium equation:

$$\frac{R}{P} = \theta\rho + (1 - \theta)(1 - \phi)r + \tau - g + g((1 - \theta)(1 - \delta)) \frac{\rho - (1 - \phi)r}{\rho + \delta}$$

θ : down payment fraction

ρ : discount rate

$(1 - \phi)r$: after-tax shield mortgage rate

τ : property taxes, maintenance, insurance (as fraction of P)

g : growth rate of R and τ

δ : mobility rate

Assume $\rho = (1 - \phi)r$:

$$\frac{R}{P} = (1 - \phi)r + \tau - g$$

In a discounted cash flow analysis, one should compare the monthly rental payment with a zero down payment interest-only NPV equivalent mortgage whose interest is Y :

$$Y = P((1 - \phi)r + \tau - g)$$

$$M = P(1 - \theta)r \left(1 - \frac{1}{(1 + r)^T} \right) - PVT_S + P\tau$$

For example, consider the following mortgage contract: there is a 20% down payment requirement, interest rate is 4% per year (or 0.33% per month), the house is selling at \$200,000. It can be

rented for \$1,400 a month or can be purchased through a 15.6 years mortgage with monthly payments. The marginal tax rate is 25%, property taxes, maintenance, insurance represent each year 3.35% of the house price and the rent growth rate is 1% per year. What would the rational discounted cash flow analysis recommend? And what decision a household under the mortgage blind spot effect would take?

$$Y = P((1 - \phi)r + \tau - g)$$

$$Y = \$200,000 * ((1 - 25\%) * 0.33\% + 0.28\% - 0.08\%) = \$892$$

$$M = P(1 - \theta)r \left(1 - \frac{1}{(1 + r)^T} \right) - PVTs + P\tau$$

$$M = \$200,000 * (1 - 20\%) * 0.33\% * \left(1 - \left(\frac{1}{1.0033^{188}} \right) \right) - \$81 + \$200,000 * 0.28\% = \$1,625$$

The return on investment worth the price of the house is \$892. The monthly mortgage is \$1,625. As previously mentioned, the rent is \$1,400. The interest rate of the mortgage leads to returns (\$892) that are lower than the rent (\$1,400). Therefore, the rational decision is to buy the house. However, the monthly mortgage installment leads to monthly payments (\$1,625), that are higher than the rent (\$1,400). Therefore, the mortgage blind spot decision is to rent the house. As a result, in this example, if home buyers follow the rational choice, they would buy, but if they follow the mortgage blind spot, they would rent.

In sum, one can compare the rent to the mortgage given a certain interest rate by considering the return on capital worth the price of the house with the same interest rate. This is analogous to considering the monthly amount of an interest-only mortgage with zero down payment worth the total price of the house. For example, consider one who pays for rent \$1,100 for an apartment worth \$300,000 and is offered to buy the apartment with a mortgage of 2%. The zero down payment interest-only mortgage of 2% worth the total price of the apartment is \$500. Therefore, the rent is expensive, and one should buy a house given this rental price and interest rate of a mortgage. However, if the interest rate of the mortgage was 6%, leading to monthly payments of \$1,500 for a zero down payment interest-only mortgage, the rent

would be cheap and one should rent instead. Home buyers should therefore consider the return on capital of the house price. This allows them to compare the rent to the monthly mortgage independent of the length of the mortgage and the down payment. If the rent is higher than that amount, one should buy. If it is lower, one should rent. However, instead of performing such financial analysis, we argue that many households resort to a simpler yet potentially deceiving analysis by directly comparing the rent to the mortgage installment.

Empirical Plan and Contribution

Our studies test the effect of the difference between the monthly installment of a mortgage and the monthly rental payment on the decision to buy a property. Households are more likely to buy a property when the monthly mortgage is around the same as the monthly rent.

Study 1 extracts the monthly dollar amount that Panel Study of Income Dynamics (PSID) panelists pay for mortgage in the first year of buying a house and for rent the year before buying. We find that the difference between panelists' last monthly rent and first monthly mortgage concentrates around zero. This suggests that home buyers use a threshold for the monthly mortgage installment that is around the monthly rent they used to pay. In addition, the correspondence between monthly mortgage and rent is not influenced by income or income increase. Web appendix A replicates these results in the German Socio-Economic Panel Study. We then conduct a series of experiments to test the causality of the difference between monthly rent and mortgage on the decision to buy a house. Study 2 examines the mortgage blind spot effect in contexts that vary the interest rate. We find that the likelihood of buying a house increases when the monthly mortgage is lower than the rent even when renting is the optimal choice. Study 3 tests the effect of increasing the monthly mortgage in small amounts of \$50 by lengthening the maturity of the mortgage contract in short durations while keeping everything else constant. Instead of a linear decay, we find a discontinuity at a value for which the monthly mortgage is around the monthly rental payment. Participants become less likely to buy a house when the monthly

mortgage becomes lower than the rent. Study 4 examines individual differences that may correlate with the mortgage blind spot effect. More present biased individuals prefer mortgages in which the monthly instalment is lower than the rent. Study 5 examines the choice of mortgages and finds that participants prefer mortgages whose monthly payments are closer to the rent's. Study 6 examines the changes in the likelihood of buying as a function of changes in the rent. Study 7 shows that financial education does not reduce this bias. Study 8 uses a realistic home sale advertising design to elicit the preferences of individuals.

The contribution of this paper is to document a new heuristic of home purchasing. Our findings indicate that households might use a simplistic rule that causes them to deviate from economically rational expectations. Home buyers use their monthly rental payment as a reference point to the prospective monthly mortgage. They narrowly focus on monthly payments and try to equalize them. This leads investors to take decisions that are inconsistent with rational discounted cash flow valuations.

Study 1: Field Evidence from the Panel Study of Income Dynamics (PSID)

We extract individual yearly level data from PSID between 1993 and 2013 on the dollar amount panelists pay per month for rent or for mortgage. We identified 2,754 panelists that bought a house in the period of the panel and used to pay rent before the house purchase. We obtain the monthly installment of the mortgage in the year of purchase of the house, the monthly rental payment in the year before, and income in both years.

We observe the following: i) the mode of the distribution of the difference between the first monthly mortgage and the last monthly rental payment is zero, and deviates from the normal distribution ($kurtosis > 0$), suggesting a concentration of households when the monthly mortgage is the same as the rent; ii) the derivative of the distribution is steeper to the left of the mode, implying that homebuyers are willing to pay for mortgage around the same as for rent; iii) the monthly rent is a significant predictor of the monthly mortgage, even when controlling for the monthly income at the time of purchase and of

renting; iv) the concentration of monthly mortgages around the same as the monthly rent remains significant even when financial constraints are not binding.

Figure 1 presents the histogram of the difference between the monthly mortgage installment and the monthly rent in bins of 25 dollars. The distribution is concentrated around zero (Mode = 0, Kolmogorov-Smirnov test statistic = .10, $p < .01$) and deviates from the normal distribution (Kurtosis = 1.53, 95%CI = 1.35 to 1.72; Kurtosis of the normal curve = 0).

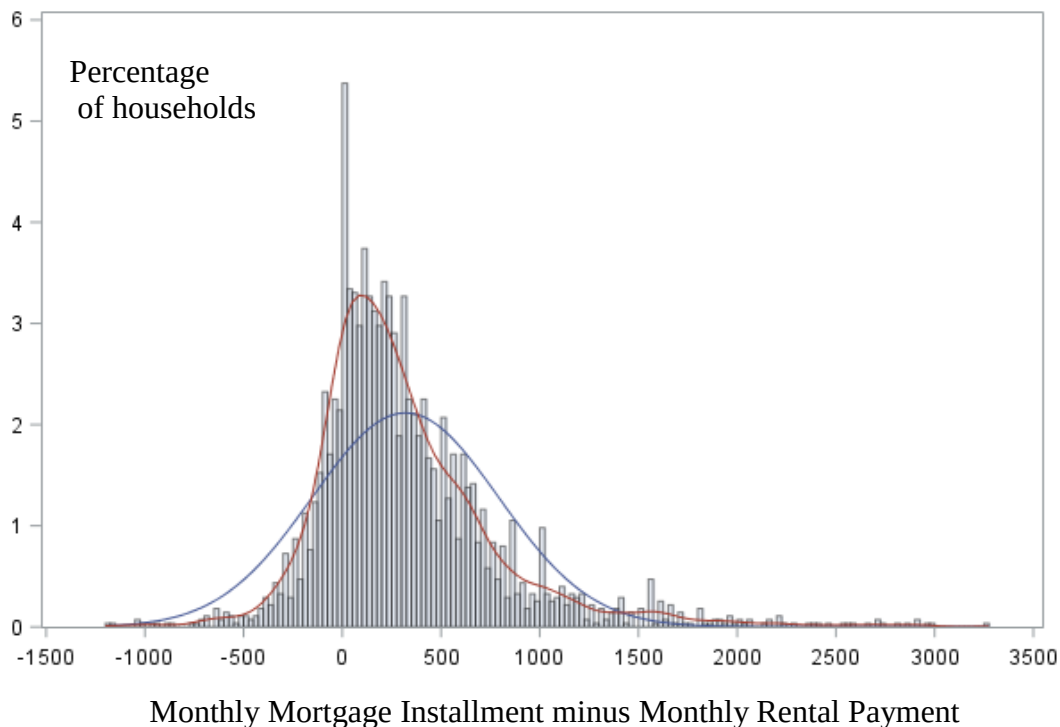


Figure 1: Histogram of the difference between the monthly mortgage installment and the monthly rental payment in bins of 25 dollars

The figure shows the percentage of home buyers as a function of the difference between the first monthly mortgage installment and the last monthly rental payment in bins of \$25 dollars. $N = 2,754$. The red curve is the Kernel density and the blue curve is the normal distribution.

The concentration of the distribution indicates bunching when the monthly mortgage installment is around the same value as the monthly rental payment. On average, respondents pay per month 319.42 dollars more for their first mortgage ($M = 931.30$, $SD = 598.49$) than what they used to pay per month for their last rent ($M = 611.88$, $SD = 345.91$; $t = 35.57$, $p < .01$). But there are more home buyers who pay for mortgage 0 to 25 dollars more than their previous rent, the highest bin (5.37% of households), compared

to 100 to 125 more than their previous rent, the second highest bin (3.74% of households; $\chi^2 = 8.09$, $p < .01$). The supplemental online appendix B presents alternative representations of the distribution in bins of 1 dollar and of the percentage difference between the monthly mortgage installment and the monthly rental payment.

Peak concentration of households when the monthly mortgage installment is the same as the monthly rental payment is bordered by an ascending curve to the left and a descending curve to the right. We estimate an exponential function ($y = ae^{bt}$) of those curves such that y is the percentage of households, t is the difference between the monthly mortgage installment and the monthly rental payment (in number of bins) within ± 3 SDs from the mean, and a and b are constants as in Rubin and Wenzel (1996). The exponential estimate of the ascending curve ($B = .21$, $p < .01$) is higher in absolute terms than the exponential estimate of the descending curve ($B = -.057$, $p < .01$; 95%CI = 0.12 to 0.20). These results suggest that homebuyers are unwilling to pay much more for mortgage per month than they pay for rent, and therefore we observe a steeper curve in the distribution of the percentage of homebuyers when rental payments are lower than monthly mortgages than when they are higher.

We then examine whether the association between the monthly rent and the monthly mortgage was confounded with income at the time of renting and at the time of purchase. There is a strong correlation between the monthly rental payment and the monthly mortgage installment ($r = .62$, $p < .01$). By social science conventions, $r \leq .10$ is a small effect-size; $.10 < r < .40$ is medium; and $r \geq .40$ is large. We regress the monthly mortgage installment on the monthly rental payment ($B = 1.07$, $t = 41.21$, $p < .01$). Note that the coefficient is very close to 1. A dollar increase in rent produces almost the same increase in monthly mortgage. We then control for the effect of income at the time of the house purchase and at the time of renting. Panelists earn more income in the year of the house purchase ($M = 67,279.88$, $SD = 57,242.13$) than when they used to pay rent ($M = 54,265.04$, $SD = 45,990.03$; $t = 16.52$, $p < .01$). We find an effect of income in the year of purchase ($B = .003$, $t = 13.49$, $p < .0001$), of income in the year of paying rent ($B = .0007$, $t = 2.59$, $p < .01$), and of the monthly rental payment ($B = .77$, $t = 26.23$, $p < .01$).

.0001). The monthly rental payment before the house purchase predicts the monthly mortgage controlling for income in the year of house purchase and in the year of rental payment.

Finally, we examine whether the concentration of respondents who pay for monthly mortgage a similar amount as the monthly rent differs as a function of financial constraints. We find that 24.95% of respondents pay for mortgage between US\$ 100 more and US\$ 100 less than the rent. We then divide the sample in quartiles of percentage income increase from the year of renting to the year of buying (1st quartile: those who earned less than 6% less in the year of purchase relative to the year of renting; 2nd quartile: between 6% less and 17% more; 3rd quartile: between 17% more and 58% more; 4th quartile: more than 58% more in the year of purchase relative to the year of renting). Finally, we examine whether the percentage of homebuyers who pay for mortgage between US\$ 100 more and US\$ 100 less than the rent differs across the quartiles of income increase. The percentage of home buyers is higher in the first quartile relative to the second (33% vs 25%; $\chi^2 = 11.69$, $p < .01$). However, there is no significant difference between the second and the third quartiles (25% vs 23%; $\chi^2 = 1.19$, $p = .28$), and only a marginally significant difference between the third and the fourth quartiles (23% vs 19%; $\chi^2 = 2.79$, $p = .09$). The concentration of households paying for monthly mortgage around the same amount as the monthly rent is indeed higher for households that are more financially constrained (among those in the first quartile who had a reduction of 6% or less in the year of purchase). However, it remains similar, around 25%, in the groups in which financial constraints are not binding.

Discussion

The distribution of the difference between the monthly mortgage installment and the monthly rental payment is concentrated around zero, where the monthly mortgage installment is around the same value as the monthly rental payment. The distribution rises quickly around zero. The derivative of the distribution is steeper (in absolute terms) to the left of the mode. This suggests that households prefer to pay each month for a mortgage a similar amount as they used to pay each month for their rent. In addition, the effect of the monthly rent (before house purchase) on the monthly mortgage (after the house

purchase) is strong and significant even after controlling for income before and after purchase. The concentration of home buyers when the monthly payment for the rent is the same as the mortgage installment holds even when financial constraints are not binding. Furthermore, these results are not specific to the PSID analysis. We replicate the test and find similar results using the German Socio-Economic Panel Study (web appendix B).

Study 2: Mortgage Blind Spot vs. Rational Benchmark

Study 2 tests the effect of the mortgage blind spot effect and the results of the discounted cash flow analysis on the decision to buy or rent a house. Our goal is to show that beyond the discounted cash flow analysis, home buyers follow the rent vs mortgage heuristic when deciding whether they should buy or rent. Hence, participants face a housing decision that is affected by these two factors: (i) whether rent is higher or lower than the monthly mortgage and (ii) whether rent is higher or lower than the no down payment interest only mortgage. By combining these two factors, participants will answer whether to buy or rent a house in any of the four scenarios.

Method

Four hundred and eighty-three Mturk workers took part in the experiment. We discard 37 participants who failed the attention check. We have a final sample of 446 Mturk workers (55% females, Mage = 36.3 years, SD = 12.8 years). Each participant answered four choices. Each choice represents one out of four scenarios and has as possible answers “buy” or “rent”. The four scenarios are the combination of the two potential outcomes of the mortgage blind spot heuristic (whether the rent is higher or lower than the monthly mortgage) and the discounted cash flow analysis (whether the rent is higher or lower than the return on capital worth the house price). The order in which participants answer the choices is according to the Balanced Latin Square methodology.

In each question, participants are told they rent a house they live in for R dollars each month. The house value is US\$ 270,000. They are offered the option to buy it with a mortgage contract with the following characteristics: down payment D dollars; annual interest rate i (%); the monthly mortgage installment M dollars; mortgage length contract in years T. They are also told that they have the alternative to invest the D dollars they own and earn the same rate of annual interest rate i (%). Table 1 describes all the parameters in each of the four scenarios. Across the four scenarios, the monthly rental payment R and the down payment D are constant. The monthly mortgage installment M, the mortgage length contract T and the annual interest rate i vary in a way that home buyers are faced with the four potential outcomes of the mortgage blind spot heuristic and the discounted cash flow analysis. If the return on capital worth the house price Y is higher (lower) than the monthly rent R, the rational decision based on the discounted cash flow analysis is to rent (buy). If the monthly mortgage M is higher (lower) than the monthly rent R, the biased decision based on the mortgage blind spot is to rent (buy).

Scenario	MBS Prediction	DCF Prediction	R	M	i (%)	Down payment	House Price	T	Y
A	BUY	BUY	1,150	889	4.0	20%	270,000	40	883
B	RENT	BUY	1,150	1,295	4.0	20%	270,000	20	883
C	BUY	RENT	1,150	1,089	5.5	20%	270,000	40	1,207
D	RENT	RENT	1,150	1,462	5.5	20%	270,000	20	1,207

Table 1: Parameters of the scenarios in Study 2

DCF Prediction is the outcome of the discounted cash flow analysis, which depends on R and Y. Y is the monthly amount yield of the NPV-equivalent interest-only mortgage. R is the monthly rental payment in dollars. If Y is higher (lower) than R, the rational decision of the discounted cash flow analysis is to rent (buy). MBS Prediction is the outcome predicted by the Mortgage blind spot heuristic, which depends on R and M. M is the monthly mortgage installment in dollars. If R is higher (lower) than M, the biased decision of the mortgage blind spot heuristic is to buy (rent). i is the annual interest rate charged on the mortgage. Down payment is the initial mortgage payment in percentage of the full house price. House price is the price at which the house is selling in dollars. T is the mortgage length term in years.

Results

We find that the mortgage blind spot heuristic influences home buyers when deciding whether to buy or rent a house: home buyers become more inclined to buy a house if the monthly mortgage installment M is lower than the monthly rental payment R (Wald $\chi^2 = 79.65$, $p < .001$). Home buyers are

also influenced by the discounted cash flow analysis effect: they become more likely to buy the house if the monthly yield Y off capital worth the house value is lower than the monthly rental payment R (Wald $\chi^2 = 146.41, p < .001$). The two effects can be assessed in figure 2. The mortgage blind spot is consistent with the fact that participants are more likely to buy in scenarios A and C (in which the monthly mortgage is lower than the rent) relative to B and D (in which the monthly mortgage is higher than the rent). The conditional average of buyers for the four scenarios are as follows: (A) 85%; (B) 72%; (C) 71%; (D) 48%.

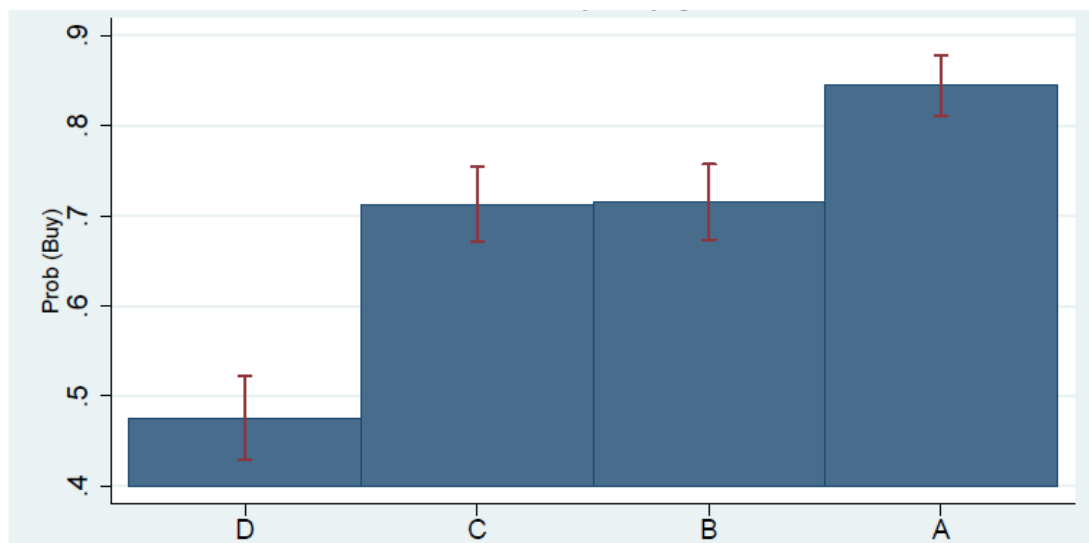


Figure 2: Study 2 results. Probability of buying as a function of the mortgage blind spot heuristic and the discounted cash flow analysis results.

Note: The predictions of the mortgage blind spot and DCF analysis effects per scenario are respectively as follows: D: RENT, RENT; C: BUY, RENT; B: RENT, BUY; A: BUY, BUY. The 4 scenarios are represented on the horizontal axis. The y-axis represents the probability of buying. The error bars represent the 95% confidence interval for the distribution of probability of buying per scenario.

Discussion

This experiment showed the decision to buy or rent a house is influenced by the mortgage blind spot heuristic and the discounted cash flow analysis. Participants are asked whether they want to buy or rent a house in four different scenarios that form the four potential outcomes of the two factors: (i) whether the rent is higher or lower than the monthly mortgage; (ii) whether the interest rate is high or low for the optimal decision to be rent or buy based on the discounted cash flow analysis. When the

discounted cash flow analysis suggests renting, 48% of participants buy if the mortgage blind spot effect predicts renting, and 71% of participants buy if the mortgage blind spot effect predicts buying. Thus, out of the participants that rent in the scenario that both effects predict renting, 45% switch to buy (48% vs 71%) as the mortgage blind spot effect switches from rent to buy. If the discounted cash flow analysis effect's prediction is to buy, the equivalent figure is smaller but still relevant: it has 15% less accuracy (85% vs 72%) predicting participants' outcome if the mortgage blind spot effect prediction does not coincide. Note that there is no difference in the likelihood of buying the house between condition B, in which the monthly mortgage is higher than the rent, and condition C, in which the interest rate is high, but the term of the mortgage is long for the monthly mortgage to be lower than the rent.

Study 3: Mortgage Blind Spot Affects Choices

Study 3 is a non-parametric randomized control trial, in which the mortgage blind spot effect is the treatment. Participants answer whether they intend to buy or rent a house (as in study 2). In all scenarios, the monthly rental payment and the discounted cash flow analysis predictions are constant. We choose values that make the discounted cash flow analysis prediction to be neutral between buying and renting. The only parameters that are not constant are the mortgage term and the monthly mortgage installment, the latter decreasing for longer terms. Participants answer eight questions in random order, four in which the monthly mortgage installment M is lower than the monthly rental payment R (\$800) and another four in which the opposite holds. We expect that participants will be less likely to buy the house as the monthly mortgage becomes higher than the monthly rental payment.

Method

Eight hundred forty-four M-Turk workers took part in this experiment, out of which 74 were discarded as they failed the attention check. The final sample has 770 M-Turkers workers (44% females; $M_{age} = 34.7$ years; $SD = 10.8$ years). Each worker receives a questionnaire with 8 questions. They can

only answer “buy” or “rent” to each question. In all questions, the monthly rental payment, the house value, the down payment, and the annual interest rate are constant and fixed at the respective values: \$800, \$324,000, \$149,000 and 3%. The respondents are told that they are allowed to invest in a savings account that yields the same annual interest rate of 3%. In all questions, the return on capital (allocated to the house) worth \$324,000 yields \$800 each month. Hence, the discounted cash flow analysis is neutral between “buy” or “rent” for all questions.

The only 2 variables that change across questions are the mortgage length contract T (in years and months) and the mortgage monthly installment M (in dollars). From question 1 to question 8, the pair (T,M) is as follows: Q1: (39 years and 8 months, \$625); Q2: (34 years and 6 months, \$675); Q3: (30 years and 7 months, \$725); Q4: (27 years and 6 months, \$775); Q5: (25 years and 1 month, \$825); Q6: (23 years, \$875); Q7: (21 years and 3 months, \$925); Q8: (19 years and 9 months, \$975). To dissipate any potential effect of the ordering of the questions, participants answer them according to the Balanced Latin Square Methodology.

This experiment is designed as close as possible to a randomized control trial, in which the only source of variation is the difference between the monthly rental payment R and the mortgage monthly installment M . If participants are simply willing to pay less per month for mortgage, we will find that the likelihood of buying goes down with the mortgage term. However, if the mortgage blind spot affects the likelihood of buying, we will find a discontinuity in the distribution as participants will become considerably less likely to buy around the point that the monthly mortgage becomes higher than the rent.

Results

The likelihood of buying is only significantly reduced between bins 4 ($M=775$) and 5 ($M=825$), yielding a 10.7% difference ($p<0.01$), and between bins 6 ($M=875$) and 7 ($M=925$), yielding a 21.1% difference ($p<0.01$). Note that the mortgage blind spot effect is strongest exactly between bins 4 and 5 – represented by the vertical dotted line in figure 3 - as all mortgages to the left of bin 5 are lower than R

and all mortgages to the right of bin 4 are higher than R (R is the monthly rental payment fixed at \$800 for all mortgage values).

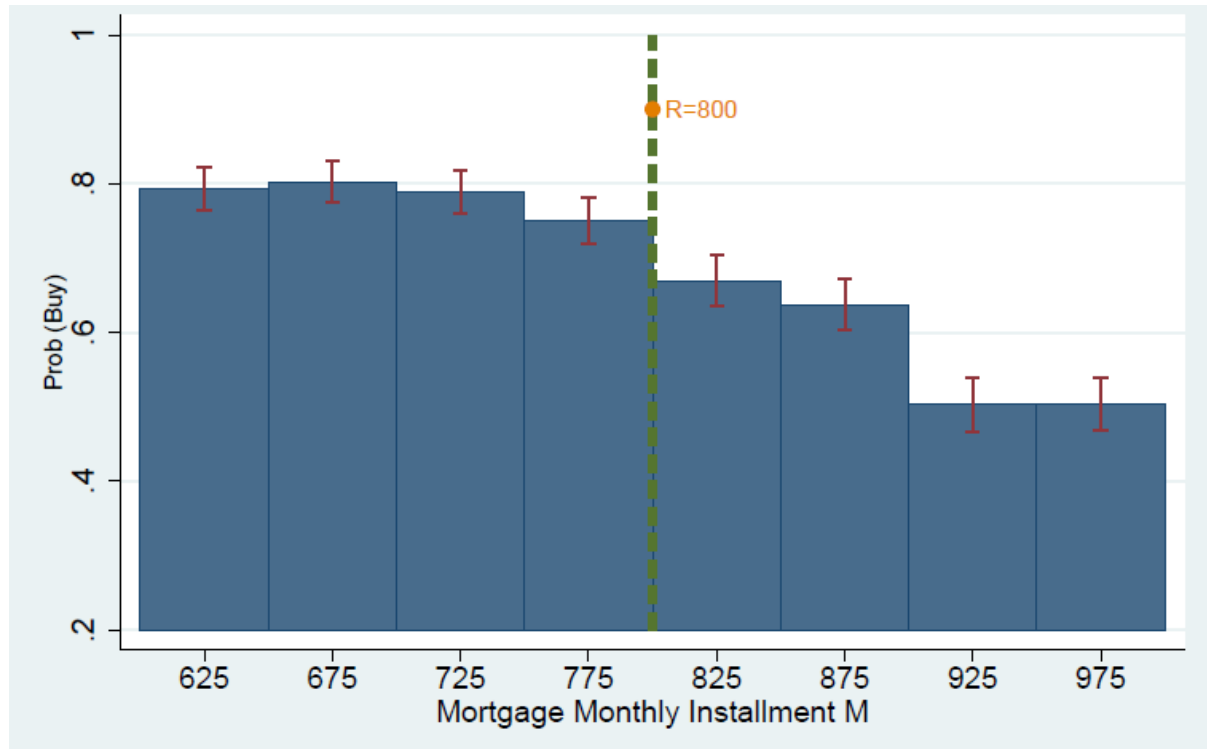


Figure 3: Study 3 results. Probability of buying as a function of monthly mortgage

Note: The figure shows the average number of participants that choose to buy per bin. All bins have a monthly rental payment R of 800 dollars and for all bins the *discounted cash flow analysis* prediction is neutral between buying and renting. Bins vary only according to the mortgage monthly installment M and the mortgage length term. The error bars represent the 95% confidence interval for the distribution of probability of buying per bin.

The two regions for which switchers are most frequent are (i) from $M=775$ to $M=825$ and (ii) from $M=875$ to $M=925$, matching the findings in which we pool all observations. In both cases, the mass of switchers is located between the monthly mortgage installment $M=800$ and $M=900$, just to the right to the point in which M equals the monthly rental payment $R=800$.

Discussion

We find a significant reduction in the probability of buying when the mortgage becomes higher than the rent. For monthly mortgage values lower than the rent, the probability of buying a house is flat; for monthly mortgage values higher than the rent, the probability of buying a house is a decreasing

function of the mortgage monthly instalment. When the rent is higher than the monthly mortgage, most participants choose to buy the house. This shows that participants not only have a downward sloping mortgage demand curve but want to pay considerably less than what the demand curve only would suggest around the point that the mortgage becomes higher than the rent.

Study 4: Correlates of the Mortgage Blind Spot Effect

The goal of Study 4 is to assess the individual differences that correlate with the tendency to incur the mortgage blind spot effect.

Method

Six hundred and four Mturk workers took part in the experiment, of which 535 passed an attention filter (59% females, $M_{\text{age}} = 36.8$ years, $SD = 12$ years). Participants answer whether they would rent or buy an apartment in four scenarios. The scenarios are the combination of the two potential outcomes of the mortgage blind spot heuristic and the discounted cash flow analysis: (buy,buy), (buy,rent), (rent,buy) and (rent,rent), analogous to the scenarios we used in Study 2.

In each scenario, participants are told they rent a house they live in for US\$ 1,100 each month. The house is for sale for US\$ 300,000. They are offered the option to buy it with a mortgage contract of 30 years of length. The discounted cash flow analysis is treated by varying the annual interest rate, which is 3% in scenarios A and B, and 6% in scenarios C and D. The mortgage blind spot heuristic is treated by the down payment requirements, which are either 0%, 24%, 29%, or 46% in scenarios A, B, C, and D, respectively. As a result, the monthly mortgage installment is \$1,250, \$950, \$1,250, \$950 in scenarios A, B, C, and D, respectively.

Across the four scenarios, the monthly rental payment and the mortgage length contract are constant. The down payment and the annual interest rate i vary in a way that participants are faced with the four potential outcomes of the mortgage blind spot heuristic and the discounted cash flow analysis.

According to the mortgage blind spot heuristic, participants should be more likely to buy the property in scenarios B and D, in which the monthly installment of the mortgage is lower than the rent. According to the discounted cash flow analysis, participants should be more inclined to buy the property in scenarios A and B, in which the monthly return Y worth the house price is lower than the rent. Table 2 describes all the parameters for the four different scenarios.

Scenario	MBS Prediction	DCF Prediction	R	M	i (%)	Down payment	House Price	T	Y
A	BUY	BUY	1,100	950	3.0	24%	300,000	30	740
B	RENT	BUY	1,100	1,250	3.0	0%	300,000	30	740
C	BUY	RENT	1,100	950	6.0	46%	300,000	30	1,460
D	RENT	RENT	1,100	1,250	6.0	29%	300,000	30	1,460

Table 2: Parameters of the scenarios in Study 4

Note: DCF Prediction is the outcome of the discounted cash flow analysis, which depends on R and Y . Y is the monthly amount yield of the NPV-equivalent interest-only mortgage. R is the monthly rental payment in dollars. If Y is higher (lower) than R , the rational decision of the discounted cash flow analysis is to rent (buy). MBS Prediction is the outcome of the mortgage blind spot heuristic, which depends on R and M . M is the monthly mortgage installment in dollars. If R is higher (lower) than M , the biased decision of the mortgage blind spot heuristic is to buy (rent). i is the annual interest rate charged on the mortgage. Down payment is the initial mortgage payment in percentage of the full house price. House price is the price at which the house is selling in dollars. T is the mortgage length term in years.

We then measure the following individual difference scales: financial literacy (13 items; Fernandes, Lynch, and Netemeyer 2014), focus on intuition (5 items; Epstein, Pacini, Denes-Raj, and Heier 1996), need-for-cognition (5 items; Epstein et al. 1996), numeracy (8 items; Soll, Keeney, and Larrick 2013), propensity to plan for time in the short-run (6 items; Lynch, Netemeyer, Spiller, and Zammit 2010), propensity to plan for money in the long-run (6 items; Lynch et al. 2010), tightwad-spendthrift (4 items; Rick, Cryder, and Loewenstein 2008), time discounting and immediacy bias (10 items; Meier and Sprenger 2012), and willingness to take financial risks (4 items; Weber, Blais, and Betz 2002). The items of each individual difference scale can be found in the Web Appendix D.

To measure immediacy bias and time discounting, we followed the procedure of Meier and Sprenger (2012). Participants indicated their preferences for sooner, smaller payouts over later, larger ones in a series of choices. The first five decisions are about \$75, \$70, \$65, \$60, and \$50 guaranteed today over \$80 guaranteed in a month, respectively. The last five decisions are about \$75, \$70, \$65, \$60,

and \$50 guaranteed in six months over \$80 guaranteed in seven months, respectively. For example, if a participant chooses \$75 in decision 1 and switches to \$80 in decision 2, she receives a score of 75/80. Immediacy bias is the score in the first five decisions (when payouts are immediate) divided by the score in the last five decisions (when payouts happen in six months). Time discounting is the score in the last five decisions.

Financial literacy reflects the ability to deal with financial information. Focus on intuition measures the reliance on intuitive judgments. Need-for-cognition measures the motivation to engage in analytical thinking. Numeracy reflects the ability in numerical reasoning. Propensity to plan for time and for money measure the extent to which individuals plan their time and budget. Tightwad-spendthrift assesses the extent to which people find spending money to be painful. Time discounting measures the monthly discount factor by prompting people to choose between sooner, smaller payouts and later, larger ones. The immediacy bias measures the extent to which people discount the future more when sooner, smaller payouts are paid immediately. Willingness to take financial risks measures the tendency of individuals to make risky investments.

We also measure whether respondents own a house, their willingness to own a house, their home value, their net wealth, whether they have ever invested in stocks, the percentage of their investments in stocks and fixed income funds, and demographic characteristics (age, gender, number of children, annual income, employment status, marital status and education level).

Results

A repeated measures logistic regression on the choice of buying vs. renting was conducted with the mortgage blind spot heuristic (whether the mortgage installment is higher or lower than the rental payment) and the discounted cash flow analysis (whether the NPV-equivalent interest-only mortgage is higher or lower than the rent) as dichotomous factors. We observe a significant effect of the mortgage blind spot (Wald $\chi^2 = 285.57$, $B = 0.42$, $p < .001$). 72.4% of participants buy the house when the monthly mortgage installment is lower than the rent, whereas 36.7% buy the house when the monthly mortgage

installment is higher than the rent. We also observe a significant effect of the discounted cash flow analysis (Wald $\chi^2 = 52.43$, $B = -0.14$, $p < .001$). 60.1% of participants buy the house when the NPV-equivalent zero down payment interest-only mortgage is lower than the rent, whereas 49.1% bought when the NPV-equivalent zero down payment interest-only mortgage is higher than the rent.

We find that the mortgage blind spot heuristic influences choices. Participants are more inclined to buy a house when the monthly mortgage installment M is lower than the monthly rental payment R (scenarios A and C). Participants are also influenced by the discounted cash flow analysis: they are more likely to buy the house if the zero down payment monthly NPV-equivalent interest-only mortgage Y is lower than the monthly rental payment R (scenarios A and B). The percentage of participants buying the house in each scenario is: 78.5% in scenario A, 41.7% in scenario B, 66.4% in scenario C, and 31.8% in scenario D.

We find that 24.3% of the sample closely follows the mortgage blind spot heuristic (they choose to rent in scenario A, to buy in scenario B, to rent in scenario C, and to buy in scenario D), and 5.2% closely follows the discounted cash flow analysis (they choose to buy in scenarios A and B, and to rent in scenarios C and D). We then test whether the likelihood to follow the mortgage blind spot heuristic and the discounted cash flow analysis are related to the individual difference scales.

We averaged individual self-report scales: focus on intuition ($\alpha = .93$), need-for-cognition ($\alpha = .88$), propensity to plan for time ($\alpha = .91$), propensity to plan for money ($\alpha = .89$), tightwad-spendthrift ($\alpha = .85$), and willingness to take financial risks ($\alpha = .78$). We count the number of correct responses in the objective scores scales of financial literacy (KR-20 $\alpha = .77$), and numeracy (KR-20 $\alpha = .70$). We compute the scores of immediacy bias and time discounting.

We find a significant negative effect of time discounting on the likelihood to follow the mortgage blind spot heuristic (Wald $\chi^2 = 4.67$, $B = -0.12$, $p = .03$) and a marginally significant positive effect of immediacy bias (Wald $\chi^2 = 3.35$, $B = 0.11$, $p = .07$). The more respondents prefer later, larger rewards, the less likely they are to incur the mortgage blind spot heuristic.

We find a marginally significant effect of financial literacy on the likelihood to follow the discounted cash flow analysis (Wald $\chi^2 = 2.88$, $B = 0.21$, $p = .09$). Financial literate respondents are more likely to follow the discounted cash flow analysis. No other individual difference scale predicts likelihood to incur the mortgage blind spot heuristic nor use the discounted cash flow analysis.

Among the demographic variables, we find that those who are more likely to incur the mortgage blind spot heuristic are also marginally less wealthy (Wald $\chi^2 = 3.41$, $B = -0.13$, $p = .07$), less likely to hold stocks (Wald $\chi^2 = 3.81$, $B = -0.11$, $p = .05$), and marginally allocate less money to equity funds (Wald $\chi^2 = 2.75$, $B = -0.11$, $p = .10$). No other item is associated to the mortgage blind spot heuristic or the discounted cash flow analysis. Web Appendix E shows the correlation matrix of all variables.

Discussion

Participants become more likely to buy a property when the monthly instalment is lower than the rent. Individuals with high time discounting (who prefer smaller payouts in 6 months rather than later larger payouts in 7 months) are more likely to incur the mortgage blind spot heuristic. Consumers who exhibit high time discounting are more likely to default on their debt (Atlas, Johnson, and Payne 2017; Meier and Sprenger 2012) and to be underwater in their mortgages (Atlas et al. 2017). The excessive focus on the near future may lead borrowers to ignore the long-term costs of a loan. Consumers who incur the mortgage blind spot heuristic minimize monthly payments rather than the total cost of a mortgage. As expected, these consumers also tend to prefer smaller sooner payouts. Finally, we find that financial literacy increases the likelihood to follow the rational choice of a discounted cash flow analysis. However, financial literacy does not reduce the likelihood to follow the mortgage blind spot heuristic.

Study 5: Relative Preference for Mortgage Options

Study 5 aims to examine consumers' relative preference for mortgage options. As in previous studies, we expect that consumers use the rental price as a reference point to the monthly mortgage. In

this study, participants are shown all mortgage options at once. Participants answer whether they would buy or rent a property in 12 scenarios of mortgage options with decreasing maturities, and corresponding increase in monthly installments. We expect that consumers are more likely to buy a house as the difference between the monthly mortgage and the monthly rental payment decreases.

Method

Two hundred ninety-nine Mturk workers take part in the experiment (60% females, $M_{age} = 36.7$ years, $SD = 12.3$ years). As in Study 3, participants read a scenario in which they currently rent a property and are offered the opportunity to buy it. The monthly rent is \$1,400, the house price is \$200,000, the down payment is \$40,000 and the interest rate is 4%. Differently from the previous studies in which participants evaluated mortgage options one at a time, participants in this study are simultaneously shown 12 options of a mortgage contract. For each option, they must answer whether they would buy or rent the property. The only two variables that change across options are the mortgage maturity (in years and months) which in turn determines the mortgage monthly installment (in dollars). From options 1 to 12, the pair (maturity, installment) is as follows: 1: (40 years and 4 months, \$1,125); 2: (34 years and 7 months, \$1,175); 3: (30 years and 4 months, \$1,225); 4: (27 years and 1 month, \$1,275); 5: (24 years and 6 months, \$1,325); 6: (22 years and 4 months, \$1,375); 7: (20 years and 7 months, \$1,425); 8: (19 years and 1 month, \$1,475); 9: (17 years and 9 months, \$1,525); 10: (16 years and 8 months, \$1,575); 11: (15 years and 8 months, \$1,625); 12: (14 years and 9 months, \$1,675). Participants indicate whether they would buy or rent a house for each mortgage maturity option.

In this study, as in Study 3, the only source of variation is the difference between the monthly rent and the monthly mortgage (along with the mortgage maturity). The NPV-equivalent zero down payment interest-only mortgage is \$892. Hence, the discounted cash flow analysis suggests that participants should buy in all options. The mortgage blind spot heuristic suggests that participants will be more inclined to buy the property when the monthly installment of the mortgage is around the rent one. The Web Appendix F shows the verbatim questions.

Results

A repeated measures logistic regression on the choice of buying vs. renting is conducted with maturity options (1 to 12) as a continuous factor and whether the mortgage installment is higher or lower than the rental payment as a dichotomous factor. We observe a significant interaction between the maturity options and the mortgage blind spot effect (Wald $\chi^2 = 73.37$, $B = 0.16$, $p < .001$). Specifically, we find a positive effect of maturity on the likelihood to buy the house when the monthly mortgage installment is lower than the rent (Wald $\chi^2 = 29.71$, $B = 0.15$, $p < .001$) and a negative effect when the monthly mortgage installment is higher than the rent (Wald $\chi^2 = 47.62$, $B = -0.18$, $p < .001$). Figure 4 displays the likelihood of buying for each mortgage option as a function of the monthly mortgage.

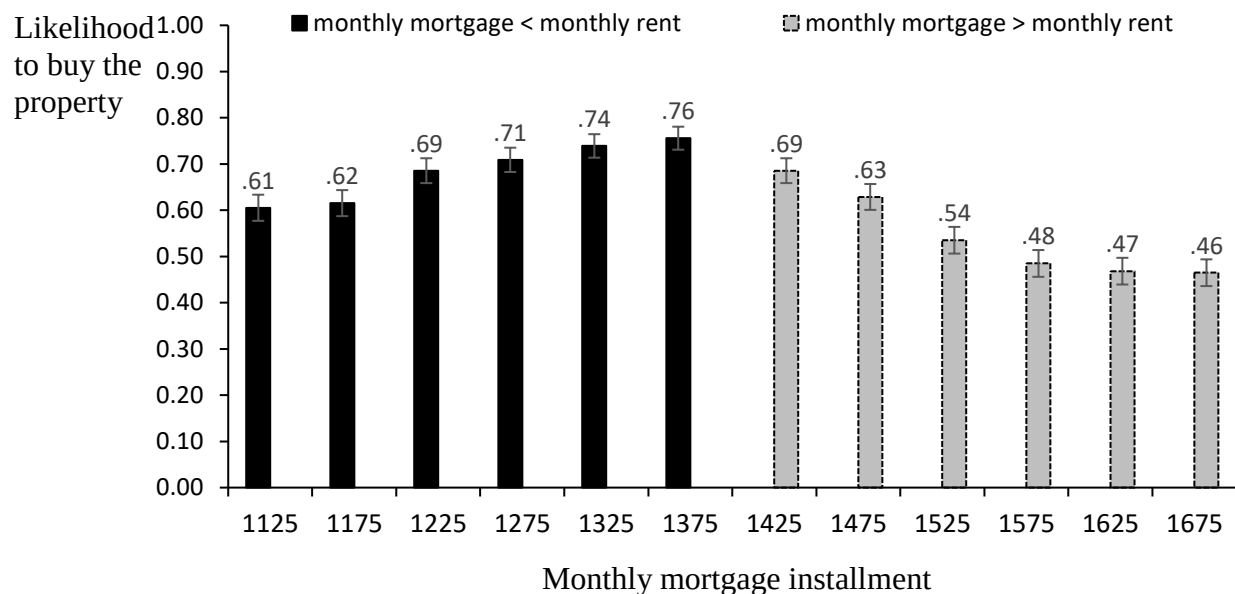


Figure 4: Likelihood to buy the property as a function of the monthly mortgage installment (rent is constant at \$1,400 a month)*

* The figure shows the likelihood of buying for each mortgage option. The monthly mortgage installment is treated by the maturity of the mortgage contract. Higher monthly mortgage installments are the result of shorter mortgage length terms. The monthly rental payment is fixed at 1,400 dollars for all mortgage options. The error bars represent the standard errors around the mean probabilities.

Separate contrasts reveal that the likelihood to buy the house significantly increases from 62% to 69% as the monthly mortgage installment increases from \$1,175 to \$1,225 ($\chi^2 = 13.15$, $B = 0.07$, $p < .001$). However, the likelihood to buy the house significantly decreases successively from 76% to 69%, 63%, 54%, and 48% as the monthly mortgage installment increases from \$1,375 to \$1,425 ($\chi^2 = 6.53$, $B = -0.07$, $p = .01$), to \$1,475 ($\chi^2 = 9.02$, $B = -0.06$, $p = .003$), to \$1,525 ($\chi^2 = 18.07$, $B = -0.09$, $p < .001$), and to \$1,575 ($\chi^2 = 8.57$, $B = -0.05$, $p = .003$), respectively.

Discussion

We observe a discontinuity in the distribution of responses to the choice of buying the property. Participants are more likely to buy a property as the difference between monthly mortgage installment and the monthly rental payment decreases. The likelihood to buy the property increases for mortgage values lower than the monthly rental payment and then decreases for mortgage values higher than the rent. This shows that the monthly rental payment is a reference point to the choice of mortgage. Participants are more willing to pay per month when the mortgage payment is around the rental one.

Our studies show that the mortgage blind spot influences the decision of buying a house. When offered multiple mortgage options at the same time, participants prefer a maturity option in which the monthly mortgage is about the same as the monthly rental payment. Consistent with Vihriälä (2021), households prefer mortgages with short maturity contracts that commits them to quick repayments. The rental price shifts the distribution as people prefer monthly mortgage payments that are around the rent.

Study 6: Rental Price Changes

Study 6 manipulates the rental price in \$10 amounts. Participants indicate whether they would buy or rent a house with different rental prices. If movements in rental price as fine as \$10 can affect the likelihood of buying a house, it reinforces that indeed consumers use the monthly rental price vs mortgage installment comparison to decide whether to rent or buy the house. We also expect that changes in rental

price more strongly affects the likelihood of buying the property when the rent is cheaper than the mortgage, as in the previous studies.

Method

Four-hundred thirty-four MTurk participants answer the study (62% female; $M_{\text{age}} = 35.9$ years, $SD = 11.7$ years). Participants are asked to indicate whether they prefer to buy or rent an apartment for 40 values of monthly rental payment. They read two scenarios in which they are asked to imagine they rent their home and that they have the opportunity to buy it (as in previous studies). In both scenarios, the price of the house is \$170,000, the required down payment is \$34,000 and the length of the mortgage is 28 years. After each scenario, participants answer whether they would rent or buy the house for each of 40 different rent options in which two adjacent rent options differ by \$10 only. In one scenario, the APR interest rate is 6.3%, the monthly mortgage installment is fixed at \$1,200, and the monthly rental payment ranges from \$1,005 to \$1,395. In the other scenario, the APR is 2.5%, the monthly mortgage installment is fixed at \$1,000 and the monthly rental payment ranges from \$805 to \$1,195. The order of the scenarios is counterbalanced.

Results

A repeated measures logistic regression on the choice of buying vs renting is conducted with the monthly rental payment as a continuous factor from 1 (lowest amount) to 40 (highest amount), the interest rate (2.5% APR vs 6.3% APR) and whether the monthly mortgage installment is higher or lower than the monthly rental payment as dichotomous factors. We find an interaction between the monthly rental payment and whether the monthly rental price is lower or higher than the monthly mortgage installment ($\chi^2 = 168.22$, $B = 0.13$, $p < .001$). Figure 5 displays the likelihood of buying as a function of rent in the conditions of high interest rate (Panel A) and of low interest rate (Panel B). In the condition of high interest rate, increases in rental payments enhance the likelihood of buying more strongly when the rent is lower than the mortgage ($\chi^2 = 216.70$, $B = 0.34$, $p < .001$) than when the rent is higher than the mortgage

($\chi^2 = 4.39$, $B = 0.06$, $p < .01$). Similarly, in the condition of low interest rate, increases in monthly rental payments enhance the likelihood of buying more strongly when the rent is lower than the mortgage ($\chi^2 = 200.64$, $B = 0.31$, $p < .001$) than when the rent is higher than the mortgage ($\chi^2 = 14.91$, $B = 0.09$, $p < .001$).

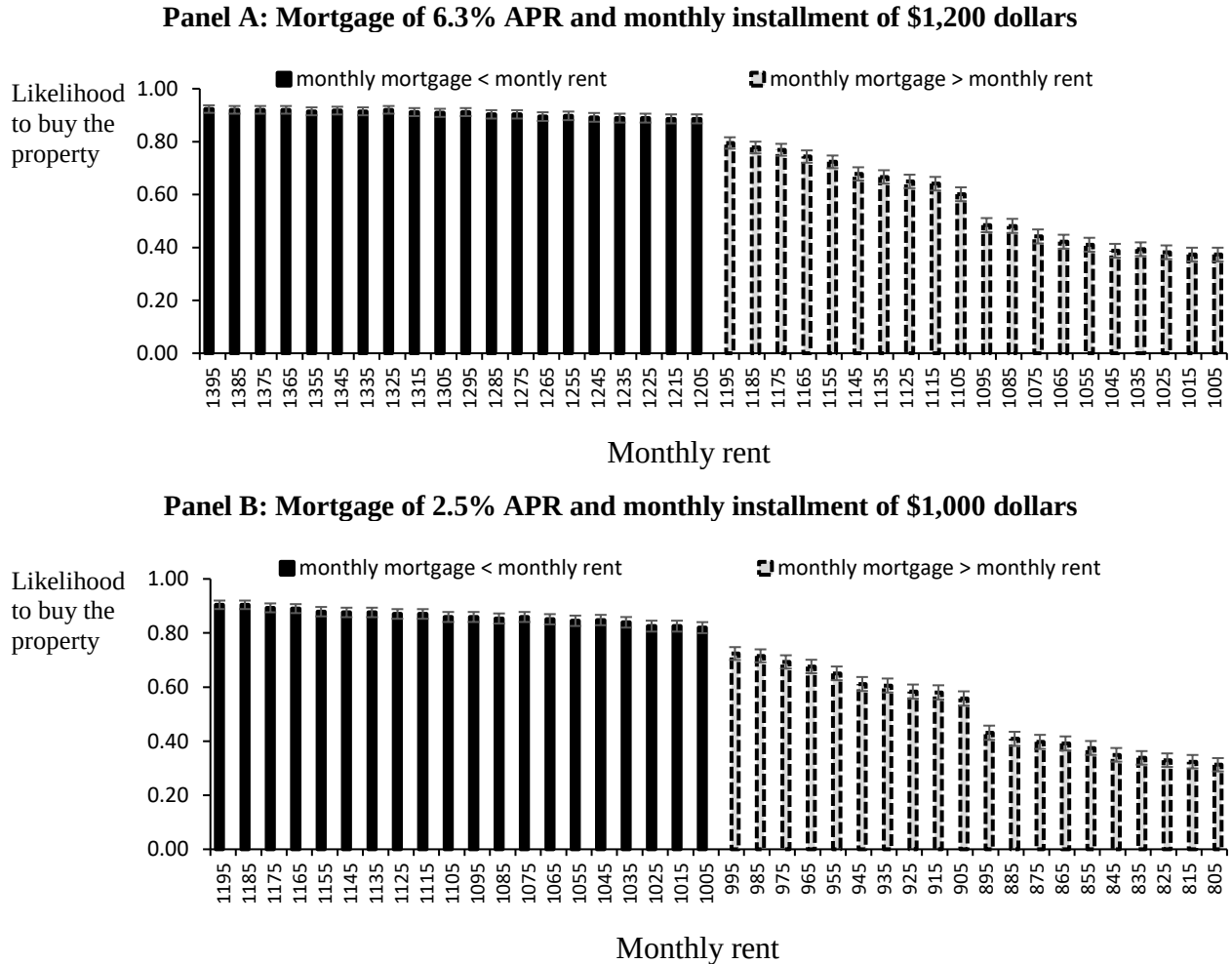


Figure 5: Likelihood to buy the property as a function of the monthly rental in the high interest rate (Panel A - with the monthly mortgage installment fixed at \$1,200 dollars) and low interest rate (Panel B - with the monthly mortgage installment fixed at \$1,000 dollars) conditions*

* The figure shows the likelihood of buying for each scenario of monthly rent. The monthly mortgage installment is fixed at \$1,200 dollars in Panel A and \$1,000 in Panel B. The error bars represent the standard errors around the estimated probabilities from the regression coefficients.

Discussion

The distribution of responses to the choice of buying the property is shifted as the monthly rental payment becomes cheaper than the monthly mortgage installment. In both scenarios, we observe a decrease in the likelihood of buying as the monthly rent decreases and a sharper decrease when the monthly rental payment is lower than the monthly mortgage installment.

Under economic rational assumptions, participants should be less likely to buy a property when the monthly rent decreases, which is what they actually do. However, they use the monthly rental payment as a reference point to the decision of buying a house. Decreases in the monthly rental payment more strongly affect the likelihood of buying the property if the monthly rental payment is lower than the monthly mortgage installment. In contrast, if the monthly rental payment is higher than the monthly mortgage installment, changes in the rental payment value do not significantly influence the likelihood buy the property.

Study 7: Financial Education

The objective of this experiment to assess whether teaching participants, in a laboratory environment, about the composition of the debt in a mortgage contract (in particular the role of interest rate, down payment and maturity in the amount to be repaid) affects how likely they are to consider the mortgage blind spot heuristic when deciding to buy or rent a house.

Method

Two hundred nineteen students answered the study (52% female; $M_{\text{age}} = 22.9$ years, $SD = 1.4$ years). About half of participants are asked to read a brochure that teaches them basic valuation concepts of a mortgage contract. Participants can read the material at their pace. The material explains the most relevant financial terms of a mortgage. The brochure can be seen in the Web Appendix G. Participants then face a housing decision as in Study 2: they answer whether they would rent or buy an apartment in

four scenarios representing the four possible combinations of the mortgage blind spot and discounted cash flow effects.

In each scenario, participants are told they rent a house they live in. The house value is US\$ 270,000. They are offered the option to buy it with a mortgage contract. The discounted cash flow analysis is treated by varying the annual interest rate, which is 4.1% in scenarios A and B, and 6% in scenarios C and D. The mortgage blind spot heuristic is treated by the maturity and the down payment of the mortgage. As a result, the mortgage installment is cheaper than the monthly rental payment in scenarios A and C, and more expensive in scenarios C and D. To minimize inattention mistakes, participants answer each scenario twice in counterbalancing orders.

According to the mortgage blind spot heuristic, participants should be more likely to buy the property in scenarios A and C, in which the monthly mortgage installment is lower than the monthly rental payment. According to the discounted cash flow analysis, participants should be more inclined to buy the property in scenarios A and B, in which the NPV-equivalent zero down payment interest-only mortgage Y is lower than the monthly rental payment. Table 3 describes all the parameters of the four different scenarios.

Scenario	MBS Prediction	DCF Prediction	R	M	i (%)	Down payment	House Price	T	Y
A	BUY	BUY	1,250	1,100	4.1	40,000	270,000	30	922
B	RENT	BUY	1,250	1,400	4.1	40,000	270,000	20	922
C	BUY	RENT	1,000	750	6.0	143,000	270,000	30	1,350
D	RENT	RENT	1,000	1,250	6.0	58,000	270,000	30	1,350

Table 3: Parameters of the scenarios in Study 5

Note: DCF Prediction is the outcome of the discounted cash flow analysis, which depends on R and Y. Y is the monthly amount yield of the NPV-equivalent zero down payment interest-only mortgage. MBS Prediction is the outcome of the mortgage blind spot effect, which depends on R and M. M is the monthly mortgage installment in dollars. R is the monthly rental payment in dollars. i is the annual interest rate charged on the mortgage. Down payment is the initial mortgage payment. House price is the price at which the house is selling in dollars. T is the mortgage length term in years.

Results

A repeated measures logistic regression on the choice of buying vs. renting is conducted with the mortgage blind spot (whether the mortgage installment is higher or lower than the rental payment), the

discounted cash flow analysis (whether the monthly amount yield worth the NPV-equivalent zero down payment interest-only mortgage is higher or lower than the rent) and the financial education intervention (present vs. absent) as dichotomous factors. We observe a significant effect of the mortgage blind spot effect (Wald $\chi^2 = 87.89$, $B = 0.42$, $p < .001$). 52.3% of participants buy the house when the monthly mortgage installment is lower than the monthly rental payment, whereas 33.6% buy the house when the monthly mortgage installment is higher than the rent. We observe no effect of the discounted cash flow analysis (Wald $\chi^2 = 2.08$, $B = -0.14$, $p = .14$). 44.5% of participants buy the house when the rational choice (discounted cash flow analysis) suggests buying, whereas 41.3% buy the house when the rational choice suggests renting. There is no interaction between the mortgage blind spot and the education intervention (Wald $\chi^2 = 0.16$, $B = 0.42$, $p = .69$) and also no interaction between the discounted cash flow analysis and the education intervention (Wald $\chi^2 = 2.62$, $B = 0.42$, $p = .11$).

Among participants who do not receive the education intervention, the percentage of participants buying the house in each scenario is: 42.2% in scenario A, 32.1% in scenario B, 52.8% in scenario C, and 24.3% in scenario D. Among participants who receive the education intervention, the percentage of participants buying the house in each scenario is: 56.8% in scenario A, 46.8% in scenario B, 57.3% in scenario C, and 30.9% in scenario D.

We replicate that the mortgage blind spot heuristic influences choices: participants become more inclined to buy a house when the monthly mortgage installment is *lower* than the monthly rental payment (scenarios A and C). However, participants are not influenced by the discounted cash flow analysis: they are not more likely to buy the house when the monthly amount yield Y worth the NPV-equivalent zero down payment interest-only mortgage is *lower* than the monthly rental payment R (scenarios A and B). Participants are also not influenced by the education intervention. They are as sensitive to the mortgage blind spot heuristic and the discounted cash flow analysis when they receive financial education as when they do not.

Discussion

This result is consistent with earlier findings in the literature that show that personal financial decision behaviors are hard to change (Fernandes, Lynch, and Netemeyer 2014). Only longer interventions (e.g. one-year long course, as in Brown et al. 2016) or that teach easy to implement rule-of-thumbs (Drexler, Fischer, and Schoar 2014) have been more effective at changing personal financial decision behaviors.

Study 8: Home Sale Price

The objective of Study 8 is twofold: first, to test whether the rent vs mortgage comparison affects the sensitivity to house prices; second, to further test whether the mortgage blind spot effect is present even when we control for financial constraints.

Method

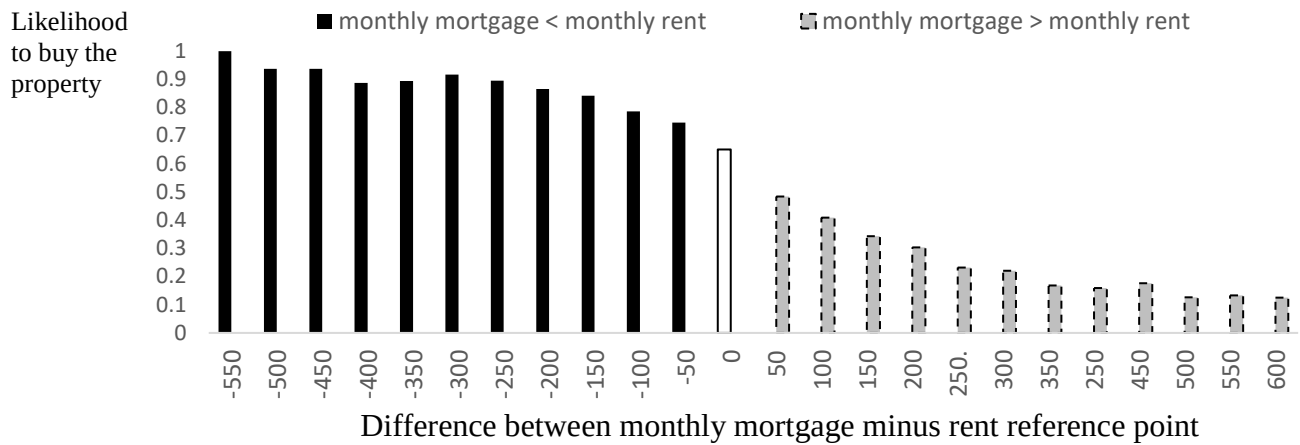
Five hundred forty-eight participants answer the study (40% female; $M_{\text{age}} = 40.4$ years, $SD = 12$ years) and are recruited from one of the authors' LinkedIn page. Participants are asked to read a house advertising (Web Appendix H shows the actual ad). Next, they are told that the owner is undecided whether to sell or rent the house and is accepting bids for both sale and for rent. The suggested rental price, informed to participants, is US\$ 1,500. Assuming a 2% fixed rate 30 year mortgage with no down payment, participants are asked to indicate whether they would buy or not the house for each of 13 offers with increasing US\$ 8,000 amounts of the house price, from US\$ 192,500 to US\$ 288,500, and corresponding increasing US\$ 50 monthly mortgage payments, from US\$ 1,200 to US\$ 1,800. Next, participants answer whether they would rent the house for 13 offers with increasing US\$ 50 amounts of rent prices, from US\$ 1,200 to US\$ 1,800. Finally, participants answer how financially constrained they are from 1 = very financially constrained to 10 = very financially unconstrained.

In this study, the reference point is specific to each participant: it is the amount each participant is willing to pay for rent. We expect that participants will be more sensitive to house prices when the monthly mortgage installment is higher than the amount they are willing to pay for rent. We also expect that financial constraints will not significantly alter the stronger sensitivity to house price increases when monthly mortgage payments are around the monthly rent.

Results

We examine the sensitivity of the likelihood to buy to house prices. On average, we find that every US\$ 8,000 increase in the house price (and corresponding US\$ 50 increase in the monthly mortgage) reduces the likelihood of buying by 5.21%. The decrease in the likelihood of buying is significantly higher and about twice as large (10.40%; $t = 4.07$, $p < .001$) when the monthly mortgage increases from US\$ 1,500 to US\$1,550 and therefore becomes larger than the suggested monthly rent of US\$ 1,500. The decrease in the likelihood of buying was also significantly higher and about three times as large (16.63%; $t = 6.89$, $p < .001$) when the monthly mortgage becomes US\$ 50 higher than the rent one is willing to pay for. Figure 6 panel A shows the likelihood of buying as a function of the difference between the monthly rent and monthly mortgage one is willing to pay, while panel B shows the difference between each succeeding bar in panel A. As the monthly rent becomes closer to the monthly mortgage, participants become significantly less likely to buy. The decrease is steeper in the region where the monthly mortgage is around the monthly rent, as evidenced by panel B: the largest difference is exactly for values around the monthly rent.

Panel A: Likelihood to buy the property as a function of the difference between the monthly rental payment and the mortgage installment.



Panel B: Reductions in the likelihood to buy the property as a function of changes in the difference between the monthly rental payment and the mortgage installment.

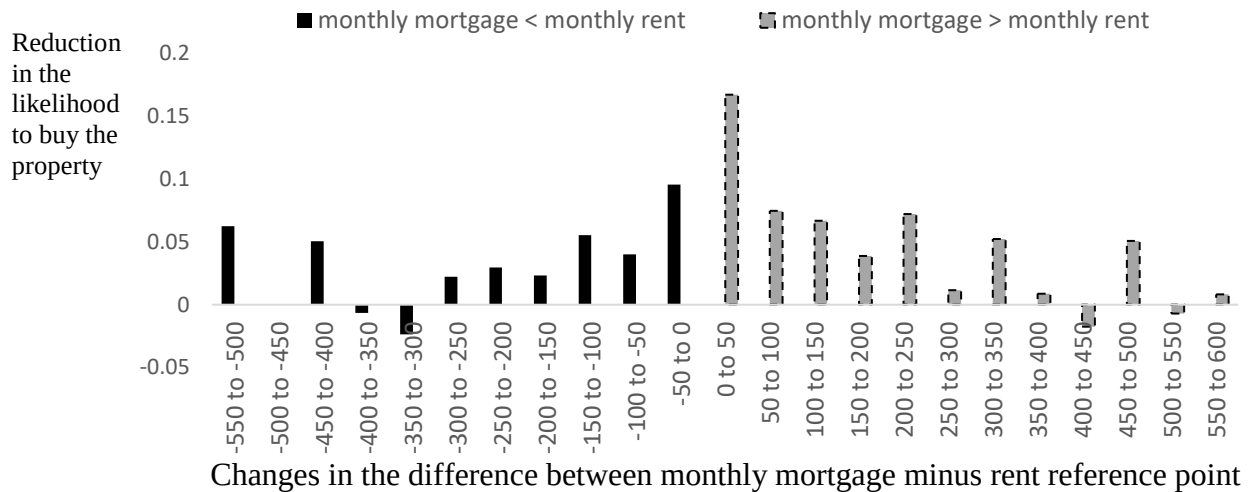


Figure 6: Likelihood to buy the property as a function of the difference between monthly mortgage and rent reference point

* Panel A shows the likelihood of buying the property as a function of the difference between maximum monthly mortgage and rent that each participant is willing to pay. Panel B shows the reductions in the likelihood of buying the property as a function of each US\$ 50 increase in the difference between the maximum monthly mortgage and rent that each participant is willing to pay. Each bar in panel B is the difference between succeeding bars in panel A.

Of the 61.3% of respondents who change their choice from buying to not buying with house price increases, most do for mortgage values around the rent: 17.6% change their opinion when the monthly mortgage becomes US\$ 50 higher than the suggested rent (US\$1,500), while 19.9% change their opinion

when the monthly mortgage becomes US\$ 50 higher than the maximum rental price they are willing to pay.

We also find that the extent of being financially constrained does not predict the likelihood to change the choice of buying when the monthly mortgage becomes higher than the rental price the respondent was willing to pay ($p = .47$).

Discussion

This study shows that the mortgage blind spot influences the price one is willing to pay for a house. Respondents are less likely to buy when the house price increases (and, correspondingly, when the monthly mortgage increases). But the likelihood in this reduction is not linear and it is dependent on the suggested rental price and the maximum rental price one is willing to pay. The reduction is steeper stronger when the monthly mortgage is around the same as the monthly rent, i.e., the willingness to buy a house is more sensitive to house prices when monthly mortgage payments are around the maximum rental price one is willing to pay. About one fifth of respondents switch from buying to renting when the monthly mortgage is around the suggested rental price. In addition, the propensity to be in that group is not related to financial constraints.

General Discussion

This paper proposes and tests a new heuristic used by households when deciding to buy or rent a house, the mortgage blind spot effect. Consumers are more likely to enter mortgage contracts when the monthly rental payment they used to pay before buying the house is higher than the prospective monthly mortgage installment. They use the rental payment as a reference point to the mortgage even though the monthly rental payment and the monthly mortgage installment are not directly comparable.

In order to identify the causal effect of the mortgage blind spot on the decision to buy or rent a house, we design experiments that aim to isolate the other factors that influence this decision. We create

scenarios in which we vary the difference between the mortgage monthly installment at a fixed rate and the monthly rental payment, allowing to compare them in a controlled setting whether potential home buyers switch from buy to rent as we progress from one treated region (monthly mortgage installment is lower than monthly rental payment) to the other (monthly mortgage installment is higher than monthly rental payment).

We find a causal effect of the mortgage blind spot heuristic on the decision to buy or rent a house. It is detected even in settings for which discounted cash flow analysis, liquidity constraints and other individual level biases are considered. Study 1 shows that there is a mass concentration of home buyers in the PSID that pay per month for a mortgage about the same amount as they used to pay for rent each month. The monthly mortgage installment is strongly related to the monthly rental payment, an effect that cannot be explained by income and income gain relative to the year before home purchase. In Study 2, we find that potential home buyers are more likely to buy if the mortgage monthly installment is lower than the monthly rental payment regardless of whether a discounted cash flow analysis suggests renting or buying. In Study 3, we observe a discontinuity in the distribution of responses to the choice of buying the house as the monthly mortgage installment increases and becomes higher than the monthly rental payment. This shows that the mortgage blind reduces the likelihood to pay with the mortgage monthly installment more than a typical downward-sloping curve would explain. Consumers prefer a mortgage contract in which the maturity leads to a monthly payment that is around their current monthly rent. Study 4 shows that more impatient individuals are more likely to follow the mortgage blind spot effect. Study 5 shows that when offered multiple mortgages at the same time, consumers prefer mortgages that are slightly lower than the rental payment. In Study 6, we narrow the difference between the monthly mortgage installment and the monthly rental payment to \$10 dollars. We find a drastic reduction in the willingness to buy in the region where the monthly mortgage installment is around the monthly rental payment. This result is hard to reconcile with a liquidity constraint explanation. Participants are more strongly influenced by reductions in the monthly rental payment as it becomes \$10 dollars cheaper than the monthly mortgage installment. Study 7 shows that a financial education intervention is not effective at

reducing the mortgage blind spot effect. Finally, Study 8 shows that the mortgage blind spot effect on the likelihood to buy sensitivity to house prices.

Our studies are meant to resemble real-world decisions of home purchase. When shopping for a mortgage, consumers usually have some discretion on their preferred maturity. Most lenders present several maturity options for consumers to choose. Accordingly, we observe the mortgage blind spot not only in controlled experiments but also in the field. The results highlight at least two decision-making issues in the housing market: mental accounting and anchoring.

People hold their money in separate accounts, which can be physical, or sometimes only mental. For instance, people have savings for children's education, for holidays, or for medical emergencies. People are reluctant to draw on these accounts to cover unrelated needs. Sussman and O'Brien (2016) find that people prefer to accumulate expensive debt on credit card rather than use their savings. Separate accounts help us keep things under control and manageable. Instead of having a comprehensive view of their portfolio, investors set up an account for each stock and minimize their losses in that specific stock given a certain period (Barberis and Huang 2001). Our results suggest that people lump the monthly mortgage installment and the monthly rental payment in the same mental account. They might set a monthly cap for living expenses whether they are paying the rent or the mortgage.

The mortgage blind spot is also consistent with anchoring. Home buyers, uncertain about how much they should pay each month for their mortgage, end up anchoring on how much they pay for rent. Home buyers use the monthly rental payment as a reference point to the monthly mortgage installment. They focus on the monthly expenses of renting vs. buying and fail to consider that these expenses are part of a longer stream of payments. Rather than employing a discounted cash flow analysis, home buyers resort to the simpler mortgage blind spot heuristic when deciding whether to buy a house.

Cognitive limitations hinder the ability of consumers to make a rational assessment of best debt repayment scheme. Stango and Zinman (2009) show that borrowers fail to appreciate the power of compound interest in borrowing, which leads them to ignore the negative consequences of long-maturity loans on the total cost of the loan. Soll, Keeney, and Larrick (2013) show that people underestimate how

long it takes to pay down debt when payments barely cover the interest owed. The dual process theory of thinking suggests that it is hard for people to avoid using System 1 (Kahneman and Frederick 2002). It is our natural tendency to use shortcuts to arrive at a difficult answer. Therefore, when evaluating a mortgage, even financially sophisticated individuals may fall prey to the mortgage blind spot effect as they consider the monthly rental payment and the monthly mortgage installment at the same time.

Future research may examine whether financial advisors, real estate agents and brokers also display the mortgage blind spot effect. Recent research suggests that knowledge, experience and training help reduce many cognitive biases (Mellers et al. 2015). More knowledgeable, less confident and more open-minded individuals can integrate multiple sources and pieces of knowledge as they process information more diligently (Tetlock and Gardner 2015).

Future research may also study whether real estate agents exploit the mortgage blind spot effect in order to sell expensive mortgages. Realtors may increase the likelihood of selling by suggesting a monthly mortgage installment that is about the same as the monthly rental payment of potential buyers. Real estate agents have typically a strong incentive for selling a house (Levitt and Syverson 2008) and participated in the widespread falsification of income information on mortgage applications in the credit boom of 2002 to 2005 (Mian and Sufi 2017). Consumers often lack good third-party financial advice. Misconduct and fraud are often observed and rarely coerced among financial advisors (Egan, Matvos, and Seru 2018). It is, therefore, possible that real estate agents exploit the mortgage blind spot effect to increase their profits while selling expensive mortgages to households that are unaware that they are purchasing a house that is a negative present value decision. Anecdotal evidence suggests that some real estate agents indeed instill homebuyers to compare the rent with the monthly mortgage while drawing little attention to the interest rate. For instance, some slogans of real estate agents recommend homebuyers to “pay mortgage, not rent” or “stop wasting money on rent”. Finally, some consumers justify the purchase of a house as a smart choice given that the rental payment was close to the monthly mortgage (Metro news 2021).

The 2007/2008 housing crisis lead many to question the immunity of home purchasing as a risk-free financial investment. Households took out subprime mortgage contracts they could not afford later (Mian and Sufi 2009). It is possible that one of the reasons that might have pushed those households into the subprime contracts is the use of mortgage blind spot heuristic. Home buyers directly compare the monthly rental payment and the monthly mortgage installment even though these two payments are not directly comparable. Those who follow the mortgage blind spot heuristic are likely to enter into bad mortgage contracts. By narrowly focusing on the comparison between the monthly rental payment and the monthly mortgage installment, home buyers might be overlooking important terms of a mortgage contract such as the interest rate. They take out mortgage contracts in part due to the fact that the monthly rental payment is high enough or the maturity of the mortgage long enough for the monthly mortgage installment to be lower than the monthly rental payment.

The decision to buy a house is a very important event for most households. Households who follow the mortgage blind spot heuristic might end up defaulting on mortgages, worsening their balance sheets and their employment prospects. For some, the income after retirement might be tightly linked on how successful the choice of the house and the mortgage are. Nonetheless, it is a rare and complex event, which might take some households to be influenced by rules of thumb that help them decide whether to accept or turn down a mortgage. If a discounted cash flow analysis proposes renting as the best option, yet the household follows the mortgage blind spot heuristic, it would increase household leverage, worsening their after retirement income prospects.

Conclusion

This paper shows that the mortgage blind spot heuristic influences the decision to buy or rent a house. Consumers use their monthly rental payment as a reference point to decide whether they should buy a house. Our results suggest that the willingness to buy a house is more strongly reduced when the mortgage monthly installment is slightly higher than the monthly rental payment. This is consistent with

the mortgage blind spot effect, i.e., consumers use the monthly rental payment as a reference point for the monthly mortgage installment. This effect survives tests in which we control for liquidity constraints and financial education and is robust to different test methods, such as panel data and surveys from different sources.

Regulators can include the mortgage blind spot heuristic in their information set when designing the optimal policies to prevent mortgage defaults, as consumers that use the mortgage blind spot heuristic when deciding whether to buy or rent a house on are more likely to default. If banks are securitizing mortgages, they have a steep incentive to sell mortgages irrespective of their quality, as it was commonplace during the 2007/2008 credit crisis. Banks might be knowingly using the mortgage blind spot heuristic to sell expensive subprime mortgages. They might draw the attention of customers to the monthly mortgage and its affordability relative to the monthly rent irrespective of the interest rate. More research is needed to understand the effects of consumers using the mortgage blind spot heuristic.

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Web Appendix Sections 1-9

The Mortgage Blind Spot: Rent as the Reference Point for Mortgage Monthly Payments

This document supplements the main text with the following sections:

- Web appendix A examines the Socio-Economic Panel Study (SOEP) in Germany.
- Web appendix B provides additional information and alternative representations of the M-R distribution from the Panel Study of Income Dynamics (PSID).
- Web appendix C explains the reference point conceptual framework used to make our predictions.
- Web appendix D reports the scales used in Study 4.
- Web appendix E shows the correlation matrix of the variables in Study 4.
- Web appendix F shows the verbatim questions in Study 5.
- Web appendix G shows the brochure of the financial education intervention used in Study 7.
- Web appendix H shows the ad of the house sale used in Study 8.

Web Appendix A: German Socio-Economic Panel Study (SOEP)

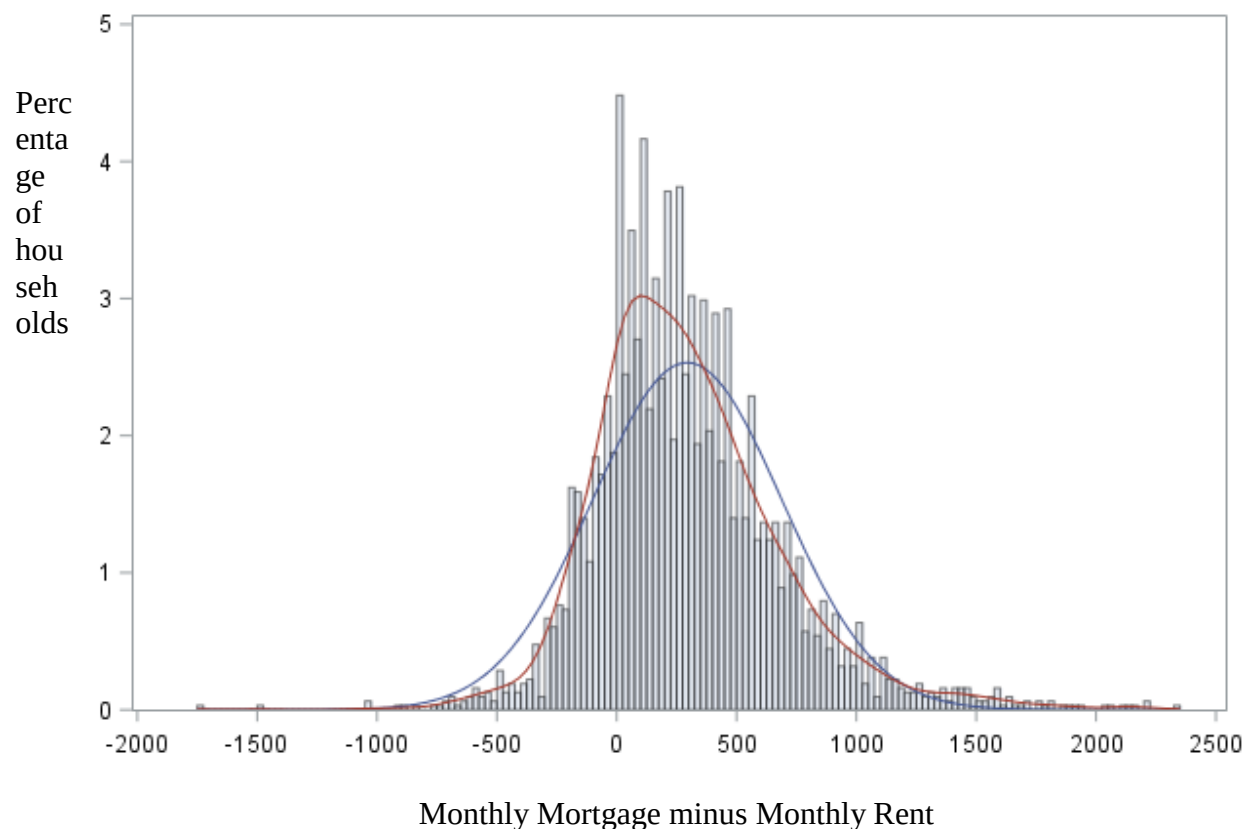
We analyzed the data from the SOEP between 1985 and 2015 inclusive. The data included 3,154 home buyers who used to pay rent before buying. We obtain the monthly mortgage installment and the monthly rental payments in the year before the purchase and income in both years in euros (€). Three households paid for mortgage 1900 or less than the rent in the previous year and five paid 2500 or more than the rent in the previous year (more than 4 SDs from the mean) and were therefore not considered.

The SOEP is a representative longitudinal survey of private households in Germany conducted by TNS Infratest Sozialforschung GmbH. The survey was launched in 1984 and since data has been collected yearly. In 1998, 2000, 2002, 2006, 2009, 2011, and 2012 new households were added to the survey which covers nearly 11,000 households yearly. SOEP's household sampling procedure consists of a random-walk and all of its samples are multi-stage random samples which are regionally clustered. The database is composed of households switching being tenants to owners as in previous panels. The data is freely available for the scientific community: <https://www.diw.de/en/soep>.

Frequency distribution. We examine the distribution M-R of the difference between the monthly mortgage installment and the monthly rental payment (monthly mortgage installment minus monthly rental payment) in bins of 25 euros (e.g., 0 euros to 25 euros, 25 euros to 50 euros). Figure W1 presents the histogram of the distribution. The red curve represents the Kernel density and the blue curve represents the normal distribution. The distribution is concentrated around zero (Mode = 0, Kolmogorov-Smirnov test statistic = .07, $p < .01$) and deviates from the normal distribution (Kurtosis = 0.95, 95%CI = 0.78 to 1.12; Kurtosis of the normal curve = 0).

Concentration of households. The concentration of the distribution indicates a clear bunching when the monthly mortgage installment is the same as the monthly rental payment. On average, respondents pay per month for their mortgage ($M = 779.33$, $SD = 419.35$) more than what they used to pay per month for rent ($M = 485.24$, $SD = 258.52$; $t = 41.88$, $p < .01$). The highest bin, in which home buyers pay for mortgage 0 to 25 dollars more than their previous rent (4.48% of households).

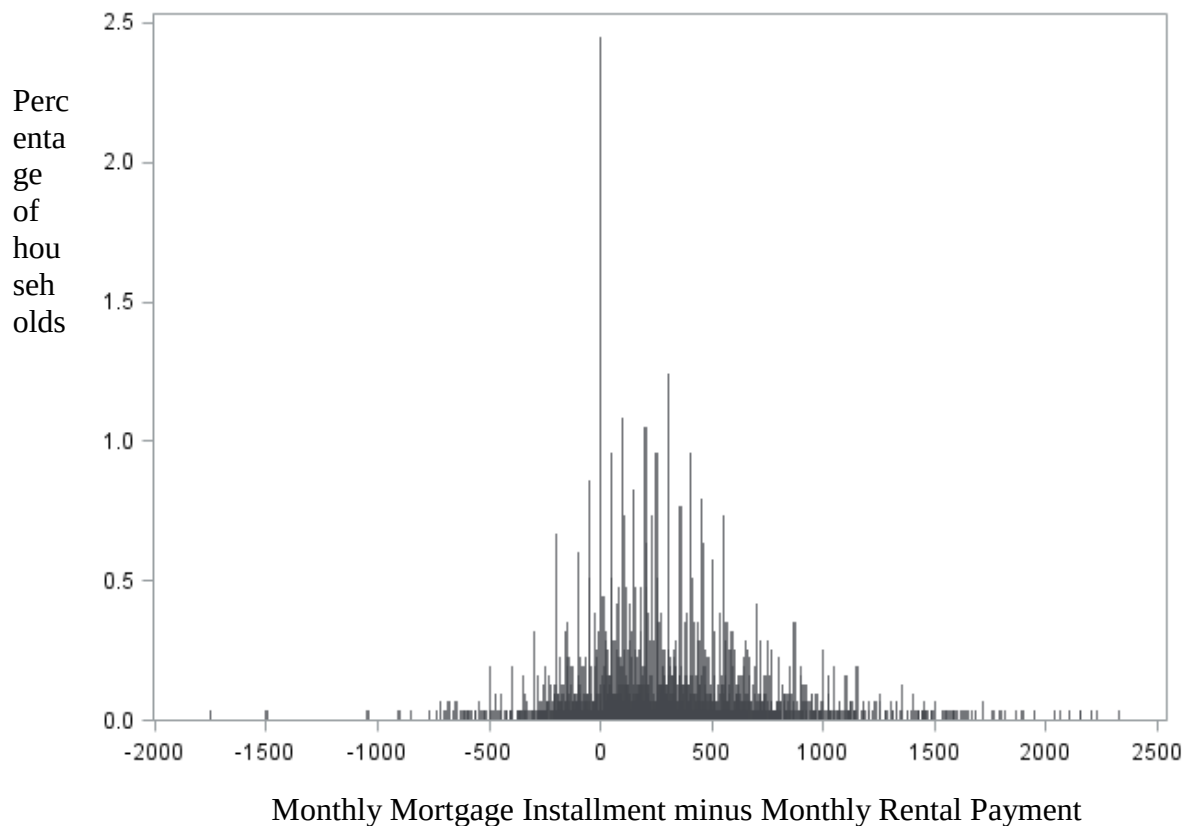
Figure W1: Histogram of the difference between the monthly mortgage installment and the monthly rental payment in bins of 25 euros in the SOEP*



* The figure shows the percentage of home buyers as a function of the difference between current monthly mortgage installment and previous year monthly rental payment in bins of \$25 euros. The data is from the German Socio-Economic Panel Study and includes 3146 panelists from 1985 to 2015.

Figure W2 reports the distribution M-R (monthly mortgage installment minus monthly rental payment) in bins of 1 euro. The distribution is concentrated around zero (Mode = 0, Kolmogorov-Smirnov test statistic = .06, $p < .01$) and deviates from the normal distribution (Kurtosis = 0.94, 95%CI = 0.77 to 1.12; Kurtosis of the normal curve = 0).

Figure W2: Histogram of the difference between the monthly mortgage installment and the monthly rental payment in bins of 1 euro in the SOEP*

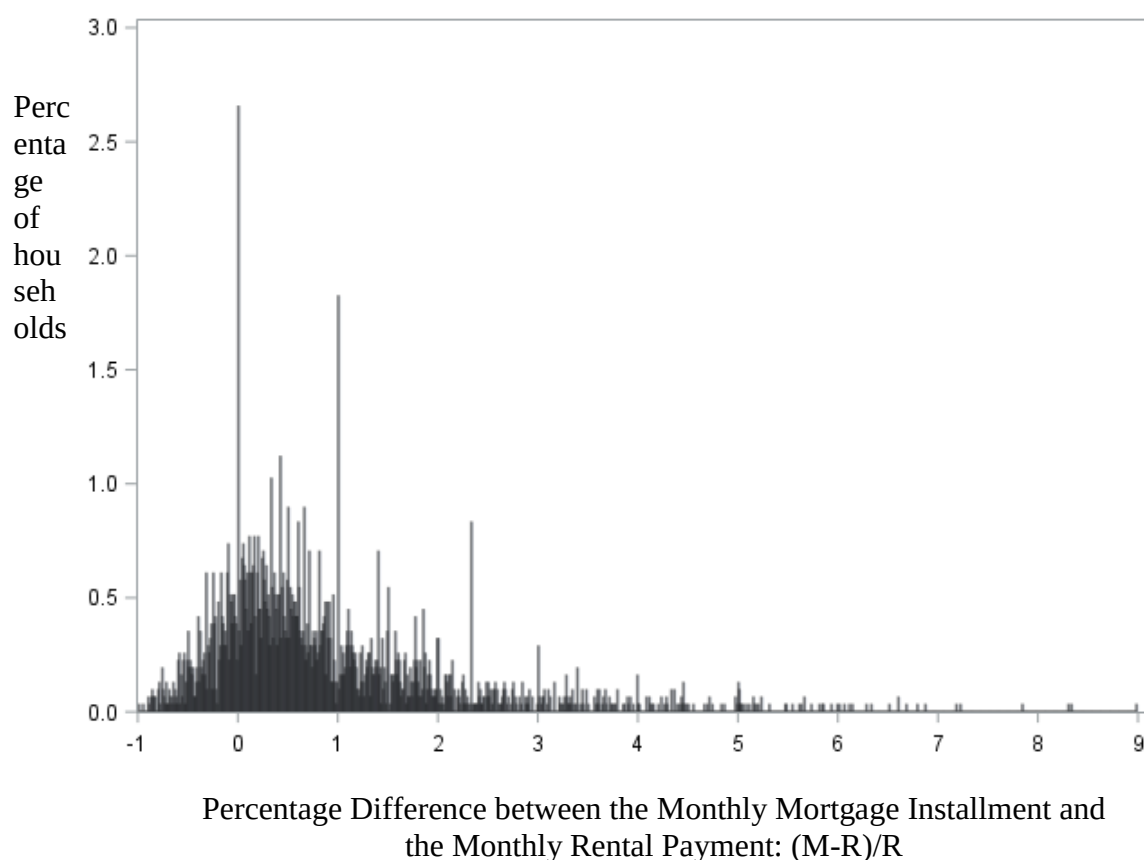


* The figure shows the percentage of home buyers as a function of the difference between the first monthly mortgage installment and the last monthly rental payment in bins of \$1 euro. The data is from the German Socio-Economic Panel Study and includes 3146 panelists from 1985 to 2015.

Figure W3 reports the distribution $(M-R)/R$ of the percentage difference between the first monthly mortgage installment M and the last monthly rental payment R before purchase of the

house (monthly mortgage installment minus monthly rental payment divided by the monthly rental payment) the SOEP panel in bins of 0.01 (1%). The distribution is concentrated around zero (Mode = 0, Kolmogorov-Smirnov test statistic = .14, $p < .01$) and deviates from the normal distribution (Kurtosis = 5.36, 95%CI = 5.19 to 5.53; Kurtosis of the normal curve = 0). We observe another kink point at 1 (100%) showing that a disproportional percentage of households at the point when the monthly mortgage installment is twice as much as the monthly rent.

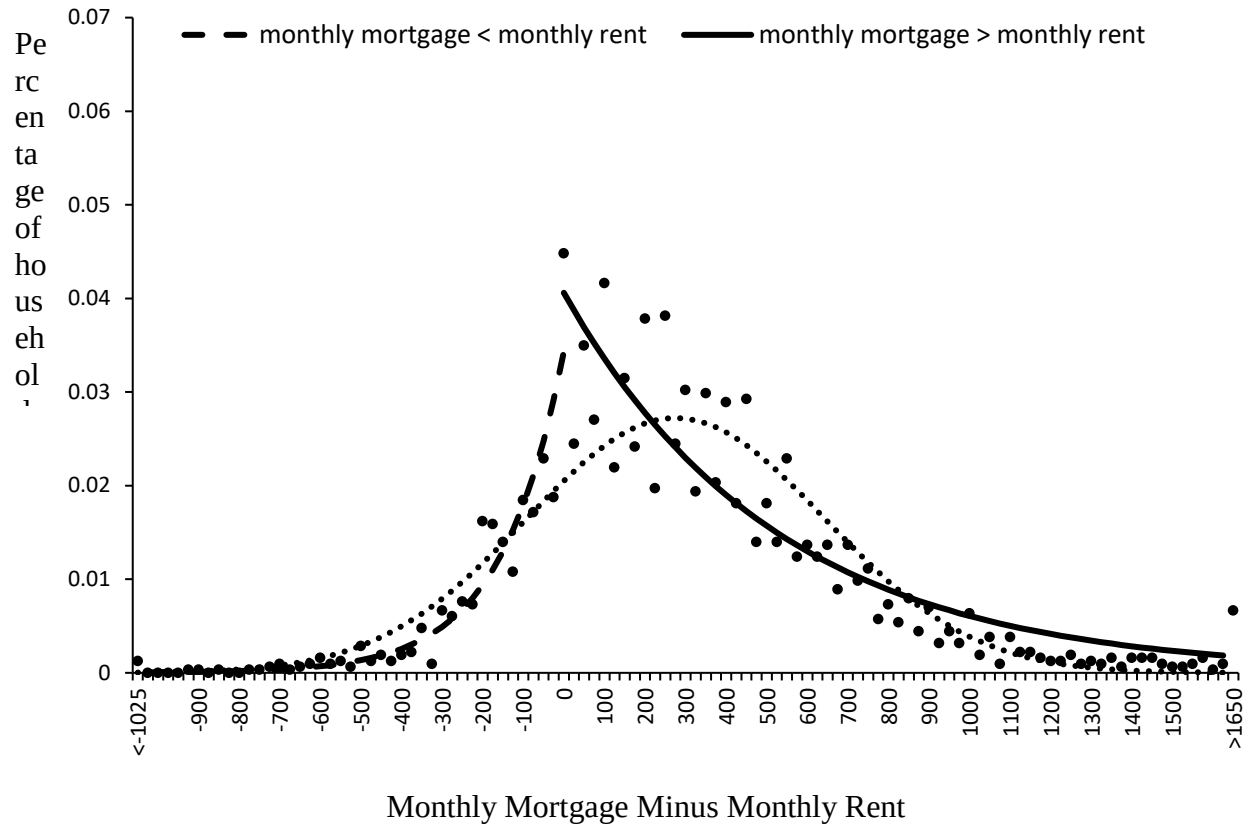
Figure W3: Histogram of the percentage difference between the monthly mortgage installment and the monthly rental payment in bins of 0.01 (1%) in the SOEP*



* The figure shows the percentage of home buyers as a function of the difference between the first monthly mortgage installment and the last monthly rental payment in bins of 0.01 (1%). The data is from the German Socio-Economic Panel Study and includes 3126 panelists from 1985 to 2015.

Form of concentration. We then examined the form of concentration of households in the distribution M-R of the difference between the monthly mortgage installment M and the monthly rental payment R (monthly mortgage installment minus monthly rental payment) in bins of 25 euros. Peak concentration of households when the monthly mortgage installment is the same as the monthly rental payment is bordered by an ascending curve to the left and a descending curve to the right. We estimate an exponential function ($y = ae^{bt}$) of those curves such that y is the percentage of households, t is the difference between the monthly mortgage installment and the monthly rental payment (in number of bins) within $\pm 3SDs$ from the mean, and a and b were constants as in Rubin and Wenzel (1996). The exponential estimate of the ascending curve ($B = 0.16, p < .01$) is higher than the exponential estimate of the normal curve ($B = 0.06, p < .01$; 95%CI = 0.07 to 0.13). The exponential estimate of the descending curve ($B = -0.05, p < .01$) is higher than the exponential estimate of the normal curve ($B = -0.06, p < .01$; 95%CI = 0.004 to 0.02). Figure W4 shows the exponential functions for the ascending and the descending curves of the percentage of households as a function of the difference between the monthly mortgage installment and the monthly rental payment.

Figure W4: Percentage of households as a function of the difference between the monthly mortgage installment and the monthly rental payment in bins of 25 euros in the SOEP



* The figure shows the percentage of home buyers as a function of the difference between the current year monthly mortgage installment and the previous year monthly rental payment in bins of \$25 euros. The dotted line is the normal curve. The dashed line represents the exponential function when the monthly mortgage installment is lower than the monthly rental payment. The solid line represents the exponential function when the monthly mortgage is higher than the rent. The points are the actual percentage of consumers.

Relationship between the monthly rental payment and the monthly mortgage

installment. There was a strong correlation between the monthly rent and the monthly mortgage installment ($r = .40$, $p < .01$). By social science conventions, $r \leq .10$ is a small effect-size; $.10 < r < .40$ is medium; and $r \geq .40$ is large. Next, we regressed the monthly mortgage installment on the rental payment before buying the house, the monthly income at the year of purchase and at

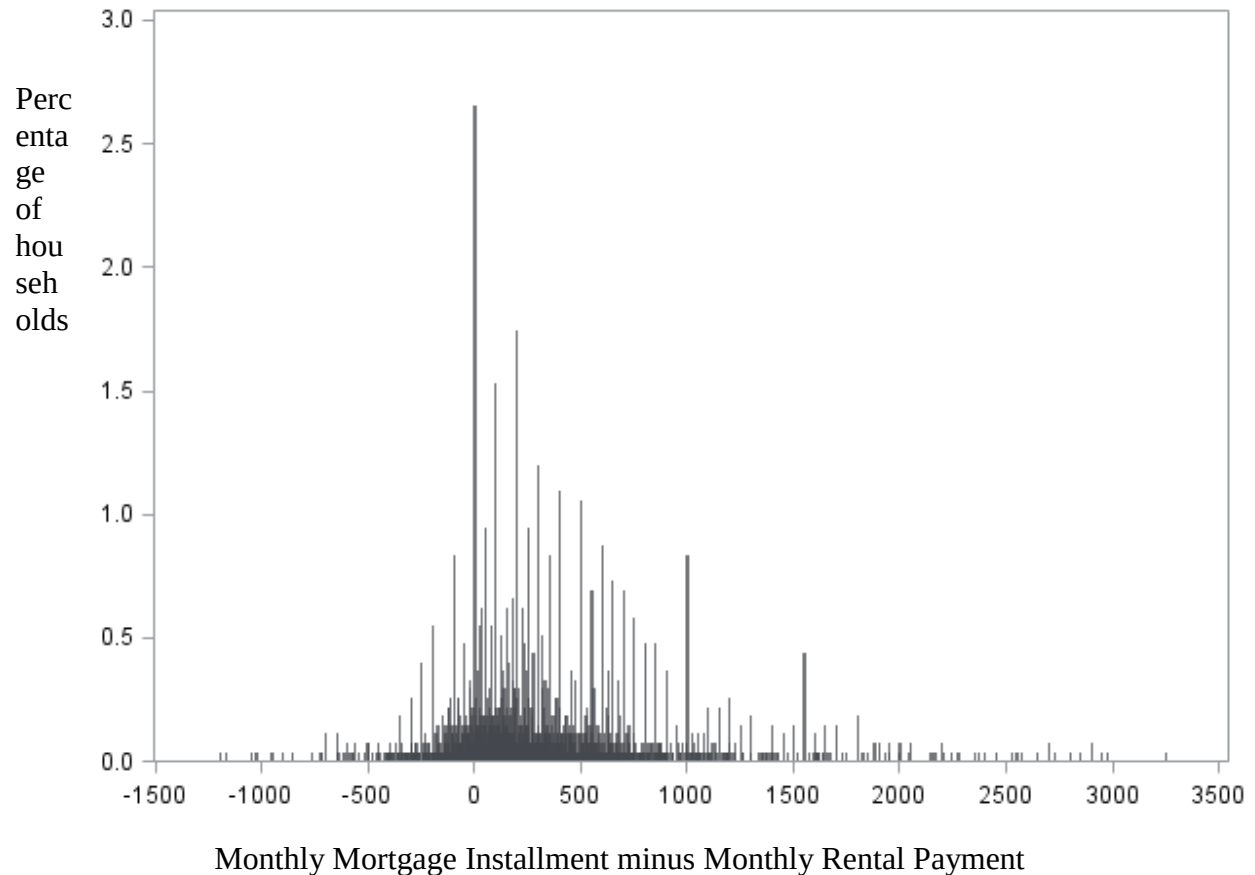
the year of paying rent. Income was higher in the year of the house purchase ($M = 2,938.35$, $SD = 1,451.67$) than in the year when they used to rent ($M = 2,684.64$, $SD = 1,468.71$; $t = 13.36$, $p < .01$). We find an effect of income in the year of purchase ($B = .40$, $t = 16.77$, $p < .01$), of income in the year of paying rent ($B = .09$, $t = 3.62$, $p < .06$), and, most importantly, of the monthly rental payment before the purchase ($B = .14$, $t = 7.73$, $p < .001$). This indicates that the monthly rental payment before purchase predicts the monthly mortgage installment beyond the effects of income in the year of purchase and in the year of paying rent.

Web Appendix B: Additional information and alternative representations of the M-R distribution in the Panel Study of Income Dynamics (PSID) reported in Study 1

The Panel Study of Income Dynamics (PSID) is the longest running longitudinal household survey in the world. It started in 1968 with a nationally representative sample of 9,048 families in the United States. Having started as a yearly survey, in 1999 it became biennial. The survey is directed by faculty at the University of Michigan. The data is freely available for the scientific community at <https://psidonline.isr.umich.edu/>. We selected all households which during the survey time switched from being home renters to being home buyers from 1993 to 2013 leading to a sample of 2,754 panelists.

Figure 1 reports the distribution M-R of the difference between the first monthly mortgage installment M and the last monthly rental payment R before purchase of the house (monthly mortgage installment minus monthly rental payment) in the PSID in bins of 1 dollar. The distribution is concentrated around zero (Mode = 0, Kolmogorov-Smirnov test statistic = .09, $p < .01$) and deviates from the normal distribution (Kurtosis = 1.53, 95%CI = 1.34 to 1.71; Kurtosis of the normal curve = 0).

Figure 1: Histogram of the difference between the monthly mortgage installment and the monthly rental payment in bins of 1 dollar in the PSID*

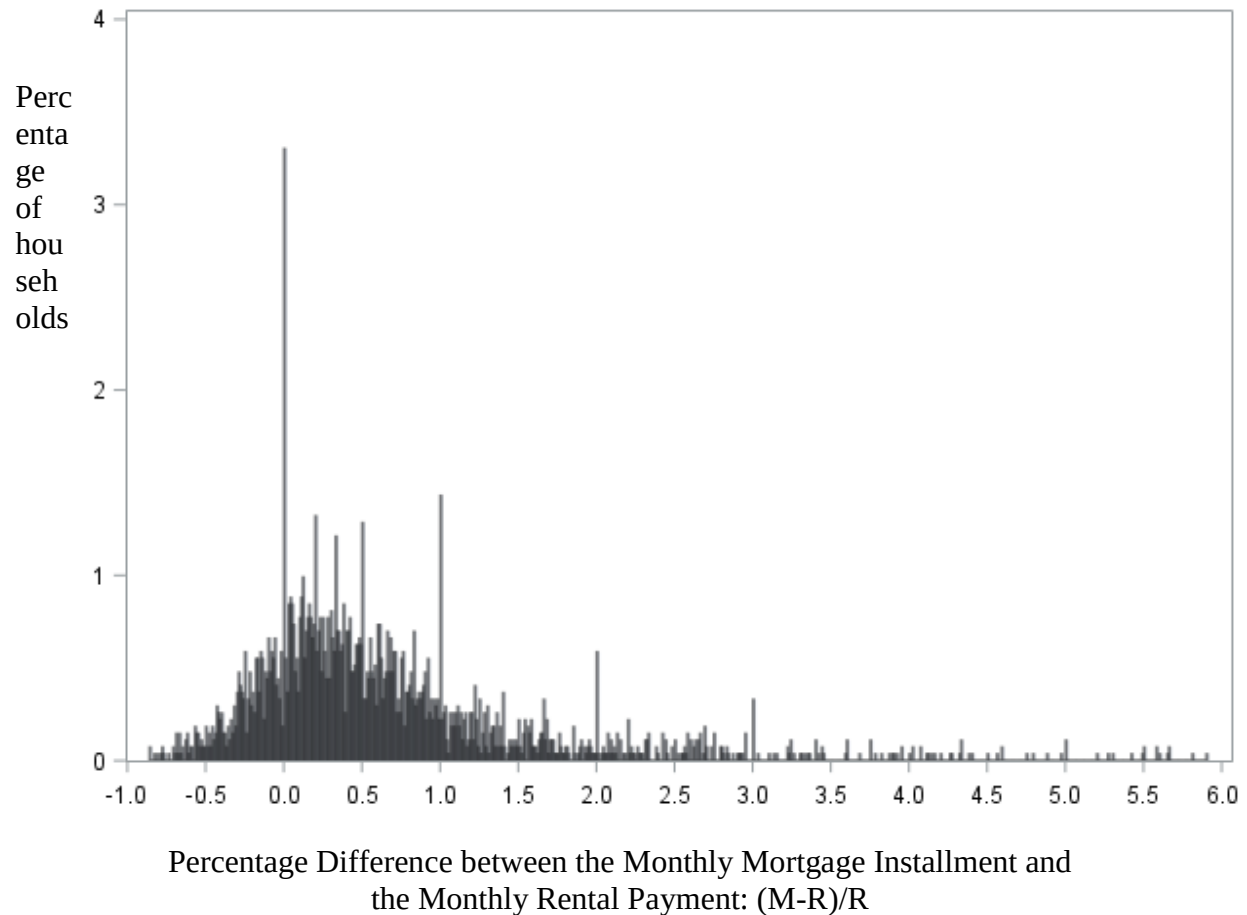


* The figure shows the percentage of home buyers as a function of the difference between the first monthly mortgage installment and the last monthly rental payment in bins of \$1 dollar. The data is from the Panel Study of Income Dynamics and includes 2,754 panelists from 1993 to 2013.

Figure 2 reports the distribution $(M-R/R)$ of the percentage difference between the first monthly mortgage installment M and the last monthly rental payment R before purchase of the house (monthly mortgage installment minus monthly rental payment divided by the monthly rental payment) in the PSID in bins of 0.01 (1%). The distribution is concentrated around zero (Mode = 0, Kolmogorov-Smirnov test statistic = .14, $p < .01$) and deviates from the normal distribution (Kurtosis = 6.13, 95%CI = 5.95 to 6.31; Kurtosis of the normal curve = 0).

We observe a kink in the distribution when $M = R$. We observe another kink point at 1 (100%) showing that a disproportional percentage of households concentrates at the point when the monthly mortgage installment is twice as much as the monthly rental payment.

Figure 2: Histogram of the percentage difference between the monthly mortgage installment and the monthly rental payment in bins of 0.01 (1%) in the PSID*



* The figure shows the percentage of home buyers as a function of the difference between the first monthly mortgage installment and the last monthly rental payment in bins of 0.01 (1%). The data is from the Panel Study of Income Dynamics and includes 2,725 panelists from 1993 to 2013. For illustration purposes, the 1% extreme tail of the right side of the distribution is not shown.

Web Appendix C: Reference point conceptual framework

We analyze two types of reference dependence, each of them associated with a discontinuity on the utility function at: (i) its level, and (ii) its first derivate.

In this section, we aim to formalize these two types of reference dependence points in the context of the house buying decision. We borrow the reference-dependent preferences conceptual framework analysis laid out in Allen, Dechow and Wu (2016) for marathon runners and adapt it to the house buying decision.

Reference-dependence preferences are associated to a failure of expected utility theory, as individuals evaluate outcomes differently when evaluating their utility above or below a neutral reference point. In a seminal paper, Kahneman and Tversky (1980) propose the prospect theory, that rationalize better than the expected utility theory outcomes around a reference point.

In our setting, the reference point is the difference between the monthly rental payment R and the monthly mortgage installment M . Expected utility is increasing in $R-M$, i.e., house buyers are happier the less they pay monthly for their mortgage as compared to a benchmark monthly rental payment (for instance, how much they would pay each month as rent for the same house they are buying).

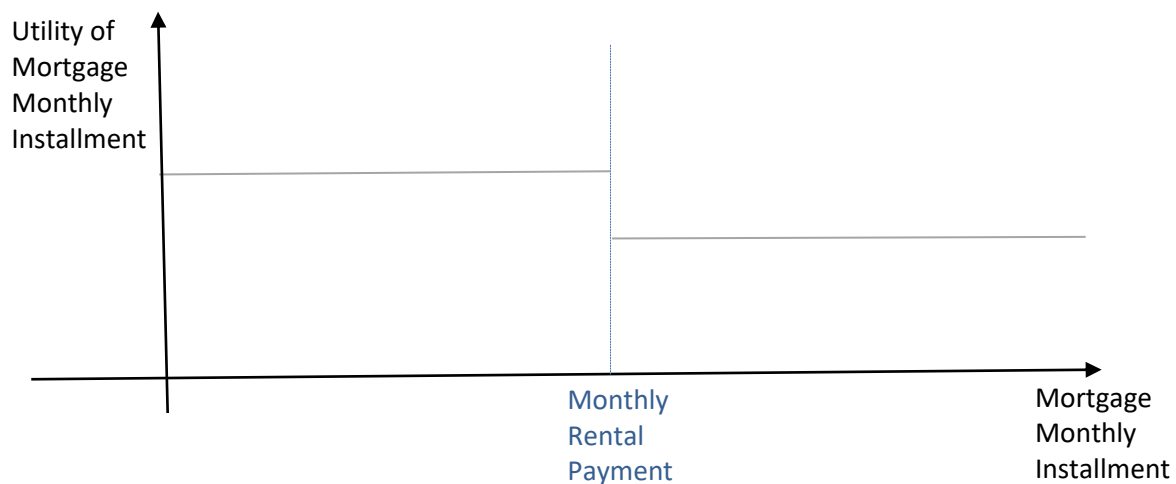
We argue in this paper is that this level of expected utility in $R-M$ can be discontinuous at two levels. More formally, let $u(x)$ be a utility function with a reference point when $x=r$. First, we argue that $u(x)$ is discontinuous at $x=r$: $\lim_{\eta \rightarrow 0} u(x - \eta) \neq \lim_{\eta \rightarrow 0} u(x + \eta)$. Second, we also argue that the first derivative of $u(x)$ is discontinuous at $x=r$: $\lim_{\eta \rightarrow 0} u'(x - \eta) \neq \lim_{\eta \rightarrow 0} u'(x + \eta)$. More intuitively:

- (i) a discontinuity at the level: when $R-M$ is just above zero, there is a jump in expected utility and house buyers are discontinuously happier than when $R-M$ is

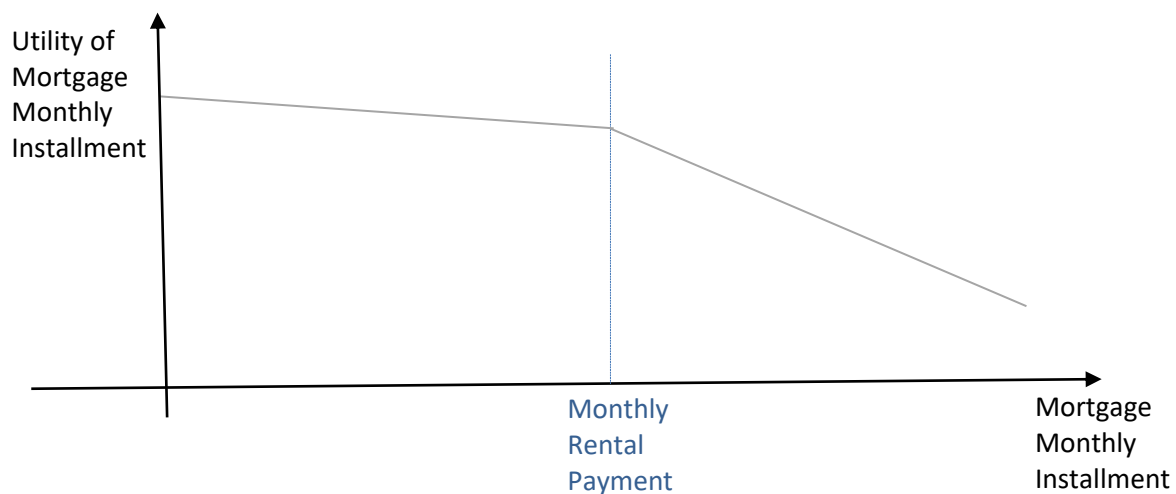
just below zero. More intuitively, individuals get an extra kick of happiness if they can pay less each month for the mortgage than for the equivalent rent; **This discontinuity is present in experiments 3 (RCT), 5 (choice of a mortgage), 6 (rental price changes) and 8 (home sale price).**

- (ii) a discontinuity at the first derivative: house buyers are increasingly happier the lower M is compared to R , but the rate of how much they get happier is lower once M is lower than R . This is akin to house buyers getting quite happier as M decreases from a value higher than R as there is some extra kick in happiness of having the possibility of paying for mortgage less than the rent each month if a bit more search or negotiating down M allows it to happen; but once this extra search/negotiating effort pays off and M is lower than R , the house buyer is still happier to pay a lower M but does not get as happy by the same amount of M reduction as if M were higher than R . This effect is in nature akin to the loss aversion effect brought forward by Kahneman and Tversky (1980). **This discontinuity is present in experiments 3 (RCT), 5 (choice of a mortgage) and 6 (rental price changes).**

Discontinuity at the level:



Discontinuity at the first derivative:



Discontinuity both at the first level and at the first derivative:

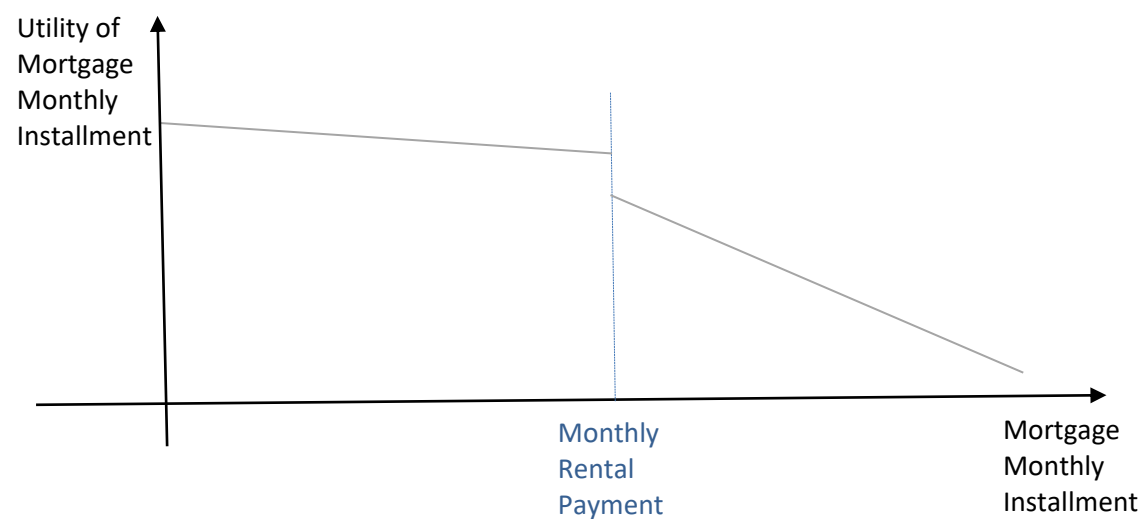


Table: Discontinuity Manifestation in the Mortgage Blind Spot Effect

Discontinuity	Discontinuity manifestation in the Mortgage Blind Spot effect
Level	Psychological jump in monetary incentives, when potential house buyers feel as if they pay less than the rent.
First derivative	<u>Loss aversion</u> : Potential buyers prefer avoiding perceived losses, when they pay more for mortgage than for rent ($M > R$), than acquiring equivalent perceived gains, when they pay less for mortgage than for rent ($M < R$). For instance, if they bargain the mortgage lender to pay \$100 less in mortgage and this bargain takes the mortgage to be lower than the rent (from the region $M > R$ to the region $M < R$), they are happier than if the bargain does not move the payment from one region to the other.

Web Appendix D: Scales used in Study 4

Scale	Construct	Type of Items	Source	# items
Financial literacy	Ability to make financial decisions	objective score	Fernandes, Lynch, and Netemeyer (2014)	13
Focus on intuition	Tendency to use of intuition	self-reported	Epstein et al. (1996)	5
Immediacy bias	Preference for immediate rewards	choice	Meier and Sprenger (2011)	5
Time discounting	Preference for smaller, sooner rewards	choice	Meier and Sprenger (2011)	5
Need-for-cognition	Propensity to think analytically	self-reported	Epstein et al. (1996)	5
Numeracy	Ability to deal with numbers	objective score	Soll, Keeney, and Larrick (2013)	8
Propensity to plan	Propensity to plan for the future	self-reported	Lynch et al. (2010)	12
Tightwad-spendthrift	Aversion to spending	self-reported	Rick, Cryder, and Loewenstein (2008)	4
Willingness to take financial risks	Willingness to take financial risks	choice	Weber, Blais, and Betz (2002)	4

Table WD1: Scales used in Study 4

Financial Literacy (coefficient alpha = .77) Answers in italics.

1) Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, would you be able to buy:

- ☐ more than today with the money in this account
- ☐ exactly the same as today with the money in this account
- ☐ *less than today with the money in this account*
- ☐ Don't know
- ☐ Refuse to answer

2) Do you think that the following statement is true or false? “Bonds are normally riskier than stocks.”

- ☐ True
- ☐ *False*
- ☐ Don't know
- ☐ Refuse to answer

3) Considering a long time period (for example 10 or 20 years), which asset described below normally gives the highest return?

- ☐ savings accounts
- ☐ *stocks*
- ☐ bonds
- ☐ Don't know
- ☐ Refuse to answer

4) Normally, which asset described below displays the highest fluctuations over time?

- ☐ savings accounts
- ☐ *stocks*
- ☐ bonds
- ☐ Don't know
- ☐ Refuse to answer

5) When an investor spreads his money among different assets, does the risk of losing a lot of money:

- ☐ increase
- ☐ *decrease*
- ☐ stay the same
- ☐ Don't know
- ☐ Refuse to answer

6) Do you think that the following statement is true or false? “If you were to invest \$1000 in a stock mutual fund, it would be possible to have less than \$1000 when you withdraw your money.”

- ☐ *True*
- ☐ False
- ☐ Don't know
- ☐ Refuse to answer

7) Do you think that the following statement is true or false? “A stock mutual fund combines the money of many investors to buy a variety of stocks.”

- ☐ True
- ☐ False
- ☐ Don't know
- ☐ Refuse to answer

8) Do you think that the following statement is true or false? “After age 70 1/2, you have to withdraw at least some money from your 401(k) plan or IRA.”

- ☐ True
- ☐ False
- ☐ It depends on the type of IRA and/or 401(k) plan
- ☐ Don't know
- ☐ Refuse to answer

9) Do you think that the following statement is true or false? “A 15-year mortgage typically requires higher monthly payments than a 30-year mortgage, but the total interest paid over the life of the loan will be less.”

- ☐ True
- ☐ False
- ☐ Don't know
- ☐ Refuse to answer

10) 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?

- ☐ More than \$200
- ☐ Exactly \$200
- ☐ Less than \$200
- ☐ Don't know
- ☐ Refuse to answer

11) Which of the following statements is correct?

- ☐ Once one invests in a mutual fund, one cannot withdraw the money in the first year
- ☐ *Mutual funds can invest in several assets, for example invest in both stocks and bonds*
- ☐ Mutual funds pay a guaranteed rate of return which depends on their past performance
- ☐ None of the above
- ☐ Don't know
- ☐ Refuse to answer

12) Which of the following statements is correct? If somebody buys a bond of firm B:

- ☐ He owns a part of firm B
- ☐ *He has lent money to firm B*
- ☐ He is liable for firm B's debts
- ☐ None of the above
- ☐ Don't know

☐ Refuse to answer

13) Suppose you owe \$3,000 on your credit card. You pay a minimum payment of \$30 each month. At an Annual Percentage Rate of 12% (or 1% per month), how many years would it take to eliminate your credit card debt if you made no additional new charges?

- ☐ less than 5 years
- ☐ between 5 and 10 years
- ☐ between 10 and 15 years
- ☐ *never*
- ☐ Don't know
- ☐ Refuse to answer

Focus on Intuition (coefficient alpha = .93). Items scored 1 = strongly disagree, 6 = strongly agree.

- 1) I trust my initial feelings about people.
- 2) I believe in trusting my hunches.
- 3) My initial impressions of people are almost always right.
- 4) When it comes to trusting people, I can usually rely on my "gut feelings".
- 5) I can usually feel when a person is right or wrong even if I can't explain how I know.

Immediacy Bias and Time Discounting The scores are computed by the switching point. For example, if a participant chooses \$75 in decision 1 and switches to \$80 in decision 2, she receives a score of 75/80. Immediacy bias is the score in the first five decisions (when payouts are immediate) divided by the score in the last five decisions (when payouts happen in six months). Time discounting is the score in the last five decisions (when payouts happen in six months).

Please indicate for each of the following 15 decisions, whether you would prefer the smaller payment in the near future or the bigger payment later. Option A (TODAY) or Option B (IN 1 MONTH)

Decision (1)

- ☐ \$75 guaranteed today
- ☐ \$80 guaranteed in a month

Decision (2)

- ☐ \$70 guaranteed today
- ☐ \$80 guaranteed in a month

Decision (3)

- ☐ \$65 guaranteed today
- ☐ \$80 guaranteed in a month

Decision (4)

- ☐ \$60 guaranteed today
- ☐ \$80 guaranteed in a month

Decision (5)

- ☐ \$50 guaranteed today

- ☐ \$80 guaranteed in a month

Option A (TODAY) or Option B (IN 6 MONTHS)

Decision (6)

- ☐ \$75 guaranteed today
- ☐ \$80 guaranteed in 6 months

Decision (7)

- ☐ \$70 guaranteed today
- ☐ \$80 guaranteed in 6 months

Decision (8)

- ☐ \$65 guaranteed today
- ☐ \$80 guaranteed in 6 months

Decision (9)

- ☐ \$60 guaranteed today
- ☐ \$80 guaranteed in 6 months

Decision (10)

- ☐ \$50 guaranteed today
- ☐ \$80 guaranteed in 6 months

Option A (IN 6 MONTHS) or Option B (IN 7 MONTHS)

Decision (11)

- ☐ \$75 guaranteed in 6 months
- ☐ \$80 guaranteed in 7 months

Decision (12)

- ☐ \$70 guaranteed in 6 months
- ☐ \$80 guaranteed in 7 months

Decision (13)

- ☐ \$65 guaranteed in 6 months
- ☐ \$80 guaranteed in 7 months

Decision (14)

- ☐ \$60 guaranteed in 6 months
- ☐ \$80 guaranteed in 7 months

Decision (15)

- ☐ \$50 guaranteed in 6 months
- ☐ \$80 guaranteed in 7 months

Need for Cognition (coefficient alpha = .88). Items scored 1 = strongly disagree, 6 = strongly agree.

- 1) I don't like to have to do a lot of thinking (reverse coded).
- 2) I try to avoid situations that require thinking in depth about something (reverse coded).
- 3) I prefer to do something that challenges my thinking rather than something that requires little thought.
- 4) I prefer complex to simple problems.

5) Thinking hard and for a long time about something gives me little satisfaction (reverse coded).

Numeracy (coefficient alpha = .70) Answers in italics.

1) Imagine that we roll a fair, six-sided die 1,000 times. Out of 1,000 rolls, how many times do you think the die would come up as an even number? Of the values below, which is the most likely outcome?

- ☐ 157
- ☐ 298
- ☐ 512
- ☐ 754
- ☐ 919
- ☐ The above answers are all equally likely.
- ☐ I do not know.

2) In the BIG BUCKS LOTTERY, the chances of winning a \$10.00 prize are 1%. What is your best guess about how many people would win a \$10.00 prize if 1,000 people each buy a single ticket from BIG BUCKS?

- ☐ 1
- ☐ 2
- ☐ 10
- ☐ 100
- ☐ 110
- ☐ The answers above are equally likely.
- ☐ I do not know.

3) If the chance of getting a disease is 20 out of 100, this would be the same as having a _____% chance of getting the disease.

- ☐ 0.02
- ☐ 0.2
- ☐ 2
- ☐ 2.0
- ☐ 20
- ☐ 25
- ☐ 200
- ☐ I do not know.

4) In the ACME PUBLISHING SWEEPSTAKES, the chance of winning a car is 1 in 1,000. What percent of tickets of ACME PUBLISHING SWEEPSTAKES win a car?

- ☐ 0.001%
- ☐ 0.01%
- ☐ 0.1%
- ☐ 1.0%
- ☐ 1.1%
- ☐ None of the above
- ☐ I do not know.

5) If the chance of getting a disease is 10%, how many people would be expected to get the disease out of 1,000?

- ☐ 1
- ☐ 10
- ☐ 11
- ☐ 50
- ☐ 100
- ☐ 110
- ☐ 1,000
- ☐ I do not know.

6) If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets?

- ☐ 1 minute
- ☐ 5 *minutes*
- ☐ 10 minutes
- ☐ 100 minutes
- ☐ 1,000 minutes
- ☐ 1 day
- ☐ None of the above
- ☐ I do not know.

7) A bat and ball cost \$1.10 in total. The bat costs \$1.00 more than the ball. How much does the ball cost?

- ☐ 1 cent
- ☐ 5 *cents*
- ☐ 10 cents
- ☐ 11 cents
- ☐ 20 cents
- ☐ 100 cents
- ☐ 1 dollar
- ☐ I do not know.

8) In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake?

- ☐ 16 days
- ☐ 24 days
- ☐ 25 days
- ☐ 32 days
- ☐ 26 days
- ☐ 22 days
- ☐ 47 *days*
- ☐ I do not know.

Propensity to Plan for Time–Short Run (coefficient alpha = .91). Items scored 1=strongly disagree, 6 = strongly agree.

- 1) I set goals for the next 1-2 months for what I want to achieve with my time.
- 2) I decide beforehand how my time will be used in the next 1-2 months.
- 3) I actively consider the steps I need to take to stick to my time schedule in the next 1-2 months.
- 4) I consult my planner to see how much time I have left for the next 1-2 months.

- 5) I like to look to my planner for the next 1-2 months in order to get a better view of using my time in the future.
- 6) It makes me feel better to have my time planned out in the next 1-2 months.

Propensity to Plan for Money–Long Run (coefficient alpha = .89). Items scored 1=strongly disagree, 6 = strongly agree.

- 1) I set financial goals for the next 1-2 years for what I want to achieve with my money.
- 2) I decide beforehand how my money will be used in the next 1-2 years.
- 3) I actively consider the steps I need to take to stick to my budget in the next 1-2 years.
- 4) I consult my budget to see how much money I have left for the next 1-2 years.
- 5) I like to look to my budget for the next 1-2 years in order to get a better view of my spending in the future.
- 6) It makes me feel better to have my finances planned out in the next 1-2 years.

Tightwad-Spendthrift Scale (coefficient alpha = .85).

- 1) Which of the following description fits you better?

Tightwad				About the same or neither				Spendthrift			
(difficulty spending money)								(difficulty controlling spending)			
1	2	3	4	5	6	7	8	9	10	11	
- 2) Some people have trouble limiting their spending: they often spend money – for example on clothes, meals, vacations, phone calls – when they would do better not to. Other people have trouble spending money. Perhaps because spending money makes them anxious, they often don't spend money on things they should spend it on
 - a) How well does the first description fit you? That is, do you have trouble limiting your spending? Never (1); Rarely (2); Sometimes (3); Often (4); Always (5)
 - b) How well does the second description fit you? That is, do you have trouble spending money? Never (1); Rarely (2); Sometimes (3); Often (4); Always (5)

3) Following is a scenario describing the behavior of two shoppers. After reading about each shopper, please answer the question that follows. Mr. A is accompanying a good friend who is on a shopping spree at a local mall. When they enter a large department store, Mr. A sees that the store has a "one-day-only-sale" where everything is priced 10-60% off. He realizes he doesn't need anything and ends up spending almost \$100.00 on stuff. Mr. B is accompanying a good friend who is on a shopping spree at a local mall. When they enter a large department store, Mr. B sees that the store has a "one-day-only-sale" where everything is priced 10-60% off. He figures he can get great deals on many items that he needs, yet the thought of spending the money keeps him from buying the stuff. In terms of your own behavior, who are you more similar to, Mr. A or Mr. B?

Mr. A	about the same or neither				Mr. B
1	2	3	4	5	

Willingness to Take Investment Risk (coefficient alpha = .78). Items scored 1=very unlikely, 5 = very likely.

- 1) Investing 10% of your annual income in a moderate growth mutual fund.
- 2) Investing 5% of your annual income in a very speculative stock.

- 3) Investing 5% of your annual income in a conservative stock.
- 4) Investing 10% of your annual income in government bonds (treasury bills).

Demographic variables

Do you own the home where you now live? Yes or No

How willing are you to own a home to live in? Not at all = 0 to Very Much = 7

About how much would your home sell for in today's market?

- ☐ less than \$99,999 (1)
- ☐ \$100,000-\$199,999 (2)
- ☐ \$200,000-\$299,999 (3)
- ☐ \$300,000-\$399,999 (4)
- ☐ \$400,000-\$499,999 (5)
- ☐ \$500,000-\$599,999 (6)
- ☐ \$600,000-\$699,999 (7)
- ☐ \$700,000-\$799,999 (8)
- ☐ \$800,000-\$899,999 (9)
- ☐ \$900,000-\$999,999 (10)
- ☐ \$1,000,000 or more (11)

Please provide us with an estimate of your total wealth, where wealth = sum of checking and savings accounts, certificate of deposits and other short-terms assets, bonds, stocks, other assets, housing equity, other real estate, IRAs, retirement savings, and Keoghs, business equity, and vehicles minus all debts.

Have you ever invested in individual stocks. Yes or No

Please indicate below the percentage of your investments you allocate to fixed-income funds and to equity funds: Fixed-income funds ____ % Equity funds ____%

What is your age?

What is your gender?

- ☐ Male (1)
- ☐ Female (2)

How many children do you have?

What is your approximate annual income, including wages, tips, investment income, public assistance, income from retirement plans, etc.?

- ☐ Less than \$15,000 (1)

- ☐ At least \$15,000 but less than \$25,000 (2)
- ☐ At least \$25,000 but less than \$35,000 (3)
- ☐ At least \$35,000 but less than \$50,000 (4)
- ☐ At least \$50,000 but less than \$75,000 (5)
- ☐ At least \$75,000 but less than \$100,000 (6)
- ☐ At least \$100,000 but less than \$150,000 (7)
- ☐ \$150,000 or more (8)

Which of the following best describes your current employment or work status?

- ☐ Self employed
- ☐ Work full-time for an employer or the military
- ☐ Work part-time for an employer or the military
- ☐ Homemaker
- ☐ Full-time student
- ☐ Permanently sick, disabled, or unable to work
- ☐ Unemployed or temporarily laid off
- ☐ Retired
- ☐ Prefer not to say

What is your marital status?

- ☐ Single
- ☐ Married
- ☐ Divorced/Separated
- ☐ Widowed

What is your Education level? Please check one category below.

- ☐ Some High School (1)
- ☐ High School Graduate (2)
- ☐ Some College (3)
- ☐ College Graduate (4)
- ☐ Master' Degree (5)
- ☐ Doctor, Ph.D., or Law degree (6)

Web Appendix E: Study 4 Summary Statistics, Cronbach Alpha Reliabilities, and Correlations

	Mean	SD	Alpha	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
1. Mortgage blind spot	0.24	0.43	-	1.00																								
2. Discounted cash flow analysis	0.05	0.22	-	-0.13	1.00																							
1. Financial literacy	8.66	2.80	.77	-0.03	0.07	1.00																						
2. Focus on intuition	4.39	0.95	.93	0.02	0.00	-0.13	1.00																					
3. Immediacy bias	0.95	0.14	-	0.09	0.05	0.09	-0.04	1.00																				
4. Time discounting	0.90	0.13	-	-0.10	-0.04	0.24	-0.16	-0.48	1.00																			
5. Need-for-cognition	4.26	1.07	.88	-0.03	0.01	0.26	0.03	-0.01	0.11	1.00																		
6. Numeracy	4.89	2.18	.70	0.00	0.02	0.54	-0.21	0.10	0.18	0.20	1.00																	
7. Propensity to plan time	3.69	1.04	.91	0.00	0.02	-0.05	0.14	0.01	-0.04	0.17	-0.08	1.00																
8. Propensity to plan money	3.89	1.19	.89	0.02	-0.01	0.14	0.12	0.10	0.08	0.15	0.07	0.40	1.00															
9. Spendthrift / Tightwad	2.68	0.93	.85	-0.03	0.03	-0.16	0.07	-0.09	-0.06	-0.06	-0.15	-0.09	-0.24	1.00														
10. Willingness to take financial risks	2.90	0.88	.78	0.01	0.06	0.22	0.02	0.06	0.01	0.11	0.05	0.07	0.24	-0.03	1.00													
11. Home-owner	0.51	0.50	-	-0.05	0.05	0.17	0.00	0.12	-0.01	-0.05	0.06	0.01	0.13	-0.06	0.14	1.00												

12. Willingness to buy home	6.56	2.11	-	-0.06	0.05	0.13	0.02	0.11	0.04	0.00	0.05	0.14	0.17	0.03	0.06	0.48	1.00												
13. Home-value	2.89	1.91	-	0.00	0.02	-0.01	-0.06	-0.04	0.04	0.04	0.00	0.02	0.00	0.04	0.08	0.00	0.00	1.00											
14. Net-Wealth	141328	251437	-	-0.08	-0.04	0.15	-0.08	0.06	0.00	0.04	0.01	-0.02	0.17	-0.09	0.19	0.36	0.18	0.30	1.00										
15. Stock-owner	0.41	0.49	-	-0.08	0.06	0.33	0.00	0.03	0.08	0.14	0.16	0.07	0.21	-0.04	0.35	0.20	0.15	0.14	0.26	1.00									
16. % equity funds	24.29	34.18	-	-0.08	0.05	0.41	-0.01	0.02	0.12	0.10	0.21	0.03	0.19	-0.08	0.30	0.23	0.14	0.11	0.26	0.44	1.00								
17. % fixed-income funds	19.79	30.14	-	0.04	0.00	0.06	0.02	0.08	-0.13	0.00	0.00	-0.04	0.06	0.06	0.07	0.18	0.15	0.03	0.12	0.13	0.10	1.00							
18. Age	36.79	11.96	-	-0.07	-0.05	0.27	-0.03	0.00	-0.04	0.00	0.07	-0.17	0.01	-0.02	0.02	0.30	0.09	-0.09	0.24	0.15	0.10	0.03	1.00						
19. Gender	0.59	0.49	-	-0.02	-0.03	-0.20	0.19	0.06	-0.08	0.00	-0.23	0.02	-0.05	0.02	-0.23	-0.05	0.04	-0.04	-0.07	-0.17	-0.23	0.06	0.05	1.00					
20. Number of children	1.95	1.26	-	-0.04	-0.01	0.12	0.05	0.05	-0.03	-0.04	-0.03	0.00	0.07	-0.01	-0.01	0.29	0.19	-0.07	0.15	0.06	0.07	0.01	0.39	0.13	1.00				
21. Income	3.61	1.89	-	0.02	0.01	0.18	0.03	0.04	0.06	0.07	0.02	0.07	0.21	0.04	0.22	0.35	0.27	0.19	0.38	0.30	0.32	0.11	0.07	-0.10	0.23	1.00			
22. Employment	0.46	0.50	-	0.07	0.03	0.13	0.02	0.05	0.01	0.10	0.12	0.12	0.23	-0.03	0.11	0.18	0.10	-0.07	0.07	0.11	0.25	0.08	-0.12	-0.16	0.00	0.41	1.00		
23. Marital Status	0.46	0.50	-	-0.09	0.09	0.12	0.09	0.10	0.00	-0.05	0.00	0.02	0.11	0.01	0.08	0.36	0.25	0.03	0.18	0.11	0.14	0.06	0.14	0.12	0.44	0.37	0.12	1.00	
24. Education level	3.66	0.93	-	0.03	0.04	0.31	-0.10	0.06	0.12	0.16	0.21	0.02	0.10	-0.02	0.18	0.11	0.03	0.16	0.14	0.29	0.22	0.06	0.07	-0.02	-0.01	0.27	0.16	0.12	

Note: Significant correlations ($p < .10$) are in **bold**. Coding is as follows: Employment: Not full time working = 0, Full-time working = 1; Gender: 0 = Male, 1 = Female; Marital Status: 0 = Not Married, 1 = Married; Stock-owner: No = 0, Yes = 1.

Web Appendix F: Verbatim questions in Study 5

Imagine that you rent a home that fits your housing needs and that you are presented with the opportunity to purchase this home. You pay \$1400 for rent each month. The price of the home is \$200,000 and you already have a pre-approved fixed-rate mortgage with an annual interest rate (APR) of 4%. The required down payment is \$40,000. You have the down payment money in your bank account. If you do not purchase your home, you can invest the down payment money in a savings account and you will earn 4% per year (the same as the mortgage interest rate). Below, we present you a few mortgages with different length terms T . M is the effective monthly payment of the mortgage in dollars (including property taxes, insurance and maintenance costs and taking into account the tax deductibility of interest payments) if you buy the house; R is the monthly rental payment in dollars if you rent the house. Please indicate whether you would buy the home or continue renting in each condition.

	Buy home and pay mortgage per month (1)	Continue renting home and pay rent per month (2)
$M = 1125$; $R = 1400$; $T = 40$ years and 4 months	☐	☐
$M = 1175$; $R = 1400$; $T = 34$ years and 7 months	☐	☐
$M = 1225$; $R = 1400$; $T = 30$ years and 4 months	☐	☐
$M = 1275$; $R = 1400$; $T = 27$ years and 1 month	☐	☐
$M = 1325$; $R = 1400$; $T = 24$ years and 6 months	☐	☐
$M = 1375$; $R = 1400$; $T = 22$ years and 4 months	☐	☐
$M = 1425$; $R = 1400$; $T = 20$ years and 7 months	☐	☐
$M = 1475$; $R = 1400$; $T = 19$ years and 1 month	☐	☐
$M = 1525$; $R = 1400$; $T = 17$ years and 9 months	☐	☐
$M = 1575$; $R = 1400$; $T = 16$ years and 8 months	☐	☐
$M = 1625$; $R = 1400$; $T = 15$ years and 8 months	☐	☐
$M = 1675$; $R = 1400$; $T = 14$ years and 9 months	☐	☐

Web Appendix G: Brochure of the financial education intervention of Study 7.

Please read below the following text about how to financially evaluate whether one should buy or rent a house.

Suppose you are offered the opportunity to buy the house you live in for \$500,000. You currently pay $R=\$1,800$ as rental expenses each month. You don't own \$500,000 to pay the home owner, but you can approach a bank and acquire a mortgage.

The mortgage contract is as follows: (i) you pay immediately \$100,000 and the bank pays the remaining \$400,000 to the home owner. Of course, you should pay back the \$400,000 you borrowed from the bank over the next years in the following way: each month, for the next 480 months (or 40 years) you pay the bank $M=\$1,650$ as the mortgage installment expenses, which corresponds to an annual interest rate of 4%.

Just by comparing M and R , would you be able to evaluate whether it is a good decision or not to buy the house in those terms? You could be tempted to think that as $M=\$1,650 < R=\$1,800$, the best decision is to buy the house.

Now, suppose that at the last minute the bank realizes it can only offer a 30-year mortgage contract, rather than then 40-year one. Mechanically, the new mortgage installment expense, at the same annual interest rate of 4%, becomes $M'=\$1,900$. Now would you change your mind and decide not to buy the house, as $M'=\$1,900 > R=\$1,800$?

There seems to be a flaw in deciding on whether to buy or rent the house based only on the simple comparison of M and R , i.e., the monthly mortgage expenses installment M and the monthly rental expenses R .

At the end of the day, the mortgage contract is a loan. You could think it as a \$400,000 loan that makes it possible you buy a \$500,000 asset. But the same way you could invest in a house, you could also invest in a financial product. Suppose, for instance that rather than buying a house worth \$500,000, you decide to contract the most advantaged financial product, which pays you interest each month. By investing the \$500,000, you would get as monthly interest income $I=\$1,635$. (The financial product yields the same annual interest rate of 4%).

Now, would you buy the house after you acknowledge that $I=\$1,635 < R=\$1,800$? If you compare the two assets, it seems that the house is indeed at a good value. You could think of having the opportunity to buy two assets worth \$500,000 that offer different dividends:

- (i) The house worth \$500,000, which offers a dividend (the rental expense) of \$1,800 each month
- (ii) The financial product worth \$500,000, which offers a dividend (the interest income) of \$1,635 each month

As the house offers a higher dividend, you should buy the house. Whether you hire the mortgage for 30 or 40 years, or alternatively, whether the downpayment is 20% or 40% should not influence whether you should buy or not the house.

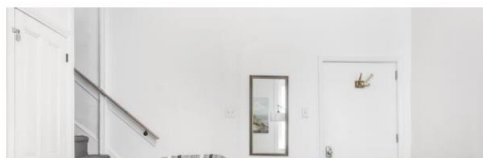
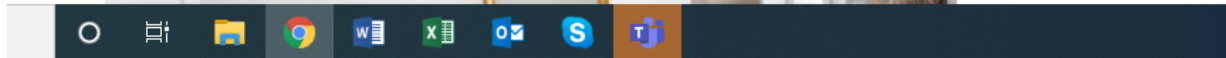
Web Appendix H: House advertising used in Study 8.

HOUSE ADVERTISEMENT

Stunning 3 bedroom, 2 bathroom apartment! This home features beautiful upper and lower front porches. Upon entering the home you will find an updated kitchen that flows through to the dining and living rooms. Upstairs you will find the master suite with dual sinks, walk-in shower, and garden tub. 3 additional bedrooms, a full bath and a laundry room complete the second floor. Minutes away from shopping, dining, community walking trails, playgrounds, and sport fields!

This home is perfect for hosting family and friends! It is spacious both inside and out, with multiple porches in the front, and a private backyard space. Inside, there is ample room for seating in the large living and dining rooms. The location also provides easy access to major roads for commuting to downtown and airport!

Please see in the following pages some pictures of the apartment.



The house owner is still undecided whether to sell or rent the house and is accepting bids for both sale and for rent. The house suggested rental price is US\$ 1,500 per month.

Assume you are eligible for a 2% fixed interest rate 30 year mortgage with no down payment for this house.

If this house ended up being for sale and not for rent, would you buy it for the prices below or not for each of the prices and corresponding monthly mortgage (the monthly mortgage value takes into account savings with tax shields and costs with property taxes, maintenance and insurance). Please consider each line separately as if this was the only offer presented to you.

	Yes	No
US\$ 1,200 per month (price of the house US\$ 192,500)	☐	☐
US\$ 1,250 per month (price of the house US\$ 200,500)	☐	☐
US\$ 1,300 per month (price of the house US\$ 208,500)	☐	☐
US\$ 1,350 per month (price of the house US\$ 216,500)	☐	☐
US\$ 1,400 per month (price of the house US\$ 224,500)	☐	☐
US\$ 1,450 per month (price of the house US\$ 232,500)	☐	☐
US\$ 1,500 per month (price of the house US\$ 240,500)	☐	☐
US\$ 1,550 per month (price of the house US\$ 248,500)	☐	☐
US\$ 1,600 per month (price of the house US\$ 256,500)	☐	☐
US\$ 1,650 per month (price of the house US\$ 264,500)	☐	☐
US\$ 1,700 per month (price of the house US\$ 272,500)	☐	☐
US\$ 1,750 per month (price of the house US\$ 280,500)	☐	☐
US\$ 1,800 per month (price of the house US\$ 288,500)	☐	☐

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If this house ended up being for rent and not for sale, would you rent it or not for each of the monthly rental prices below? The house suggested sale price is US\$ 240,500 (monthly mortgage of US\$ 1,500).

	Yes	No
US\$ 1,200 per month	☐	☐
US\$ 1,250 per month	☐	☐
US\$ 1,300 per month	☐	☐
US\$ 1,350 per month	☐	☐
US\$ 1,400 per month	☐	☐
US\$ 1,450 per month	☐	☐
US\$ 1,500 per month	☐	☐
US\$ 1,550 per month	☐	☐
US\$ 1,600 per month	☐	☐
US\$ 1,650 per month	☐	☐
US\$ 1,700 per month	☐	☐
US\$ 1,750 per month	☐	☐
US\$ 1,800 per month	☐	☐

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Supplemental Online Appendix Sections A-H References

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